ALAMO COLLEGES DISTRICT

EASTSIDE EDUCATION AND TRAINING CENTER (EETC)

FOR

ALAMO COMMUNITY COLLEGE DISTRICT

4551 DIETRICH RD, SAN ANTONIO TX 78219

EDA AWARD NO. 08-01-05138

Project Manual

October 7, 2020

Set No. _____

GBA Project No. 19-180

GARZA/BOMBERGER & ASSOCIATES

5545 Fredericksburg, Suite 100, San Antonio, TX 78229

(210) 349-7000

October 7, 2020

EASTSIDE EDUCATION TRAINING CENTER (EETC)
Alamo Community College District

ARCHITECTS

Garza/Bomberger & Associates
5545 Fredericksburg Rd., Suite 100
San Antonio, Texas 78229
Telephone: (210) 349-7000; Facsimile: (210) 349-7820

CONSULTANTS

CIVIL Engineers:
MTR Engineers
12770 Cimarron Path, Suite 100
San Antonio, Texas 78249
Telephone: (210) 698-5051; Facsimile: (210) 698-5085

MEP Engineer:
Cleary Zimmerman Engineers
1344 S. Flores, Suite 101
San Antonio, Texas 78204
Telephone: (210) 447-6100; Facsimile: (210) 447-6101

IT Design and Consultant:
True North Consulting Group
13284 Pond Springs Road, Suite 304
Austin, Texas 78729
Telephone: (512) 451-5445

These Documents (inclusive of Plans, Specifications and Addenda) when used in their entirety are intended to describe the scope of the Work; both as specifically stated and as may be reasonably implied therefrom. The Architect, his Consultants and the Owner shall not be responsible for incomplete Bids, Proposals or Pricing due to the failure of the Contractor(s) to fully examine the Construction Documents in their entirety.

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Roy L. Lewis, AIA, Partner

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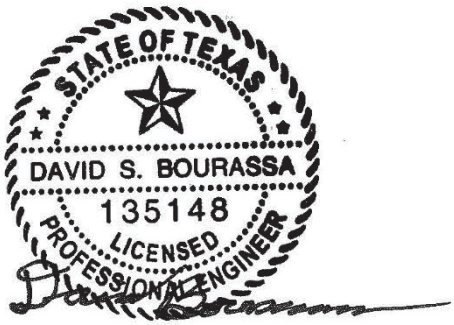

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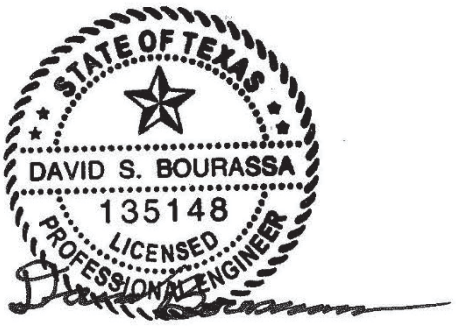

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Roy L. Lewis, AIA, Partner

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Roy L. Lewis, AIA, Partner

OSP SPECIALIST, RTPM
EXPIRES: 12/31/21
Regis. No. 117005

SIGNATURE

TRUE NORTH CONSULTING GROUP, LLC,
TX DPS SECURITY CONSULTANT COMPANY LICENSE # B05227801

10/06/2020

INDEX OF DRAWINGS

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SECTION 01 11 00

SUMMARY OF THE WORK

PART 1 - GENERAL

1.1 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work includes the maintenance and improvements for compliance with the Texas Accessibility Standards at the Alamo Community College District's Eastside Education and Training Center (EETC). The Work covered by the Contract Documents includes all demolition/renovation, and all items incidental thereto with items of equipment, specialties, site work, mechanical and electrical work and systems as described by the Contract Documents.

B. The Contractor shall supply all, labor, materials, transportation, apparatus, light, scaffolding, and tools necessary for the entire proper execution and completion of the work. Utilities do exist for the convenience of the Contractor, but the Owner makes no warranty that they will be sufficient in all aspects for the execution of the work. Where additional utilities are necessary for the execution of the work, said utilities shall be provided by, and paid for by, the Contractor. Contractor shall Install, maintain and remove all equipment of construction and other utensils or things, and be responsible for the safe, proper and lawful maintenance and use of same. Construct in the best and most workmanlike manner the complete project and everything properly incidental thereto as shown on the Drawings, stated in the Specifications or reasonably implied there from, and in accordance with the Contract Documents. This Contract includes Site, Mechanical, Plumbing and Electrical Work.

C. Contractor shall be responsible for securing and paying for all permits, fees and licenses required for the proper execution and completion of the Work except as otherwise noted.
   1. Building permit, tree preservation, and utility impact fees (if applicable) shall be paid by the Owner.

D. Give required notices.

E. Comply with codes, ordinances, rules, regulations, orders and other legal requirements of public authorities which bear on performance of the work.

F. Enforce strict discipline and good order among employees. Do not employ on the Work persons who are unfit or unskilled in assigned task.

G. The Contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex or national origin. The Contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, or national origin. Such action shall include, but not be limited to the following: employment, upgrading, demotion, or transfer; recruitment, or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post in

conspicuous places, available to employees and applicants for employment, notices to be provided by said officer setting forth the provisions of this nondiscrimination clause.

1.2 MULTIPLE CONTRACT SUMMARY

A. Contractor acknowledges that Owner reserves the right to engage other contractors, engineers, inspectors, consultants and/or its own personnel to provide work or services relating to the Project, which may be carried out concurrently with Contractors Work. Contractor shall fully cooperate by coordinating its Work with any work or services being performed by Owner and Owners other contractors, engineers, inspectors and consultants.

1.3 CONTRACTOR'S USE OF SITE AND PREMISES

A. Access to Site: Limited to construction area and as authorized by Owner. Contractor shall be provided one classroom to use as an office and storage. Additional space may be available as coordinated and approved by Owner.

B. Contractor Parking: As coordinated with and approved by Owner.

C. The Owner shall continue operations during the term of the contract for construction. The Contractor shall have restricted access to the areas of work during the duration of the project.
   1. Coordinate and schedule with Owner noisy and disruptive operations such as use of jack hammers and other noisy equipment in close proximity to occupied classrooms during regular hours of operation.

D. Emergency Building Exits shall be maintained at all times during Construction.

E. Time Restrictions for Performing Contract: 180 days.

F. Utility Outages and Shutdown:
   1. Coordinate and schedule electrical and other utility outages with Owner.
   2. Outages: Allowed only at previously agreed upon times. In general, schedule outages at times when facility is not being used.
   3. At least 72 hours before scheduled outage, submit Outage Request Plan to the A/E and Owner itemizing the dates, times, and duration of each requested outage.

1.4 PROJECT UTILITY SOURCES

A. Public Utilities Serving the Project include
   1. City Public Service
   2. San Antonio Water Service
   3. AT&T

1.5 CONFERENCES

A. Preconstruction Conference: Before any work is started, the Contractor and Subcontractors shall meet with the Architect and the Owner to discuss the methods or procedures to be followed by the Contractor.

B. The Owner will schedule weekly Progress Meetings to review project status and to allow for coordination of upcoming work. In addition, the Contractor shall convene pre-installation conferences at the work site prior to commencing the specific work items as described in Section 01 30 00. The Contractor shall notify the Architect and Owner of these meetings as indicated in Section 01 30 00.

1.6 WORK PROCEDURES

A. Surrounding Site Conditions: Prior to commencement of the work, the Contractor and the Architect shall jointly survey those improvements immediately adjacent to the Project, making permanent note and record of such existing damage as cracks, sags, or other similar damage. This record shall serve as basis for determination of subsequent damage due to the Contractor's operations. Such damage as noted shall be suitably recorded and the official record of existing damage shall be signed by all parties making the survey. Any cracks, sags, or damage of any nature to the adjacent improvements, not noted in the original survey but subsequently observed, shall be reported immediately to the Architect.

B. Time is the Essence of the Contract: The use of insufficient labor or equipment for construction purposes or inadequate scheduling of materials or equipment to be installed will not be allowed as cause for delay. Labor, materials, and equipment shall be scheduled to the site in such quantities as required for the uninterrupted progress of the work and the least obstruction of premises.

C. Measurements: Before ordering any material or doing any work, the Contractor shall verify all measurements at the building and be responsible for the correctness of same. No exchange or compensation will be allowed on account of difference between actual dimensions and the measurements indicated in the Drawings. Differences which may be found shall be submitted to the Architect for instruction before proceeding with the work.

1.7 PROTECTION

A. Protect Finish Work: Cover and protect finished floors, steps, treads, etc., against damage by workmen, equipment, etc., during the work. Wherever concrete, paint, cement, roofing, equipment, etc., are hoisted or carried into or onto the building, the walls, aluminum work, windows, etc., adjacent to the hoisting must be covered with heavy layer of building paper, the floors and steps over which any of the material is carried must be well covered to protect all the work against damage.

1.8 DISPOSITION OF UTILITIES

A. Rules and regulations governing the respective utilities shall be observed in executing all work under this Contract.

B. Active utilities shall be adequately protected from damage during construction. Where active utilities or other improvements are encountered but are not shown on the drawings, the Architect shall be advised; the work shall be adequately protected, supported, or relocated as directed by the Architect.

1.9 PROTECTION OF SITE IMPROVEMENTS

A. Do not permit the accumulation of surface or subsurface water in ditches or elsewhere on the premises. Control and dispose of such conditions by means of temporary pumps, drainage lines, dams, or other methods.

1.10 SPECIFICATION CONVENTIONS

A. These Specifications are written in imperative mood and streamlined form. This imperative language is directed to Contractor unless specifically noted otherwise. The words "shall be" are included by inference where a colon (:) is used within sentences or phrases.

PART 2 - PRODUCTS

Not Used.

PART 3 – EXECUTION

Not Used.

END OF SECTION

SECTION 01 20 00

PRICE AND PAYMENT PROCEDURES

1.1 SECTION INCLUDES

A. Contingency Allowances.

B. Schedule of Values.

C. Payment Procedures.

D. Contract Modification Procedures.

1.2 CONTINGENCY ALLOWANCES

A. Include in Contract a stipulated sum/price of $175,000.00 for use upon Owner's instruction as a contingency allowance.

B. Contractor's costs for products, delivery, installation, labor, insurance, payroll, taxes, bonding, equipment rental, overhead, and profit will be included in Change Orders authorizing expenditure of funds from this contingency allowance.

C. Funds will be drawn from contingency allowance only by Change Order.

D. At closeout of Contract, funds remaining in contingency allowance will be credited to Owner by Change Order.

1.3 SCHEDULE OF VALUES

A. Submit schedule on AIA G703 - Continuation Sheet for G702.

B. Submit Draft of Schedule of Values within 20 days after date established in Notice to Proceed. Owner and Consultants will review draft for completeness. Upon return of comments, prepare final sc

C. Format: Use Table of Contents of this Project Manual. Identify each line item with number and title of major Specification Section. Also identify Site mobilization, bonds and insurance, and allowances.

D. Include in each line item amount of allowances as specified in this Section.

E. Include within each line item, direct proportional amount of Contractor's overhead and profit.

F. Revise schedule to list approved Change Orders with each Application for Payment.

1.4 PAYMENT PROCEDURES

A. Submit four copies of each Application for Payment on AIA G702 - Application and Certificate for Payment and AIA G703 - Continuation Sheet for G702 .

B. Content and Format: Use Schedule of Values for listing items in Application for Payment.

C. Submit updated construction schedule with each Application for Payment.

D. Payment Period: Submit a draft form to the Architect by the 25th day of each month.

E. Submit submittals with transmittal letter as specified in Section 01 33 00 - Submittal Procedures.

F. Submit four copies of waivers requested by Owner.
1. Applications for payment will include the approved payment request incorporating any changes agreed upon as a part of the project review.
2. Adjustments to the project schedule shall be provided with the application for payment.
3. Adjustments made to the project schedule due to rain or mud days must be documented and submitted for the current application period

G. Substantiating Data: When Architect/Engineer requires substantiating information, submit data justifying dollar amounts in question. Include the following with Application for Payment:
1. Partial release of liens from major Subcontractors and vendors.
2. Affidavits attesting to off-Site stored products.
3. Construction Progress Schedule, revised and current.

1.5 CONTRACT MODIFICATION PROCEDURES

A. Submittals: Submit name of individual who is authorized to receive change documents and is responsible for informing others in Contractor's employ or Subcontractors of changes to the Work.

B. Carefully study and compare Contract Documents before proceeding with fabrication and installation of Work. Promptly advise Architect/Engineer of any error, inconsistency, omission, or apparent discrepancy.

C. Requests for Interpretation (RFI) and Clarifications: Allot time in construction scheduling for liaison with Architect/Engineer; establish procedures for handling queries and clarifications.
1. Contractor shall thoroughly review interpretation requests from Subcontractor prior to forwarding RFI to Architect/Engineer.
2. Architect/Engineer may respond with a direct answer on the Request for Interpretation form, or issue a change directive in the form of an Architect’s Supplemental Instructions or Proposal Request.

D. Architect/Engineer will advise of minor changes in the Work not involving adjustment to Contract Sum/Price or Contract Time by issuing supplemental instructions on AIA G710.

E. Architect/Engineer may issue Proposal Request including a detailed description of proposed change with supplementary or revised Drawings and Specifications, a

change in Contract Time for executing the change and with the period of time during which the requested price will be considered valid. Contractor will prepare and submit estimate within 10 days.

F. Contractor may propose changes by submitting a request for change to Architect/Engineer, describing proposed change and its full effect on the Work. Include a statement describing reason for the change and the effect on Contract Sum/Price and Contract Time with full documentation.

G. Stipulated Sum/Price Change Order: Based on Proposal Request AIA G709 and Contractor's fixed price quotation.

H. Construction Change Directive: Architect/Engineer may issue directive, on AIA G714 - Construction Change Directive signed by Owner, instructing Contractor to proceed with change in the Work, for subsequent inclusion in a Change Order. Document will describe changes in the Work and designate method of determining any change in Contract Sum/Price or Contract Time.
   1. Time and Material: Submit itemized account and supporting data after completion of change, within time limits indicated in Conditions of the Contract. Architect/Engineer will determine change allowable in Contract Sum/Price and Contract Time as provided in Contract Documents.
   2. Maintain detailed records of Work done on time and material basis. Provide full information required for evaluation of proposed changes and to substantiate costs for changes in the Work.

I. Document each quotation for change in Project Cost or Time with sufficient data to allow evaluation of quotation.

J. Change Order Forms: AIA G701 - Change Order.

K. Execution of Change Orders: Architect/Engineer will issue Change Orders for signatures of parties as provided in Conditions of the Contract. The process will culminate in the issuance of change order with the approval of by the Owner.

L. Change orders of $50,000 and greater will require action by the Board of Trustees of ACCD.

M. Correlation of Contractor Submittals:
   1. Promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as separate line item and adjust Contract Sum/Price.
   2. Promptly revise Progress Schedules to reflect change in Contract Time, revise subschedules to adjust times for other items of Work affected by the change, and resubmit.

N. Promptly enter changes in Record Documents.

END OF SECTION

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SECTION 01 23 00

ALTERNATES

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDED

A. Identification and description of Alternate Work.

1.2 RELATED DOCUMENTS

A. Bid Documents: Quotation of cost of each Alternate.

B. Owner-Contractor Agreement: Alternates accepted by Owner for incorporation into the Work.

C. Sections of Specifications identified in each Alternate.

D. General Conditions of the Contract and Supplementary Conditions.

1.3 PROCEDURES

A. Definitions: Alternates are defined as alternate products, materials, equipment, installations or systems for portions of the Work, which may, at Owner's option and under terms established by the Contract Documents, be selected and recorded in the Contractor (Owner-Contractor Agreement) to either supplement or displace corresponding basic requirements of Contract Documents. Alternates may or may not substantially change scope and general character of the Work; and are not to be confused with "Allowances", "Change Orders", "Substitutions", and other similar provisions.

B. General Provisions: A "Schedule of Alternates" is included at the end of this Section. Each Alternate is defined by abbreviated language, recognizing that Drawings and Specification Sections document the requirements. Coordination of related Work is required to ensure that Work affected by each selected Alternate is complete and properly interfaced with Work of Alternates.

C. Notification: Immediately following award of Contract, prepare and distribute to each entity to be involved in performance of the Work, a notification of status of each Alternate. Indicate which Alternates have been: (1) Accepted, (2) Rejected, and (3) Deferred for consideration at a later date as indicated. Include full description of negotiated modifications to Alternates, if any.

1.4 SCHEDULE OF ALTERNATES

A. **ALTERNATE BID NO. 1:** Remove existing toilet and toilet accessories at single use toilet rooms indicated on Drawings. Work includes capping waste lines, removing existing floor tile and preparing walls and floor to receive new finishes. Base Bid: No work in these rooms.

B. **ALTERNATE BID NO. 2**: Replace Doors 005 and 006 at IDF 101 and Admin Office respectively. Finish door to match existing doors. Base Bid: Existing doors 005 and 006 to remain; refinish doors to match existing doors.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

END OF SECTION

SECTION 01 26 00

CONTRACT COORDINATION

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDED

A. Coordination of Work of the Contract.

1.2 RELATED REQUIREMENTS

A. Uniform General Conditions, Supplementary General Conditions, and Special Conditions of the Contract.

B. Section 01 11 00 – Summary of Work.

C. Section 01 60 00 – Material and Equipment.

D. Section 01 73 29 – Cutting and Patching.

E. Section 01 77 00 – Project Closeout.

1.3 DESCRIPTION

A. Coordinate scheduling, submittals, and work of the various sections of Specifications to assure efficient and orderly sequence of installation of construction elements, with provisions for accommodating items to be installed later.

1.4 MEETINGS

A. In addition to progress meetings specified elsewhere, hold coordination meetings and pre-installation conferences with personnel and subcontractors to assure coordination of Work.

1.5 COORDINATION OF SUBMITTALS

A. Schedule and coordinate submittals in accordance with procedures noted in Section 01 33 00.

B. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

C. Coordinate requests for substitutions to assure compatibility of space, of operating elements, and effect on work of other sections.

1.6 COORDINATION OF SPACE

A. Coordinate use of Project space and sequence of installation of mechanical and electrical work which is indicated diagrammatically on Drawings. Follow routings shown for pipes, ducts, and conduits as closely as practicable, with due allowance

for available physical space; make runs parallel with lines of building. Utilize space efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

B. In finished areas conceal pipes, ducts, and wiring in the construction. Coordinate locations of fixtures and outlets with finish elements.

C. Verify that mechanical and electrical controls, valves, cut-offs, cleanouts, switches and other items are located to be readily accessible to user.

1.7 COORDINATION OF CONTRACT CLOSEOUT

A. Coordinate completion and cleanup of work of separate sections in preparation for Substantial Completion in accordance with Section 01 77 00.

B. After Owner occupancy of work areas, coordinate access to site by various sections for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

C. Assemble and coordinate closeout submittals specified in Section 01 77 00.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

END OF SECTION

SECTION 01 30 00

ADMINISTRATIVE REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Coordination and project conditions.

B. Preconstruction meeting.

C. Site mobilization meeting.

D. Progress meetings.

E. Pre-installation meetings.

F. Special procedures.

1.2 RELATED SECTIONS

A. Section 01 73 29 – Cutting and Patching.

1.3 COORDINATION AND PROJECT CONDITIONS

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

B. Verify utility requirements and characteristics of operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, operating equipment.

C. Coordinate space requirements, supports, and installation of mechanical and electrical Work indicated diagrammatically on Drawings. Follow routing shown 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.

D. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within construction. Coordinate locations of fixtures and outlets with finish elements.

E. Coordinate completion and clean-up of Work of separate sections in preparation for Substantial Completion and for portions of Work designated for Owner's partial occupancy.

F. After Owner occupancy of premises, coordinate access to site for correction of defective Work and Work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

1.4 PRECONSTRUCTION MEETING

A. Owner will schedule meeting after Notice of Award.

B. Attendance Required: Owner, Architect/Engineer, Contractor, and Subcontractors.

C. Agenda: As prepared by Architect.

1.5 SITE MOBILIZATION MEETING

A. Architect/Engineer will schedule meeting at Project site prior to Contractor occupancy.

B. Attendance Required: Owner, Architect/Engineer, Special Consultants, and, Contractor, Contractor's Superintendent, and major Subcontractors.

C. Agenda:
1. Use of premises by Owner and Contractor.
2. Owner's requirements and partial occupancy.
3. Construction facilities and controls provided by Owner.
4. Temporary utilities provided by Owner.
5. Survey and building layout.
6. Security and housekeeping procedures.
7. Schedules.
8. Application for payment procedures.
9. Procedures for testing.
10. Procedures for maintaining record documents.
11. Requirements for start-up of equipment.
12. Inspection and acceptance of equipment put into service during construction period.

1.6 PROGRESS MEETINGS

A. Schedule and administer meetings throughout progress of the Work at bi-monthly intervals.

B. Architect/Engineer will make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.

C. Attendance Required: Job superintendent, major subcontractors and suppliers, Owner, Architect/Engineer, as appropriate to agenda topics for each meeting.

D. Agenda:
1. Review minutes of previous meetings.
2. Review of Work progress.
3. Field observations, problems, and decisions.
4. Identification of problems impeding 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. Other business relating to Work.

E. Architect will record minutes and distribute copies to the Contractor, Owner, and Consultants.

1.7 PRE-INSTALLATION MEETINGS

A. Contractor shall convene pre-installation conferences at the work site prior to commencing work items as indicated on the Pre-Installation or Pre-Construction Meetings included in the Owner's Special Conditions.

B. Prepare agenda and preside at meeting in accordance with the NISD – Owner's Special Conditions.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

3.1 SPECIAL PROCEDURES

A. Materials: As specified in product sections.

B. Employ skilled and experienced installer to perform work.

C. Remove debris and abandoned items from area and from concealed spaces.

D. Close openings in exterior surfaces to protect existing work from weather and extremes of temperature and humidity.

E. Finish surfaces as specified in individual product sections.

END OF SECTION

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SECTION 01 33 00

SUBMITTALS

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDED

A. Procedures required for submittal items specified in Division 1 and individual Specification Sections to include, but not be limited to:
   1. Construction Progress Schedules.
   2. Schedule of Values.
   3. Requirements specified in individual Sections.
   4. Shop Drawings.
   5. Product Data, manufacturer's specifications, instructions, manuals and certificates.
   6. Samples.

1.2 RELATED REQUIREMENTS

A. Section 01 30 00 – Administrative Requirements.

B. Section 01 60 00 – Product Requirements: Manufacturer's instructions and Contractor's list of Products.

C. Section 01 77 00 – Project Closeout.

1.3 QUALITY ASSURANCE

A. Asbestos Free Material/Product: Prior to approval of the material/product to be used, the manufacturer/supplier shall furnish the Architect with Certification that the material/product contains no asbestos. Submittals furnished without the asbestos-free certification will be returned to the Contractor with no action taken until such certification is provided.

1.4 DEFINITIONS

A. Work-related submittals of this section are categorized for convenience as follows:
   1. Shop drawing include specially-prepared technical data for this project, including drawings, diagrams, performance curves, data sheets, schedules, templates, patterns, reports, calculations, instructions, measurements and similar information not in standard printed form for general application to a range of similar projects.
   2. Product data include standard printed information on materials, products and systems; not specially-prepared for this project, other than the designation of selections from among available choices printed therein.
   3. Samples include both fabricated and unfabricated physical examples of materials, products and units of work; both as complete units and as smaller portions of units of work; either for limited visual inspection or (where indicated) for more detailed testing and analysis.

a. Mock-ups are a special form of samples, which are too large or otherwise inconvenient for handling in specified manner for transmittal of sample submittals.

4. Miscellaneous submittals related directly to the work (non-administrative) include warranties, maintenance agreements, workmanship bonds, survey data and reports, physical work records, quality testing and certifying reports, copies of industry standards, record drawings, field measurement data, operating and maintenance materials, overrun stock, and similar information, devices and materials applicable to the work and no processed as shop drawings, product data or samples.

1.5 SUBMITTAL PROCEDURES

A. Transmit each submittal with a form acceptable to Architect. Provide sufficient number of copies as needed for Owner and Architect/Engineer to retain a copy as well as copies required by Contractor for project closeout.

B. Each transmittal letter shall be identified with a submittal number corresponding to Specification Section for which items are referenced, followed with a numeric extension indicating the number of submittals within the same Specification Section; ex. SUBMITTAL 08 21 00-01.

C. Items requiring resubmittal shall be identified with original number followed by the letter "-R"; ex. SUBMITTAL 08 21 00-01R1.

D. Identify Project, Contractor, Subcontractor or supplier; pertinent Drawing and Detail number, and Specification Section number, as appropriate.

E. Apply Contractor's stamp, signed or initialed 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.

F. Schedule submittals to expedite the Project, and deliver to Architect/Engineer at 5545 Fredericksburg Road, Ste. 100, San Antonio, TX 78229. Coordinate submission of related items.

G. For each submittal for review, allow 30 days for architectural and structural items, 45 days for mechanical, electrical and plumbing items, excluding delivery time to and from the Contractor.

H. Review submittals for compliance with the Contract Documents and certify with stamp of certification. Stamped certified submittal represents that the Contractor has verified field dimensions and checked and coordinated each shop drawing and sample with the requirements of the Work.

I. Identify variations from Contract Documents and Product or system limitations which may be detrimental to successful performance of the completed Work.

J. Submit initial Progress Schedule and Schedule of Values in duplicate within 7 days after award of Contract. After review by Architect revise and resubmit as required. Submit revised Schedule of Values reflecting changes since previous submittal.

K. Comply with Progress Schedule for submittals related to Work progress. Coordinate submittal of related items.

L. After Architect review of submittal, revise and resubmit as required, identifying changes made since previous submittal.

M. Distribute copies of reviewed submittals to concerned persons. Instruct recipients to promptly report any inability to comply with provisions.

1.6 CONSTRUCTION PROGRESS SCHEDULES:

A. Submit initial Schedule in duplicate within 15 days after date established in Notice to Proceed.

B. Revise and resubmit as required.

C. Submit revised Schedule with each Application for Payment, identifying changes since previous version.

D. Submit a computer generated chart with separate line for each major portion of Work or operation, identifying first work day of each week.

E. Show complete sequence of construction by activity, identifying Work of separate stages and other logically grouped activities. Indicate the early and late start, early and late finish, float dates, and duration.

F. Indicate estimated percentage of completion for each item of Work at each submission.

G. Indicate submittal dates required for shop drawings, product data, samples, and product delivery dates, including those furnished by Owner and required by Allowances.

1.7 SCHEDULE OF VALUES

A. Submit in accordance with General Conditions and Section 01 30 00.

1.8 CONTRACTOR'S APPLICATION AND CERTIFICATE FOR PAYMENT

A. Submit in accordance with General Conditions and the Owner's Pre-Construction Conference Manual.

1.9 SHOP DRAWINGS

A. Requirements are stated in General Conditions and Supplementary General Conditions and in individual Sections of the Specifications.

B. Submit to Architect/Engineer for review for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents.

1.10 PRODUCT DATA

A. Mark each copy to identify applicable products, options, and other data; supplement manufacturer's standard data to provide information unique to the Work. Include manufacturer's installation instructions when required by the Specification Section.

B. Submit the number of copies determined in SUBMITTAL PROCEDURES above.

1.11 SAMPLES

A. Submit full range of manufacturer's standard colors, textures, and patterns for Architect's selection. Submit samples for selection of finishes with reasonable promptness and in orderly sequence so to cause no delay in the Work.

B. Submit samples to illustrate functional characteristics of the products, with integral parts and attachment devices. Coordinate submittal of different categories for interfacing Work.

C. Include identification on each sample, giving full information.

D. Submit the number specified in respective Specification Section; one will be retained by Architect. Reviewed samples which may be used in the Work are indicated in the individual Specification Sections.

E. Provide field finishes at Project as required by individual Specifications Section. Install sample complete and finished. Acceptable finishes in place may be retained in completed Work.

1.12 CONTROLS SYSTEMS SHOP DRAWINGS

A. The complete HVAC control system submittal and shop drawing shall be provided within 90 days after the date of the Notice to Proceed. Failure to submit within this time period shall be considered adequate cause to stop further payment for labor and materials for the HVAC systems until the submittal is received.

1.13 INTERIOR FINISH MATERIAL SUBMITTAL

A. Submit interior finish materials for review and color selection within 45 days of Notice to Proceed. After 60 days, the Architect reserves the right to select materials from manufacturers included in these Specifications at no additional cost to the Owner.

PART 2 - PRODUCTS
Not Used.

PART 3 - EXECUTION
Not Used.

END OF SECTION

SECTION 01 40 00

QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDED

A. General Quality Control.

B. Workmanship.

C. Manufacturer's Instructions.

D. Manufacturer's Certificates.

E. Manufacturer's Field Services.

F. Testing Laboratory Services.

1.2 RELATED REQUIREMENTS

A. Uniform General Conditions, Supplementary General Conditions and Special Conditions of the Contract.

B. Section 01 10 00 – Summary of the Work.

C. Section 01 30 00 – Administrative Requirements.

D. Section 01 60 00 – Product Requrements.

1.3 QUALITY CONTROL, GENERAL

A. Maintain quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.

1.4 WORKMANSHIP

A. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.

B. Perform Work by persons qualified to produce workmanship of specified quality.

C. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration and racking.

1.5 MANUFACTURERS' INSTRUCTIONS

A. Comply with manufacturer's instructions in full detail, including each step in sequence. Should instructions conflict with Contract Documents, request clarification from Architect before proceeding.

1.6 MANUFACTURERS' CERTIFICATES

A. When required by individual Specifications Section, submit manufacturer’s certificate, in duplicate, that products meet or exceed specified requirements.

1.7 INSPECTIONS, TESTS AND REPORTS

A. Contractor shall cooperate with Testing Laboratory personnel; furnish tools, samples of materials, design mix of concrete, equipment, storage and assistance as requested.
   1. Notify Owner and Testing Laboratory 24 hours prior to expected time for operations requiring testing services.
   2. Make arrangements with Testing Laboratory and pay for additional samples and tests for Contractor's convenience and as required by the Uniform General Conditions and Supplementary General Conditions of the Contract.

B. Contractor shall coordinate and establish a schedule of activities requiring Special Inspections in Section 01 45 23 and the 2015 International Building Code.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

END OF SECTION

SECTION 01 45 23

SPECIAL TESTING AND INSPECTION SERVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Special Testing Agency responsibilities.

B. Special Testing Agency reports.

C. Limits on Special Testing Agency authority.

D. Contractor responsibilities.

1.2 RELATED SECTIONS

A. General Conditions of the Contract for Construction: Inspections, testing, and approvals required by public authorities.

1.3 REFERENCES

A. 2018 International Building Code, Chapter 17.

B. Divisions 02, 31, and 32.

1.4 DEFINITIONS

A. Special Inspection: Inspection required of the materials, installation, fabrication, erection or placement of components and connections requiring special expertise to ensure compliance with Construction Documents and referenced standards.

B. Special Inspection, Continuous: The full-time observation of Work requiring special inspection by a special inspector who is present in the area where the Work is being performed.

C. Special Inspection, Periodic: The part-time or intermittent observation of Work requiring special inspection by special inspector who is present in the area where the Work has been or is being performed and at the completion of the Work.

1.5 SELECTION AND PAYMENT

A. Owner will employ and pay for services of an independent Special Testing Agency to perform specified Special Testing and Inspections.

B. Employment of Special Testing Agency shall in no way relieve Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

1.6 SPECIAL TESTING AGENCY RESPONSIBILITIES

A. Test samples or materials provided by Contractor.

B. Provide qualified, trained personnel at site. Cooperate with Architect and Contractor in performance of services.

C. Perform specified inspection, sampling, and testing of Products in accordance with specified standards.

D. Ascertain compliance of materials with requirements of Contract Documents.

E. Promptly notify Architect and Contractor of observed irregularities or non-conformance of Work or Products.

F. Perform additional inspections and tests required by Authorities Having Jurisdiction.

G. Attend pre-construction conferences and progress meetings appropriate to phase of Work.

1.7 SPECIAL TESTING AGENCY REPORTS

A. After each inspection and test promptly submit three copies of report to Architect, one copy to Owner and two copies to Contractor.

B. Will Include:
1. Date issued.
2. Project title and number.
3. Name of inspector.
4. Date and time of sampling or inspection.
5. Identification of Product and Specifications Section.
6. Location materials being sampled and tested were placed in the Project.
7. Type of inspection or test,
8. Date of test.
9. Results of tests.
10. Conformance with Contract Documents.

C. Provide interpretations of test results to Architect.

1.8 LIMITS ON SPECIAL TESTING SERVICE AUTHORITY

A. Agency may not:
1. Release, revoke, alter, or enlarge on requirements of Contract Documents.
2. Approve or accept any portion of the Work.
3. Assume any duties of Contractor.

B. Agency has no authority to stop the Work.

1.9 CONTRACTOR RESPONSIBILITIES

A. Provide Agency access to designated location, adequate samples of materials proposed to be used which require testing.

B. Cooperate with Agency personnel, and provide access to the Work and to manufacturer's or fabricator's facilities.

C. Provide incidental labor and facilities to provide access to Work to be tested, to obtain and handle samples at the site or at source of products to be tested, to facilitate tests and inspections, storage and curing of test samples.

D. Notify Agency not less than 24 hours prior to expected time for operations requiring inspection and testing services.

E. Pay costs of re-testing when original tests indicate material tested fails to meet specified requirements. Cost for re-testing and inspections occasioned thereby will be deducted from the Contract Sum.

F. Pay cost for additional testing when originally specified tests were not conducted timely due to failure of the Contractor to provide Service adequate advance notice to schedule personnel. Cost for additional tests and inspections occasioned thereby will be deducted from the Contract Sum.

PART 2 - PRODUCTS

Refer to Divisions 02 thru 33.

PART 3 - EXECUTION

3.1 GENERAL

Special Testing and Inspection Services shall include but not be limited to the following:

A. 2018 IBC Section 1705.4 – Masonry: Periodic testing of mortar.

B. 2018 IBC Section 1705.6 – Soils: Proofrolling and placement observations, moisture, conditioning, compaction and density testing.

END OF SECTION

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SECTION 01 50 00

CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Temporary Utilities: Electricity, lighting, heat, ventilation, telephone service, water, and sanitary facilities.

B. Temporary Controls: Barriers, enclosures and fencing, protection of the Work, and water control.

C. Construction Facilities: Access roads, parking, progress cleaning, project signage, and temporary buildings.

1.2 RELATED SECTIONS

A. Section 01 77 00 - Project Closeout: Final cleaning.

1.3 TEMPORARY ELECTRICITY

A. Complement existing power service capacity and characteristics as required.

B. Provide power outlets for construction operations, with branch wiring and distribution boxes located as required. Provide flexible power cords as required.

C. Provide main service disconnect and over-current protection at convenient location.

D. Permanent convenience receptacles may not be utilized during construction.

1.4 TEMPORARY LIGHTING FOR CONSTRUCTION PURPOSES

A. Provide and maintain incandescent lighting for construction operations to achieve a minimum lighting level of 2 watt/sq ft.

B. Provide and maintain 1 watt/sq ft lighting to exterior staging and storage areas after dark for security purposes.

C. Provide and maintain 0.25 watt/sq ft H.I.D. lighting to interior work areas after dark for security purposes.

D. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps as required.

E. Maintain lighting and provide routine repairs.

F. Permanent building lighting may be utilized during construction.

1.5 TEMPORARY HEATING

A. Provide heating devices and heat as needed to maintain specified conditions for construction operations.

B. Enclose building prior to activating temporary heat in accordance with the Exterior Enclosures article in this section.

C. Prior to operation of permanent equipment for temporary heating purposes, verify that installation is approved for operation, equipment is lubricated and filters are in place. Provide and pay for operation, maintenance, and regular replacement of filters and worn or consumed parts.

D. Maintain minimum ambient temperature of 50 degrees F in areas where construction is in progress, unless indicated otherwise in product sections.

1.6 TEMPORARY COOLING

A. Provide cooling devices and cooling as needed to maintain specified conditions for construction operations.

B. Enclose building prior to activating temporary cooling in accordance with the Exterior Enclosures article in this section.

C. Prior to operation of permanent equipment for temporary cooling purposes, verify that installation is approved for operation, equipment is lubricated and filters are in place. Provide and pay for operation, maintenance, and regular replacement of filters and worn or consumed parts.

D. Maintain maximum ambient temperature of 80 degrees F in areas where construction is in progress, except as otherwise noted.

1.7 TEMPORARY VENTILATION

A. Ventilate enclosed areas to achieve curing of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

B. Utilize existing ventilation equipment. Extend and supplement equipment with temporary fan units as required to maintain clean air for construction operations.

1.8 TELEPHONE SERVICE

A. Provide, maintain, and pay for telephone service to field office at time of project mobilization. Service shall be maintained for the duration of operations under this Contract.

1.9 TEMPORARY WATER SERVICE

A. Provide, maintain and pay for suitable quality water service required for construction operations at time of project mobilization.

B. Extend branch piping with outlets located so water is available by hoses with threaded connections.

1.10 TEMPORARY SANITARY FACILITIES

A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.

1.11 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas and to protect adjacent properties from damage from construction operations.

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.

1.12 FENCING

A. Construction: Commercial grade chain link fence.

B. Provide 6 foot high fence around construction site; equip with vehicular gates with locks.

C. Fencing shall not restrict access to and egress from the building.

1.13 WATER CONTROL

A. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.

B. Protect site from standing or running water. Provide water barriers as required to protect site from soil erosion.

1.14 EXTERIOR ENCLOSURES

A. Provide temporary 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.

1.15 PROTECTION OF INSTALLED WORK

A. Protect installed Work and provide special protection where specified in individual specification sections.

B. Provide temporary and removable protection for installed Products. Control activity in immediate work area to prevent damage.

C. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

D. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

E. Prohibit traffic from landscaped areas.

1.16 SECURITY

A. Provide security and facilities to protect Work from unauthorized entry, vandalism, or theft.

1.17 PARKING

A. Provide adequate staff parking in area where approved by Owner.

B. Do not allow vehicle parking on existing pavement.

1.18 PROGRESS CLEANING AND WASTE REMOVAL

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 rubbish from site and dispose off-site.

E. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.19 PROJECT IDENTIFICATION

A. Refer to 4D-EDA Construction Site Sign Summary Page

B. Erect on site at location established by Architect/Engineer.

C. No other signs are allowed without Owner permission except those required by law.

1.20 FIELD OFFICES AND SHEDS

A. Office: Contractor may utilize one existing classroom.

1.21 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary utilities, equipment, facilities, materials, prior to Substantial Completion inspection.

B. Remove underground installations to a minimum depth of 2 feet. Grade site as indicated.

C. Clean and repair damage caused by installation or use of temporary work.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

END OF SECTION

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SECTION 01 60 00
PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDED

A. Products.

B. Transportation and Handling.

C. Storage and Protection.

D. Substitutions.

E. U.L. Labels.

1.2 RELATED REQUIREMENTS

A. Uniform General Conditions, Supplementary General Conditions and Special Conditions of the Contract.

B. Section 01 30 00 – Administrative Requirements.

C. Section 01 77 00 – Project Closeout: Operation and Maintenance Data and Warranties and Bonds.

1.3 PRODUCTS

A. Products include material, equipment and systems.

B. Any material or construction procedure specified by reference to the number, symbol or title of a specific standard such as Commercial Standard, Federal Specification, American Society of Testing Material, a trade association standard or other similar standards, shall comply with the standards referred to, incorporating limits as to type, class or grade or other modification in such reference, as if the standard was printed in the Specifications.

C. Except when the year or edition of the standard is indicated in the reference, the latest revision, amendment or supplement to the standard in effect on the date the bidding documents are issued is applicable.

D. Unless specified to the contrary, all materials of the construction shall be new and of the best of the kinds and grades specified and all workmanship shall be up to the best recognized standards known to the various trades. Salvaged materials may be used when approved by the Architect in some remodeled areas if required for matching remaining materials.

1.4 TRANSPORTATION

A. Transport products by methods to avoid product damage; deliver in undamaged condition in manufacturer's unopened containers or packaging, dry.

B. Provide equipment and personnel to handle products by methods to prevent soiling or damage.

C. Promptly inspect shipments to assure that products comply with requirements, quantities are correct and products are undamaged.

1.5 STORAGE AND PROTECTION

A. Store products in accordance with manufacturer's instructions, with seals and labels intact and legible. Store sensitive products in weather-tight enclosures; maintain within temperature and humidity ranges required by manufacturer's instructions.

B. For exterior storage of fabricated products, place on sloped supports above ground. Cover products subject to deterioration with impervious sheet covering; provide ventilation to avoid condensation.

C. Do not stack materials in a manner which would overload supporting material of structures.

D. Store loose granular materials on solid surfaces in a well-drained area; prevent mixing with foreign matter.

E. Arrange storage to provide access for inspection. Periodically inspect to assure products are undamaged and are maintained under required conditions.

F. After installation, provide coverings to protect products from damage for traffic and construction operations; remove when no longer needed.

1.6 SUBSTITUTION PROCEDURES

A. If a request for substitution by Contractor is permitted, the Owner and the Architect may accept or reject any such request in their sole discretion. Requests for substitutions submitted after such thirty (30) day period will not be considered unless a product becomes impossible to obtain due to circumstances beyond the Contractor’s control.

B. By making requests for substitutions pursuant to this Subparagraph the Contractor:
   1. Represents that the Contractor has personally investigated the proposed substitute product and determined that it is equal or superior in all respects to the product specified;
   2. Represents that the Contractor will provide the same warranty for the substitution product that the Contractor would have provided for the product specified;
   3. Certifies that the cost breakdown presented with the request is complete and includes all related costs, except for the Architect’s redesign costs, if any, and waives all claims for additional costs related to the substitution which

subsequently become apparent;

4. Agrees to coordinate and supervise the installation of the proposed substitute, making such changes as may be required for the Work to be complete in all respects; and
5. Agrees to reimburse Owner and Architect for review or redesign services associated with any re-approval by applicable governmental authorities related to the substitution.
6. Any request for substitution will include complete data substantiating compliance of the proposed substitution with the Contract Documents, together with a detailed breakdown of the cost of the project bid and the cost of the suggested substitution, which will include the cost of labor and materials and Contractor's overhead and profit allocable thereto.
7. Each request for substitution shall be submitted to the Architect with appropriate shop drawings, product data, and certified test results substantiating the proposed product equivalence.

C. The Architect shall notify the Contractor in writing of its decision to accept or reject any request for substitution submitted by Contractor in accordance with this subparagraph.

D. Requests for time extensions will NOT be approved for delays due to rejected substitutions. NO substitution will be allowed without the Architect's approval in writing.

E. Should a substitution be approved under the foregoing provisions, and subsequently prove to be defective or otherwise unsatisfactory for the service for which it was intended, the Contractor shall, without cost to Owner, and without obligation on the part of the Architects, replace the same with the material originally specified.

1.7 U.L. LABEL

A. Where applicable, all such materials and equipment, for which Underwriters' Laboratories, Inc. standards have been established, and their label service is available, shall bear the appropriate U.L. Label.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

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SECTION 01 73 29

CUTTING AND PATCHING

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDED

A. Requirements and limitations for cutting and patching of Work.

1.2 RELATED REQUIREMENTS

A. Section 01 11 00 – Summary of Work.

B. Section 01 60 00 – Product Requirements.

C. Individual Specifications Sections: Cutting and patching incidental to work of the section.

1.3 DESCRIPTION

A. Execute cutting, fitting, and patching to complete Work, and to:
1. Fit the several parts together, to integrate with other work.
2. Uncover work to install ill-timed work.
3. Remove and replace defective and non-conforming work.
4. Remove samples of installed work for testing.
5. Provide openings in non-structural elements for penetrations of mechanical and electrical work.

1.4 SUBMITTALS

A. Submit written request in advance of cutting or alteration which 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's continuing operations.

B. Include in request:
1. Identification of Project.
2. Location and description of affected work.
3. Necessity for cutting or alteration.
4. Description of proposed work, and products to be used.
5. Alternatives to cutting and patching.
6. Effect on work of Owner or separate contractor.
7. Date and time work will be executed.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Those required for original installation.

B. For any change in materials, submit request for substitution in accordance with Section 01 60 00 - Materials and Equipment.

PART 3 - EXECUTION

3.1 INSPECTION

A. Inspect existing conditions, including elements subject to damage or movement during cutting and patching.

B. After uncovering, inspect conditions affecting performance of work.

C. Beginning of cutting or patching means acceptance of existing conditions.

3.2 PREPARATION

A. Provide supports to assure structural integrity of surroundings; devices and methods to protect other portions of Project from damage.

B. Provide protection from elements for areas which may be exposed by work; maintain excavations free of water.

3.3 PERFORMANCE

A. Execute work by methods to avoid damage to other work, and which will provide surfaces to receive patching and finishing.

B. Cut rigid materials using a masonry saw or core drill. Pneumatic tools shall be prohibited.

C. Restore work with new products in accordance with requirements of Contract Documents.

D. Fit work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

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

F. At penetrations of fire-rated wall, ceiling, or floor construction, completely seal voids with fire-resistant material to fulfill equal rating of the construction element.

END OF SECTION

SECTION 01 77 00

PROJECT CLOSEOUT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Prerequisites to Substantial Completion.

B. Prerequisites to Final Acceptance.

C. Record Document Submittals.

D. Closeout Procedures.

E. Final Cleaning.

1.2 RELATED DOCUMENTS

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

1.3 DEFINITIONS

A. Closeout is hereby defined to include general requirements near end of Contract Time, in preparation for final acceptance, final payment, normal termination of contract, occupancy by Owner and similar actions evidencing completion of the work. Specific requirements for individual units of work are specified in sections of Division 2 through 33. Time of closeout is directly related to "Substantial Completion", and therefore may be either a single time period for entire work or a series of time periods for individual parts of the work which have been certified as substantially complete at different dates. That time variation (if any) shall be applicable to other provisions of this section.

1.4 PREREQUISITES TO SUBSTANTIAL COMPLETION

A. General: Prior to requesting Architect/Engineer's inspection for certification of substantial completion, (for either entire Work or portions thereof), complete the following and list known exceptions in request.
   1. In progress payment request, coincide with or first following date claimed, show either 100% completion for portion of work claimed as "substantially complete", or list incomplete items value of incompletion, and reasons for being incomplete.
   2. Include supporting documentation for completion as indicated in these contract documents.
   3. Submit a statement showing an accounting of changes to the Contract Sum.
   4. Advise Owner of pending insurance change-over requirements.
   5. Submit specific warranties, workmanship/maintenance bonds, maintenance agreements, final certifications and similar documents.

6. Obtain and submit releases enabling Owner's full, unrestricted use of the Work and access to services and utilities. Where required, include occupancy permits, operating certificates and similar releases.
7. Deliver tools, spare parts, extra stocks of material and similar physical items to the Owner. Obtain signed receipts from the Owner and bind them into the close-out documents.
8. Make the final change-over of locks and transmit the keys to the Owner. Advise the Owner's personnel of the change-over in security provisions.
9. Complete start-up testing of systems, and instruction of the Owner's operating and maintenance personnel. Discontinue or change over and remove temporary facilities and services from the project site, along with construction tools and facilities, mock-ups, and similar elements.
10. Complete final cleaning up requirements, including touch-up painting of marred surfaces.

B. Inspection Procedures: Upon receipt of Contractor's request for inspection, the Architect/Engineer will either proceed with inspection or advise Contractor of prerequisites not fulfilled. Following initial inspection, Architect/Engineer will either prepare certificate of substantial completion, or will advise Contractor of work which must be performed prior to issuance of certificate; and repeat inspection when requested and assured that work has been substantially completed. Results of completed inspection will form initial "punch list" for final acceptance.

1.5 PREREQUISITES TO FINAL ACCEPTANCE

A. General: Prior to requesting Architect's/Engineer's final inspection for certification of final acceptance and final payment, as required by General Conditions, complete the following and list known exceptions (if any) in request:
1. Submit the final payment request with final releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.
2. Submit an updated final statement, accounting for final additional changes to the Contract Sum.
3. Submit a certified copy of the Architect/Engineer's final punch-list of itemized work to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance and has been endorsed and dated by the Architect/Engineer.
4. Submit final meter readings for utilities, a measured record of stored fuel, and similar data as of the date of substantial completion, or Owner took possession of and responsibility for corresponding elements of the Work.
5. Submit consent of surety.
6. Revise and submit evidence of final, continuing insurance coverage complying with insurance requirements.

B. Reinspection Procedure: Upon receipt of Contractor's notice that all work has been completed, including punch-list items resulting from earlier inspections, and excepting incomplete items delayed because of acceptable circumstances, Architect/Engineer will reinspect the work. Upon completion of reinspection, Architect/Engineer will either prepare certificate of final acceptance or advise Contractor of work not completed or obligations not fulfilled as required for final acceptance. If necessary, procedure will be repeated.

1.6 RECORD DOCUMENT SUBMITTALS

A. General: Specific requirements for record documents are indicated in the individual sections of these specifications. Other requirements are indicated in the General Conditions. General submittal requirements are indicated in "Submittal" sections. Do no use record documents for construction purposes; protect from deterioration and loss in a secure, fire-resistive location; provide access to record documents for the Architect/Engineer's reference during normal working hours.

B. Record Drawings: Maintain a white-print set (blue-line or black-line) of contract drawings and shop drawings in clean, undamaged condition, with mark-up of actual installations which vary substantially from the work as originally shown. Mark whichever drawing is most capable of showing the actual "field" condition fully and accurately; however, where shop drawings are used for mark-up, record a cross-reference at corresponding location on the working drawings. Mark with red erasable pencil, and where feasible, use other colors to distinguish between variations in separate categories of work. Mark up new information which is recognized to be of importance to Owner, but was for some reason not shown on either contract drawings or shop drawings. Give particular attention to concealed work which would be difficult to measure and record at a later date. Note related change-order numbers where applicable. Organize record drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates and other identification on cover of set. Upon completion of the project, the Contractor shall record all such changes on one (1) set of Contractor furnished reproducible mylars (3-mil) and shall then furnish the Architect with both the white-print set and the set of mylar reproducible drawings which shall be marked by the Contractor on each Sheet as "Record Drawing".

C. Record Specifications: Maintain one copy of specifications, including addenda, change orders and similar modifications issued in printed form during construction and mark-up variations (of substance) in actual work in comparison with text of the specifications and modifications as issued. Give particular attention to substitutions, selection of options and similar information on work where it is concealed or cannot otherwise be readily discerned at a later date by direct observation. Note related record drawing information and product data, where applicable. Upon completion of mark-up, submit to Architect/Engineer for the Owner's records.

D. Record Product Data: Maintain one copy of each product data submittal and mark-up significant variations in actual work in comparison with submitted information. Include both variations in product as delivered to the site, and variations from the manufacturer's instructions and recommendations for installation. Give particular attention to concealed products and portions of the work which cannot otherwise be readily discerned at a later date by direct observation. Note related change orders and mark-up of record drawings and specifications. Upon Completion of mark-up, submit complete set to the Architect/Engineer for the Owner's records.

E. Record Sample Submittal: Immediately prior to date of substantial completion, Architect/Engineer (and including Owner's personnel where desired) will meet with Contractor at site, and will determine which (if any) of submitted samples maintained by Contractor during progress of the work are to be transmitted to Owner for record

purposes. Comply with Architect's/Engineer's instructions for packaging, identification marking, and delivery to Owner's sample storage space.

F. Miscellaneous Record Submittal: Refer to other sections of these specifications for requirements of miscellaneous record-keeping and submittal in connection with the actual performance of the Work. Immediately prior to the date or dates of substantial completion, complete miscellaneous records and place in good order, properly identified and bound or filed, ready for continued use and reference. Submit to the Architect/Engineer for the Owner's records.

G. Maintenance Manuals: Organize maintenance-and-operating manual information into suitable sets of manageable size, and bind into individual binders properly identified and indexed (thumb-tabbed). Include emergency instructions, spare parts listing, copies of warranties, wiring diagrams, recommended "turn-around" cycles, inspection procedures, shop drawings, product data, and similar applicable information. Bind each manual of each set in a heavy-duty 2", 3-ring vinyl-covered binder, and include pocket folders for folded sheet information. Mark identification on both front and spine of each binder. Upon completion of the project, submit three (3) complete sets of the maintenance manuals.

PART 2 - PRODUCTS

(Not Applicable)

PART 3 - EXECUTION

3.1 CLOSEOUT PROCEDURES

A. General Operating and Maintenance Instructions: Arrange for each installer of work requiring continuing maintenance, or operation, to meet with Owner's personnel, at project site, to provide basic instructions needed for proper operation and maintenance of entire work. Include instructions by manufacturer's representatives where installers are not expert in the required procedures. Review maintenance manuals, record documentation, tools, spare parts and materials, lubricants, fuels, identification system, control sequences, hazards, cleaning and similar procedures and facilities. For operational equipment, demonstrate start-up, shut-down, emergency operations, noise and vibration adjustments, safety, economy/efficiency adjustments, energy effectiveness, and similar operations. Review maintenance and operations in relation with applicable warranties, agreements to maintain, bonds, and similar continuing commitments. The Contractor shall obtain a sign-in sheet of all persons in attendance for the Operation and Maintenance Instruction period. The sign-sheet shall be bound into the operating and maintenance manuals.

3.2 FINAL CLEANING:

A. General: Special cleaning for specific units of work is specified in sections of Divisions 2 through 33. General cleaning during progress of work is specified in General Conditions and as temporary services in "Temporary Facilities" section of this Division. Provide final cleaning of the work, at time indicated, consisting of cleaning each surface or unit of work to normal "clean" condition expected for a first-

class building cleaning and maintenance program. Comply with manufacturer's instructions for cleaning operations. The following are examples, but not by way of limitation, of cleaning levels required.

1. Remove labels which are not required as permanent labels.
2. Clean transparent materials, including mirrors and window/door glass, to a polished condition, removing substances which are noticeable as vision-obscuring materials.
3. Replace broken glass and other damaged transparent materials.
4. Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition, free of dust, stains, films and similar noticeable distracting substances. Except as otherwise indicated, avoid disturbance of natural weathering of exterior surfaces. Restore reflective surfaces to their original reflective condition.
5. Wipe surfaces of mechanical and electrical equipment clean; remove excess lubrication and other substances.
6. Remove debris and surface dust from limited-access spaces including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics and similar spaces.
7. Clean concrete floors in non-occupied spaces broom-clean.
8. Vacuum clean carpeted surfaces and similar soft surfaces.
9. Clean plumbing fixtures to a sanitary condition, free of stains including those resulting from water exposure.
10. Clean food service equipment to a condition of sanitary ready and acceptable for intended food service use.
11. Clean light fixtures and lamps so as to function with full efficiency.
12. Clean project site (yard and grounds), including landscape development areas, of litter and foreign substances. Sweep paved areas to a broom-clean condition; remove stains, petro-chemical spills and other foreign deposits. Rake grounds which are neither planted nor paved, to a smooth, even textured surface.

B. Pest Control: Engage an experienced exterminator to make a final inspection of the project, and to rid project of rodents, insects, and other pests.

C. Removal of Protections: Except as otherwise indicated or requested by the Architect/Engineer, remove temporary protection devices and facilities which were installed during the course of the work to protect previously completed work during the remainder of the construction period.

D. Compliances: Comply with safety standards and governing regulations for cleaning operations. Do no burn waste materials at the site, or bury debris or excess materials on Owner's property, or discharge volatile or other harmful or dangerous materials into drainage systems. Remove waste materials from the site and dispose of in a lawful manner.

1. Where extra materials of value remaining after completion of associated work have become the Owner's property, dispose of these to the Owner's best advantage as directed.

END OF SECTION

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SECTION 01 81 00

CONSTRUCTION INDOOR AIR QUALITY PROCEDURES

PARTS 1 – GENERAL

1. INDOOR AIR QUALITY GOALS:

   A. Sustain the comfort and well-being of construction workers during the construction process.

   B. Protect the health of future occupants in the completed building.

   C. Protect the health of existing occupants in adjacent occupied areas and buildings.

   D. Establish and sustain a successful management of an indoor air quality plan during construction and before occupancy.

   E. All subcontractors will attend an educational session about the indoor air quality management implemented during construction.

   F. All the following information below will be agenda items to be discussed regularly at preconstruction and construction meetings.

2. ON-SITE INDOOR AIR QUALITY MEASURES:

   A. Preventive job-site practices will reduce the potential for residual problems with indoor air quality in the completed building and reduce undue health risks for workers.
      1. HVAC Protection
      2. Source Control
      3. Pathway Interruption
      4. Housekeeping
      5. Scheduling
      6. Materials Protection
      7. Job-site inspection and maintenance of IAQ measures
      8. Prohibit smoking

3. CONTRACTOR'S RESPONSIBILITIES:

   A. A member of the construction team shall be identified as the IAQ Manager and shall be responsible for the following:
      1. Ensure that all members of the project team are knowledgeable about indoor quality issues and have defined responsibilities for implementation of good indoor air quality practices.
      2. Establish subcontractor agreements that communicate the goals of the construction indoor air quality plan and maintain continual communication to reinforce the importance of the IAQ plan.
      3. Keep a copy of the Construction Indoor Air quality Plan on site and review it regularly to ensure job site operations are in compliance.

4. Monitor the work of subcontractors to ensure indoor air quality is not affected during daily construction progress. Identify activities that may adversely impact indoor air quality, notify the responsible party, review corrective procedures and institute remedial or corrective action as necessary.
5. Provide subcontractors and field personnel with the proper resources (i.e. collection bins, cleaning tools and materials) to encourage compliance.
6. Include issues related to the Construction Indoor Air Quality Plan on the agenda during regularly scheduled construction and safety meetings. Review and discuss the status, procedures and importance of the construction indoor air quality goals.
7. Include the following agenda items for regular discussion at preconstruction and construction meetings:
    a. Job-site inspection and maintenance of IAQ measures
    b. IAQ concerns and problems that require correction
8. Conduct regular inspection and maintenance of indoor air quality measures including ventilation system protection.
9. During Job Site Coordination meetings, review and discuss status of IAQ requirements and procedures with the Project Team.
    a. Document all occurrences of Construction Indoor Air Quality Plan non-compliance with a written report and photographs.
    b. Document the implementation of Construction Indoor Air Quality Plan procedures with written, dated reports and photographs.
    c. Provide signage on the jobsite during construction that clearly states that smoking is prohibited inside the building and within 25 feet of all building entrances.

4. SUBCONTRACTOR RESPONSIBILITIES:

A. Ensure that each foreman and all field crews are familiar with the goals and procedures contained in the Construction Indoor Air Quality Plan.

B. Attend construction progress and safety meetings and provide supporting documentation if requested or required.

C. Take precautionary measures to reduce health risks for workers. Require VOC safe masks for workers installing VOC emitting products. (defined as products that emit 150 g/L or more VOCs)

D. OSHA requires the use of personal protective equipment (PPE) to reduce employees' exposures to hazards when engineering and/or administrative controls are not feasible or effective in reducing these exposures to acceptable levels. Subcontractors are responsible for determining if PPE will be used to protect their workers.

E. Appropriate working apparel, hard hats, boots, etc., are required. Wearing contaminated work clothes is unacceptable.

F. Submit a construction schedule to prevent materials from acting as sinks for storage and subsequent release of contaminants emitted from finishes which have

the potential for short-term off-gassing. In the schedule, the contractor will include appropriate allowances for drying or curing times before installation of materials that have a fibrous or porous nature that tend to absorb contaminants.

G. Report occurrences that may affect or represent a potentially negative impact on indoor air quality long-term to General Contractor's Superintendent, immediately.

5. EXECUTION OF CONTROL MEASURES:

The Contractor and all Subcontractors are required to meet or exceed the recommended Control Measures of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guidelines for Occupied Buildings Under Construction, 2nd Edition 2007, ANSI/SMACNA 008-2008, Chapter 3. Contractor is required to keep a copy of the referenced standard onsite. Visit www.smacna.org or call (703) 803-2980 to obtain a copy of the referenced standard. Minimum control measures for an effective IAQ plan during the construction phase include the following:

A. HVAC Protection:

1. The intent of this section is to protect all HVAC equipment from collecting dust and / or odors. Odors can be absorbed by porous materials in the system and be released later.
2. HVAC equipment shall be delivered on-site sealed in plastic on pallets protecting the interior of the units from dust, debris and moisture. Equipment will be stored on raised pallets and sealed in plastic until installation. If necessary, the plastic can be removed during installation and replaced immediately afterward. Seal all duct and equipment openings with plastic. The protective plastic covering will remain until the system is tested prior to occupancy. At that time, all vents and ducts will be inspected for contamination. If any dust deposits are observed, the area will be cleaned by a professional with expertise in the proper use of equipment and procedures for duct cleaning.
3. The permanently installed HVAC system shall not be used during demolition or construction without prior approval of Owner and Mechanical Engineer of Record. Use temporary air handling units as needed to maintain proper temperature and humidity for finishes until the HVAC system is released for use by the Owner. Ensure that all parts of the system are properly covered/protected and stored off the ground in a clean, dry location where contaminants are not introduced, away from construction.
4. All supply and return ducts must be sealed during construction at all times. The return side of the HVAC system is, by definition under negative pressure and thus capable of drawing in nearby construction dust and odor. Isolate the return side of the HVAC system from the surrounding environment as much as possible and seal all return system openings with plastic. The permanent HVAC system will be shutdown whenever possible during heavy construction and demolition.
5. If the permanent HVAC system is approved for use during construction, protect the return side by installing temporary filtration media over grilles and openings with a Minimum Efficiency Reporting Value (MERV) of 8 as determined by ASHRAE 52.2 – 1999. For open plenum returns, the return air ducts in the plenum will need MERV 8 filters. To prevent

dirt contamination to the air terminal units prior to the installation of ceiling tiles and return grilles:

a. Have the primary air damper on the air terminal units set to fully open (by controls contractor).
b. Remove and store the filter from the air terminal units.
c. Block the return air intake at the air terminal units. The intake at the air terminal unit is located at the filter location. Once the ceiling and return air grilles are in place the MERV 8 filtration must be shifted to the return grille or other openings in the plenum if the air handlers are to be used during construction.

6. During construction, filters will be inspected every other day and replaced as needed. Maintain a filter schedule to show the type of filters installed, inspection dates and replacement dates.
7. If an unducted ceiling plenum returns over the construction zone must be used, it should be isolated by having all ceiling tiles in place. Check for leaks in the ducts and air handlers and repair promptly.
8. If permanently installed HVAC system is approved for used during construction, heaviest work areas shall be dampered off or blocked if temporary imbalance of the return air system does not create a greater problem.
9. If permanent HVAC systems are approved for use during construction, filtration with media such as activated charcoal or potassium permanganate shall be used as needed to control construction related odors.
10. Mechanical rooms shall not be used to store construction or waste materials.
11. All HVAC equipment is scheduled for commissioning and testing prior to occupancy.
12. If contamination occurs, affected components will be cleaned prior to start-up testing.
13. The mechanical contractor shall provide data sheets of filtration media used during construction and installed immediately prior to building flush-out and prior to building occupancy.

B. Source Control

Minimize the sources of construction pollution by complying with the following measures:

1. Use low-emitting materials as specified by the architect.
2. Recover, isolate and ventilate containers housing toxic materials.
3. Store liquids outdoors. To reduce the possibility of spills during storage, transfer, or mixing, store all odorous or toxic liquids outside the building and protect against freezing. Any pollution sources within the building will be stored in spaces that are exhausted directly to the outside away from openings and intakes. Do not use the mechanical rooms for storage.
4. Keep containers closed. Containers storing VOC-emitting products such as fuel, paints, finishes and solvents will be kept tightly sealed and away from absorptive materials when not in use. These items will remain outside of the building(s) when not in use.
5. Avoid use of combustion equipment indoors. Engines, heaters or equipment that runs on gasoline, diesel, kerosene or other fossil fuels shall not be operated indoors unless absolutely necessary and only when large

quantities of exhaust ventilation, such as the use of large industrial fans located downwind at nearby openings, are provided to remove combustion pollutants such as carbon monoxide, moisture, and dust. Emissions from propane-powered equipment such as generators and forklifts are cleaner but potentially harmful under some circumstances. Exhaust fumes from idling vehicles and gasoline-fueled tools within the building must be exhausted to the exterior of the building through the use of funnels or temporary piping. Use of electric power tools, hoists, forklifts and machinery will be considered whenever possible.

6. Operation of motor vehicles. Motor vehicles will not be operated within the building. Motorized equipment or delivery vehicles used near doors or openings will be limited. Turn off engines when not in use and do not allow idling.
7. Reduce construction dust. Minimize the amount of dust in the air and on surfaces. Vacuum assisted cut-off saws, grinders and drywall sanding equipment shall be used to minimize dust. Empty dust collection systems into receptacles located outside of the building.
8. No smoking or chewing tobacco is allowed on school property.
9. Permanently seal all abandoned sewer and waste piping. Unsealed abandoned floor drains and pipes can emit sewer gas back into the occupied spaces.
10. Confirm that all new and abandoned gas and refrigerant piping has been properly pressure tested and is leak-free. Abandoned refrigeration lines will be decommissioned and permanently sealed.
11. Seal all newly installed piping to prevent dust contamination.
12. Roofing kettles shall be equipped with emissions control equipment and shall be staged downwind of any building openings or outside air intakes.

C. Pathway Interruption

1. Temporary barriers shall be constructed to isolate areas under construction from clean or occupied areas.
2. Prevent air movement from the work site to clean or occupied spaces by interrupting potential contaminant pathways, and by manipulating the following factors to achieve environmental control:
    a. Depressurize the work area.
        1. Adjust the balance of the existing HVAC and exhaust systems (if prior approval is given by Owner and Mechanical Engineer of Record).
        2. Install portable fans.
        3. Exhaust the work site at a rate at least 10% greater than the rate of supply (if prior approval is given by Owner and Mechanical Engineer of Record).
    b. Pressurize occupied space
        1. Increase supply air or decrease exhaust air in occupied spaces (if prior approval is given by Owner and Mechanical Engineer of Record).
        2. Protect HVAC system from construction emissions.
    c. Erect barriers to contain construction area
        1. Dust curtains to control nuisance dust.

2. Continuous plastic seal to control hazardous dust.

d. Relocate pollutant sources
   1. Do not store construction products and waste materials in mechanical rooms.
   2. Locate emissive materials as far away from air intakes as possible.
   3. Roofing tar kettles shall be located as far away from air intakes and building openings as possible.
   4. Refurbishing of mechanical equipment shall be performed outdoors or in a shop.

e. Temporarily seal the building when construction emissions are occurring on the roof or adjacent to a building, and there is no other alternative, seal intake dampers and other building openings to prevent emissions from entering the building through the HVAC system.

D. Housekeeping

As dust accumulates at the construction site, it will become airborne when disturbed by nearby activity. Similarly, spills or excess applications of products containing solvents will increase odors at the project site.

1. Clean daily to remove construction dust and debris. Promptly clean up spills.
2. Remove accumulated water daily and keep work areas as dry as possible to discourage the growth of mold and bacteria. Take extra measures when working with hazardous materials, and clean in accordance with any requirements or regulations for the product involved.
3. Suppress dust with sweeping compounds. Use damp rags, mops or vacuum cleaners to clean up dust instead of brooms to clean construction dust from floors whenever possible.
4. Building materials, especially those with moisture absorbing properties like wood, insulation, paper and fabric, shall be kept dry to prevent the growth of mold and bacteria.
5. Cover dry materials with plastic to prevent water damage or dust contamination, and if resting on the ground, use spacers to allow air to circulate between the ground and the materials.
6. Water damaged materials shall be dried within 24 hours. Due to the possibility of mold growth, materials that are damp or wet for more than 72 hours shall be discarded.
7. Clean spills immediately. If solvents, cleaners, gasoline or other odorous or potentially toxic liquids are spilled onto the floor, they shall be cleaned up immediately. If a spill occurs on a porous building material, discard the affected product and replace it with new material.

E. Scheduling

1. Coordinate construction activities to minimize or eliminate disruption of operations in the occupied portions of the building.
2. Conduct activities with high pollution potential during off hours, such as weekends or evenings, to allow time for new materials to air out. Plan adequate time to conduct testing and balance, commissioning, and IAQ flush out and/or testing procedures before occupancy.

3. Ensure that construction activity is sequenced to minimize the absorption of VOCs by absorptive building materials.
4. Schedule construction operations so that absorptive materials like ceiling tile and carpeting are installed only after all applications of wet and odorous materials such as adhesives, sealants, paints and other coatings have been completed.
5. Prior to absorptive materials being installed, building will be dried in with doors and windows on all openings.
6. Replace all filtration media immediately prior to occupancy. Permanent filtration media shall have a minimum MERV rating of 11.

PART 2 – PRODUCTS

NOT USED

PART 3 – EXECUTION

NOT USED

END OF SECTION

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DOCUMENT 02 19 00

INFORMATION AVAILABLE TO BIDDERS

PART 1 - SUMMARY

A. Documents Include:
   1. Subsurface Investigation Report.

PART 2 - SUBSURFACE INVESTIGATION REPORT

A. Copy of the original geotechnical report is appended to the end of this document as Exhibit - A and is titled as follows:

   Pavement Evaluation Study For
   Eastside Education & Training Center
   San Antonio, Texas

   Project No. ASA20-039-00

   As prepared by: Raba Kistner
   July 27, 2020

B. The purpose of the study was to perform a visual evaluation of the existing pavement, evaluate soil properties, and recommend rehabilitation options and construction guidelines.

C. Recommendations described are not requirements of this Contract, unless specifically referenced in Contract Documents.

D. This report, by its nature, cannot reveal all conditions existing on the site. Should subsurface conditions be found to vary substantially from this report, changes in design and construction of foundations will be made, with resulting credits or expenditures to Contract Price/Sum.

PART 3 – EXECUTION

Not Used

END OF DOCUMENT

(REPORT TO FOLLOW)

RABA KISTNER

PAVEMENT EVALUATION STUDY

FOR

EASTSIDE EDUCATION & TRAINING CENTER
SAN ANTONIO, TEXAS

Project No. ASA20-039-00
July 27, 2020

12821 W Golden Lane
San Antonio, TX 78249

PO Box 690287
San Antonio, TX 78269

P 210.699.9090
F 210.699.6426
TBPE Firm F-3257

WWW.RKCI.COM

Mr. Mark T. Price
Alamo Colleges
Facilities Project Coordinator
St. Philips College Facilities
1801 Martin Luther King Drive
San Antonio, Texas 78203

RE: Pavement Evaluation Study
Eastside Education & Training Center
San Antonio, Texas

Dear Mr. Price:

RABA KISTNER Inc. (RKI) is pleased to submit the report of our Pavement Evaluation Study for the above-referenced project. This study was performed in accordance with RKI Proposal No. PSA20-065-00 (Revised), dated June 18, 2020. The purpose of this study was to perform a visual evaluation of the existing pavement, drill three borings within the existing pavement, perform laboratory testing to evaluate soil properties, and prepare an engineering report presenting rehabilitation options and construction guidelines.

We appreciate the opportunity to be of service to you on this project. Should you have any questions about the information presented in this report, or if we may be of additional assistance with the materials testing-quality control program during construction, please call.

Very truly yours,

RABA KISTNER, INC.

Alexander T. Britt, E.I.T.
Graduate Engineer

R. Blake Wright, P.E.
Project Manager

STATE OF TEXAS
R. BLAKE WRIGHT
117753
LICENSED
PROFESSIONAL ENGINEER

ATB/RBW/kv

Attachments

Copies Submitted: Above (1) Electronic

PAVEMENT EVALUATION STUDY

For

EASTSIDE EDUCATION & TRAINING CENTER
SAN ANTONIO, TEXAS

Prepared for

ALAMO COLLEGES
San Antonio, Texas

Prepared by

RABA KISTNER, INC.
San Antonio, Texas

PROJECT NO. ASA20-039-00

July 27, 2020

TABLE OF CONTENTS

ATTACHMENTS

The following figures are attached and complete this report:

INTRODUCTION

RABA KISTNER Inc. (RKI) has completed the authorized pavement evaluation for the rehabilitation and/or reconstruction of the existing asphalt pavement (parking lot) at the Eastside Education & Training Center located at 4551 Dietrich Road in San Antonio, Texas. This report briefly describes the procedures utilized during this study and presents our findings along with our recommendations for pavement design and construction guidelines.

PROJECT DESCRIPTION

To be considered in this study are the existing asphalt pavements located at 4551 Dietrich Road in San Antonio, Texas. The asphalt parking lot is on the northeast corner of the intersection of Dietrich Road and Springfield Road. It is our understanding that the existing asphalt pavements at the site are being considered for rehabilitation and/or reconstruction. The purpose of this study is to provide options for both rehabilitation and replacement of the existing pavements.

LIMITATIONS

This engineering report has been prepared in accordance with accepted Geotechnical Engineering practices in the region of South/Central Texas and for the use of St. Philips College Facilities (CLIENT) and its representatives for design purposes. This report may not contain sufficient information for purposes of other parties or other uses. This report is not intended for use in determining construction means and methods. The attachments and report text should not be used separately.

The recommendations submitted in this report are based on the data obtained from three (3) borings drilled at the site, a visual evaluation of the existing pavement, and our understanding of the project information provided to us. If the project information described in this report is incorrect, is altered, or if new information is available, we should be retained to review and modify our recommendations.

The nature and extent of any variations across the site may not become evident until construction, if any, occurs. The construction process itself may also alter subsurface conditions. If variations appear evident at the time of construction, it may be necessary to reevaluate our recommendations after performing on-site observations and tests to establish the engineering impact of the variations.

The scope of our Pavement Evaluation Study does not include an environmental assessment of the air, soil, rock, or water conditions either on or adjacent to the site. No environmental opinions are presented in this report.

BORINGS AND LABORATORY TESTING

Subsurface conditions at the site were evaluated by three (3) borings drilled at the locations shown on the Boring Location Map, Figure 1. These locations are approximate and distances were measured using a hand-held, recreational-grade GPS locator. The asphalt was cored and the thickness of the underlying base material was measured, then the soil was drilled to depths of approximately 10 ft below the existing

ground surface using a truck-mounted drilling rig. During drilling operations, split-spoon samples (with standard penetration tests) were collected.

Laboratory tests were not performed on the asphalt cores or base material collected. Each soil sample was visually classified in the laboratory by a member of our geotechnical engineering staff. The geotechnical engineering properties of the subgrade strata were evaluated by natural moisture content and Atterberg Limits tests.

The laboratory test results are presented in graphical or numerical form on the boring logs illustrated on Figures 2 through 4. A key to classification terms and symbols used on the logs is presented on Figure 5. The results of the laboratory and field testing are also tabulated on Figure 6 for ease of reference. Dynamic Cone Penetrometer (DCP) testing was performed at each boring location. The results of the DCP testing are presented on Figure 7.

Standard penetration test results are noted as "blows per ft" on the boring logs and on Figure 6, where "blows per ft" refers to the number of blows by a falling hammer required for 1 ft of penetration into the soil/weak rock.

Samples will be retained in our laboratory for 30 days after submittal of this report. Other arrangements may be provided at the request of the Client.

PAVEMENT OBSERVATIONS

Visual observations of the existing asphalt pavement were made on June 29, 2020. These observations are presented below:

- The asphalt pavement exhibits distresses such as longitudinal cracking, potholes, and fatigue cracking. Potholes and severe cracking are typically indicators of a reduction in the support from either the subgrade or base material beneath the asphalt pavement;
- The overall condition of the pavement may be rated fair to poor with a higher presence of distress in the western portion of the parking lot;
- A large area of fatigue cracking was observed in the area of Boring B-1;
- Curbs are not present along the perimeter of the pavement area north of Boring B-1; and
- Standing water was observed in the southwest portion of the parking lot and is an indicator of insufficient drainage of the parking area.

PAVEMENT RECOMMENDATIONS

Recommendations and considerations for asphalt overlay, asphalt mill and inlay, asphalt removal and replacement, and full reconstruction are presented in this report. For all options, drainage conditions will have a significant impact on long term performance, particularly where permeable base materials are utilized in the pavement section. Drainage considerations are discussed in more detail in a subsequent section of this report.

It should be noted the asphalt distresses present at this site are the result of environmental affects and not necessarily traffic loading. The subgrade clays are the main contributors to the pavement failures. Any rehabilitation or reconstruction efforts that do not address vertical and horizontal movements of the subgrade should not be expected to perform on a long-term basis without new cracks and/or other distresses forming.

ASPHALT OVERLAY/ASPHALT MILL AND INLAY/FULL-DEPTH RECLAMATION

Due to the variable and relatively thin asphalt thicknesses encountered in our borings as well as the significant observed distresses, we do not recommend that an asphalt overlay, asphalt mill and inlay, or a full-depth reclamation be performed at this site. If any of these are performed, existing distresses will quickly reflect up through the new asphalt surface layer. Once the distresses are present at the surface, the degradation may accelerate and the pavement will approach a condition similar to its present state.

ASPHALT REMOVAL AND REPLACEMENT

Removal and replacement of the existing asphalt pavement is an option that may be considered at this site. If this option is selected, we recommend the underlying base material be evaluated after removal of the asphalt to identify any soft or weak areas or areas where the asphalt removal process may have disturbed the base material. We also recommend quality control testing be performed during construction if this option is selected.

Areas where distresses are significant should have full-depth repairs prior to any new asphalt placement. The exposed subgrade should be moisture conditioned by scarifying to a minimum depth of 6 in. and recompacted to at least 95 percent of maximum density as determined by TxDOT Tex-114-E or ASTM D698 Compaction Test. The moisture content of the subgrade should be maintained within the range of optimum moisture content to 3 percentage points above optimum until permanently covered.

This option does not address the subgrade materials and expectations of post-construction performance should be considered as previously discussed.

FULL RECONSTRUCTION

Full reconstruction of all of the pavements may also be considered. If full reconstruction is selected, we recommend a pavement section consisting of 2 in. of asphalt overlying 8 in. of flexible base overlying 10 in. of lime or cement treated subgrade be utilized. Lime or cement content may be estimated at 5 percent by weight of the soil for estimating and budgeting purposes. The appropriate percentage of lime or cement should be determined by laboratory testing prior to construction. This testing should also include tests for sulfate content of the subgrade soils.

If lime and/or cement treatment of the subgrade is not utilized, then this option does not address the subgrade materials and expectations of post-construction performance should be considered as previously discussed.

If lime and/or cement treatment of the subgrade is utilized, fewer distresses should be expected over the life of the pavement. However, distresses should be still be expected due to the 10 to 15 ft of soil that is expected to move vertically and/or horizontally with fluctuations in moisture content and other environmental effects.

RIBBON CURBS/CURB AND GUTTER

We recommend curbs be installed along all pavement edges where curbs are not already present. Curbs may consist of traditional "curb and gutter" type devices or a "ribbon" curb.

It is good practice to construct curbs such that the depth of the curb extends through the entire depth of the granular base material to act as a protective barrier against the infiltration of water into the granular base. Pavements that do not have this protective barrier to moisture tend to develop cracks near the edge of the pavement. Once these cracks develop, further degradation and weakening of the underlying granular base may occur due to water seepage through the cracks.

DUMPSTER PADS

No dumpsters were present on or near the concrete pad located in the northwest portion of the parking lot. However, if there is any possibility for garbage trucks to utilize the pavement area in the future, we recommend concrete be placed in the garbage truck drive lane and especially any areas where the truck will turn or lift dumpsters.

PAVEMENT CONSTRUCTION CONSIDERATIONS

SUBGRADE PREPARATION FOR FULL-DEPTH REPAIR AND RECONSTRUCTION

Where full-depth repair is necessary or reconstruction is selected the existing pavement section should be removed. The exposed subgrade should be moisture conditioned by scarifying to a minimum depth of 6 in. and recompacted to at least 95 percent of maximum density as determined by TxDOT Tex-114-E or ASTM D698 Compaction Test. The moisture content of the subgrade should be maintained within the range of optimum moisture content to 3 percentage points above optimum until permanently covered.

FLEXIBLE BASE COURSE

If required, the flexible base course should be crushed limestone conforming to TxDOT 2014 Standard Specifications, Item 247, Type A, Grade 1-2. Base course should be placed in lifts with a maximum thickness of 8 in. and compacted to a minimum of 95 percent of the maximum density at a moisture content within the range of 2 percentage points below to 2 percentage points above the optimum moisture content as determined by Tex-113-E, or 98 percent of maximum density as determined by ASTM D698.

PRIME COAT

If required, a prime coat should be placed on top of any compacted base course and should be a MC-30 or AE-P conforming to the 2008 City of San Antonio Standard Specification for Construction Item 202 – *Prime Coat* as well as *TxDOT Standard Specifications 2004, Item 300 – Asphalts, Oils or Emulsions.* Prime coat application rates are typically between 0.1 to 0.3 gal/yd^2 and are generally dependent upon the absorption rate of the granular base and other environmental conditions at the time of placement. City of San Antonio Standard Specification Item 202 – Prime Coat states that the application rate shall not exceed 0.2 gal/yd^2.

TACK COAT

A tack coat should be placed between asphaltic concrete surface lifts and/or prior to overlays and should be a PG binder with a minimum high-temperature grade of PG 58, SS-1H, CSS-1H, or EAP&T conforming to TxDOT Standard Specifications 2014, Item 300 – Asphalts, Oils or Emulsions. For construction, the application rate shall not exceed 0.1 gal/yd^2.

ASPHALTIC CONCRETE

The asphaltic concrete surface course should conform to TxDOT Standard Specifications, Item 340, Type C or D. The asphaltic concrete should be compacted to a minimum of 92 percent of the maximum theoretical specific gravity (Rice) of the mixture determined according to Test Method Tex-227-F. Pavement specimens, which shall be either cores or sections of asphaltic pavement, will be tested according to Test Method Tex-207-F. The nuclear-density gauge or other methods which correlate satisfactorily with results obtained from project roadway specimens may be used when approved by the Engineer. Unless otherwise shown on the plans, the Contractor shall be responsible for obtaining the required roadway specimens at their expense and in a manner and at locations selected by the Engineer.

DRAINAGE CONSIDERATIONS

As with any soil-supported structure, the satisfactory performance of a pavement system is contingent on the provision of adequate surface and subsurface drainage. Insufficient drainage which allows saturation of the pavement subgrade and/or the supporting granular pavement materials will greatly reduce the performance and service life of the pavement systems. **We recommend drainage patterns be corrected to facilitate quick drainage of the pavement area.**

Surface and subsurface drainage considerations crucial to the performance of pavements at this site include (but are not limited to) the following:

1) Any known natural or man-made subsurface seepage at the site which may occur at sufficiently shallow depths as to influence moisture contents within the subgrade should be intercepted by drainage ditches or below grade French drains.
2) Final site grading should eliminate isolated depressions adjacent to curbs which may allow surface water to pond and infiltrate into the underlying soils. **Curbs should completely penetrate base materials and should be installed to sufficient depth to reduce infiltration of water beneath the curbs**.

3) Pavement surfaces should be maintained to help minimize surface ponding and to provide rapid sealing of any developing cracks. These measures will help reduce infiltration of surface water downward through the pavement section.

MISCELLANEOUS PAVEMENT RELATED CONSIDERATIONS

Utilities

Our experience indicates that significant settlement of backfill can occur in utility trenches, particularly when trenches are deep, when backfill materials are placed in thick lifts with insufficient compaction, and when water can access and infiltrate the trench backfill materials. The potential for water to access the backfill is increased where water can infiltrate flexible base materials due to insufficient penetration of curbs, and at sites where geological features can influence water migration into utility trenches. It is our belief that another factor which can significantly impact settlement is the migration of fines within the backfill into the open voids in the underlying free-draining bedding material.

To reduce the potential for settlement in utility trenches, we recommend that consideration be given to the following:

- All backfill materials should be placed and compacted in controlled lifts appropriate for the type of backfill and the type of compaction equipment being utilized and all backfilling procedures should be tested and documented.
- Consideration should be given to wrapping free-draining bedding gravels with a geotextile fabric (similar to Mirafi 140N) to reduce the infiltration and loss of fines from backfill material into the interstitial voids in bedding materials.

Pavement Maintenance

Regular pavement maintenance is critical in maintaining pavement performance over a period of several years. All cracks that develop in asphalt pavements should be regularly sealed. Areas of moderate to severe fatigue cracking (also known as alligator cracking) should be sawcut and removed. The underlying base should be checked for contamination or loss of support and any insufficiencies fixed or removed and the entire area patched. Other maintenance techniques should be followed as required.

Construction Traffic

Construction traffic on prepared subgrade or granular base should be restricted as much as possible until the protective surface pavement is applied. Significant damage to the underlying layers resulting in weakening may occur if heavily loaded vehicles are allowed to use these areas.

CONSTRUCTION RELATED SERVICES

CONSTRUCTION MATERIALS TESTING AND OBSERVATION SERVICES

As presented in the attachment to this report, *Important Information About Your Geotechnical Engineering Report*, subsurface conditions can vary across a project site. The conditions described in this report are based on interpolations derived from a limited number of data points. Variations will be encountered during construction, and only the geotechnical design engineer will be able to determine if these conditions are different than those assumed for design.

Construction problems resulting from variations or anomalies in subsurface conditions are among the most prevalent on construction projects and often lead to delays, changes, cost overruns, and disputes. These variations and anomalies can best be addressed if the geotechnical engineer of record, RKI is retained to perform construction observation and testing services during the construction of the project. This is because:

- RKI has an intimate understanding of the geotechnical engineering report's findings and recommendations. RKI understands how the report should be interpreted and can provide such interpretations on site, on the client's behalf.
- RKI knows what subsurface conditions are anticipated at the site.
- RKI is familiar with the goals of the owner and project design professionals, having worked with them in the development of the geotechnical work scope. This enables RKI to suggest remedial measures (when needed) which help meet the owner's and the design teams' requirements.
- RKI has a vested interest in client satisfaction, and thus assigns qualified personnel whose principal concern is client satisfaction. This concern is exhibited by the manner in which contractors' work is tested, evaluated and reported, and in selection of alternative approaches when such may become necessary.
- RKI cannot be held accountable for problems which result due to misinterpretation of our findings or recommendations when we are not on hand to provide the interpretation which is required.

BUDGETING FOR CONSTRUCTION TESTING

Appropriate budgets need to be developed for the required construction testing and observation activities. At the appropriate time before construction, we advise that RKI and the project designers meet and jointly develop the testing budgets, as well as review the testing specifications as it pertains to this project.

Once the construction testing budget and scope of work are finalized, we encourage a preconstruction meeting with the selected contractor to review the scope of work to make sure it is consistent with the construction means and methods proposed by the contractor. RKI looks forward to the opportunity to provide continued support on this project, and would welcome the opportunity to meet with the Project Team to develop both a scope and budget for these services.

* * * * * * * * * * * * * * * * * * *

ATTACHMENTS

RABA KISTNER
12821 West Golden Lane
San Antonio, TX 78249
(210)699-9090 TEL
(210)699-6426 FAX
www.rkci.com
TBPE Firm Number 3257

SOURCE: Aerial imagery provided by City of San Antonio (2013)

BORING LOCATION MAP

EASTSIDE EDUCATION AND TRAINING CENTER
SAN ANTONIO, TEXAS

PROJECT No.:	ASA20-039-00
ISSUE DATE:	06/30/2020
DRAWN BY:	KRB
CHECKED BY:	ATB
REVIEWED BY:	RBW

FIGURE

1

NOTE: This Drawing is Provided for Illustration Only, May Not be to Scale and is Not Suitable for Design or Construction Purposes

LOG OF BORING NO. B-1

Eastside Education & Training Center
San Antonio, Texas

RABA KISTNER
TBPE Firm Registration No. F-3257

DRILLING METHOD: Straight Flight Auger

LOCATION: N 29.44182; W 98.40346

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WEIGHT, pcf	SHEAR STRENGTH, TONS/FT^2 (0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0) / PLASTIC LIMIT / WATER CONTENT / LIQUID LIMIT (10 20 30 40 50 60 70 80)	PLASTICITY INDEX	% -200
			ASPHALT (1.75 in.)					
			BASE (5.25 in.)					
			FILL MATERIAL: CLAY, Stiff, Dark Brown and Tan, with trace gravel					
			CLAY, Stiff, Dark Brown	10			42	78
				14				
			CLAY, Stiff to Very Stiff, Reddish-Brown					
5				20			40	
			- with gravel and calcareous deposits below 5.5 ft					
				14				59
			CLAY, Hard, Tan, calcareous					
				33				
10			Boring Terminated					

DEPTH DRILLED:	10.0 ft	**DEPTH TO WATER:**	Dry	**PROJ. No.:**	ASA20-039-00
DATE DRILLED:	7/9/2020	**DATE MEASURED:**	7/9/2020	**FIGURE:**	2

NOTE: THESE LOGS SHOULD NOT BE USED SEPARATELY FROM THE PROJECT REPORT

LOG OF BORING NO. B-2

Eastside Education & Training Center
San Antonio, Texas

RABA KISTNER
TBPE Firm Registration No. F-3257

DRILLING METHOD: Straight Flight Auger

LOCATION: N 29.44162; W 98.40358

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WEIGHT, pcf	SHEAR STRENGTH, TONS/FT^2 (0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0) / PLASTIC LIMIT / WATER CONTENT / LIQUID LIMIT (10 20 30 40 50 60 70 80)	PLASTICITY INDEX	% -200
			ASPHALT (1.25 in.)					
			BASE (8.75 in.)					
			CLAY, Firm to Stiff, Dark Brown	7			47	
				10				
5			CLAY, Stiff, Reddish-Brown, with trace gravel	12				64
			CLAY, Very Stiff to Hard, Tan, calcareous	19				
				41			5	
10			Boring Terminated					

DEPTH DRILLED:	10.0 ft	**DEPTH TO WATER:**	Dry	**PROJ. No.:**	ASA20-039-00
DATE DRILLED:	7/9/2020	**DATE MEASURED:**	7/9/2020	**FIGURE:**	3

NOTE: THESE LOGS SHOULD NOT BE USED SEPARATELY FROM THE PROJECT REPORT

LOG OF BORING NO. B-3

Eastside Education & Training Center
San Antonio, Texas

RABA KISTNER
TBPE Firm Registration No. F-3257

DRILLING METHOD: Straight Flight Auger

LOCATION: N 29.44160; W 98.40311

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WEIGHT, pcf	SHEAR STRENGTH, TONS/FT^2 (0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0) / PLASTIC LIMIT / WATER CONTENT / LIQUID LIMIT (10 20 30 40 50 60 70 80)	PLASTICITY INDEX	% -200
			ASPHALT (1.25 in.) BASE (5.75 in.)					
			CLAY, Stiff, Dark Brown	8				
			CLAY, Stiff to Very Stiff, Reddish-Brown	10				
5			- with calcareous deposits below 5 ft	16			21	
			CLAY, Very Stiff to Hard, Tan, calcareous	15				
				31			29	
10			Boring Terminated					

NOTE: THESE LOGS SHOULD NOT BE USED SEPARATELY FROM THE PROJECT REPORT

DEPTH DRILLED:	10.0 ft	**DEPTH TO WATER:**	Dry	**PROJ. No.:**	ASA20-039-00
DATE DRILLED:	7/9/2020	**DATE MEASURED:**	7/9/2020	**FIGURE:**	4

KEY TO TERMS AND SYMBOLS

MATERIAL TYPES

SOIL TERMS


CALCAREOUS


CALICHE


CLAY


CLAYEY


GRAVEL


GRAVELLY


PEAT


SAND


SANDY


SILT


SILTY


FILL

ROCK TERMS


CHALK


CLAYSTONE


CLAY-SHALE


CONGLOMERATE


DOLOMITE


IGNEOUS


LIMESTONE


MARL


METAMORPHIC


SANDSTONE


SHALE


SILTSTONE

OTHER


ASPHALT


BASE


CONCRETE/CEMENT


BRICKS / PAVERS


WASTE


NO INFORMATION

WELL CONSTRUCTION AND PLUGGING MATERIALS


BLANK PIPE


SCREEN


BENTONITE


CEMENT GROUT


BENTONITE & CUTTINGS


CONCRETE/CEMENT


CUTTINGS


GRAVEL


SAND


VOLCLAY

SAMPLE TYPES


AIR ROTARY


GRAB SAMPLE


CORE


GEOPROBE SAMPLER


ROTOSONIC -DAMAGED


MUD ROTARY


NO RECOVERY


NX CORE


PITCHER


ROTOSONIC -INTACT


SHELBY TUBE


SPLIT BARREL


SPLIT SPOON


TEXAS CONE PENETROMETER


DISTURBED

STRENGTH TEST TYPES


POCKET PENETROMETER


TORVANE


UNCONFINED COMPRESSION


TRIAXIAL COMPRESSION UNCONSOLIDATED-UNDRAINED


TRIAXIAL COMPRESSION CONSOLIDATED-UNDRAINED

NOTE: VALUES SYMBOLIZED ON BORING LOGS REPRESENT SHEAR STRENGTHS UNLESS OTHERWISE NOTED

PROJECT NO. ASA20-039-00

KEY TO TERMS AND SYMBOLS (CONT'D)

TERMINOLOGY

Terms used in this report to describe soils with regard to their consistency or conditions are in general accordance with the discussion presented in Article 45 of SOILS MECHANICS IN ENGINEERING PRACTICE, Terzaghi and Peck, John Wiley & Sons, Inc., 1967, using the most reliable information available from the field and laboratory investigations. Terms used for describing soils according to their texture or grain size distribution are in accordance with the UNIFIED SOIL CLASSIFICATION SYSTEM, as described in American Society for Testing and Materials D2487-06 and D2488-00, Volume 04.08, Soil and Rock; Dimension Stone; Geosynthetics; 2005.

The depths shown on the boring logs are not exact, and have been estimated to the nearest half-foot. Depth measurements may be presented in a manner that implies greater precision in depth measurement, i.e 6.71 meters. The reader should understand and interpret this information only within the stated half-foot tolerance on depth measurements.

RELATIVE DENSITY

Penetration Resistance Blows per ft	Relative Density
0 - 4	Very Loose
4 - 10	Loose
10 - 30	Medium Dense
30 - 50	Dense
> 50	Very Dense

COHESIVE STRENGTH

Resistance Blows per ft	Consistency	Cohesion TSF
0 - 2	Very Soft	0 - 0.125
2 - 4	Soft	0.125 - 0.25
4 - 8	Firm	0.25 - 0.5
8 - 15	Stiff	0.5 - 1.0
15 - 30	Very Stiff	1.0 - 2.0
> 30	Hard	> 2.0

PLASTICITY

Plasticity Index	Degree of Plasticity
0 - 5	None
5 - 10	Low
10 - 20	Moderate
20 - 40	Plastic
> 40	Highly Plastic

ABBREVIATIONS

B = Benzene
T = Toluene
E = Ethylbenzene
X = Total Xylenes
BTEX = Total BTEX
TPH = Total Petroleum Hydrocarbons
ND = Not Detected
NA = Not Analyzed
NR = Not Recorded/No Recovery
OVA = Organic Vapor Analyzer
ppm = Parts Per Million

Qam, Qas, Qal = Quaternary Alluvium
Qat = Low Terrace Deposits
Qbc = Beaumont Formation
Qt = Fluviatile Terrace Deposits
Qao = Seymour Formation
Qle = Leona Formation
Q-Tu = Uvalde Gravel
Ewi = Wilcox Formation
Emi = Midway Group
Mc = Catahoula Formation
El = Laredo Formation
Kknm = Navarro Group and Marlbrook Marl
Kpg = Pecan Gap Chalk
Kau = Austin Chalk

Kef = Eagle Ford Shale
Kbu = Buda Limestone
Kdr = Del Rio Clay
Kft = Fort Terrett Member
Kgt = Georgetown Formation
Kep = Person Formation
Kek = Kainer Formation
Kes = Escondido Formation
Kew = Walnut Formation
Kgr = Glen Rose Formation
Kgru = Upper Glen Rose Formation
Kgrl = Lower Glen Rose Formation
Kh = Hensell Sand

KEY TO TERMS AND SYMBOLS (CONT'D)

TERMINOLOGY

SOIL STRUCTURE

Slickensided	Having planes of weakness that appear slick and glossy.
Fissured	Containing shrinkage or relief cracks, often filled with fine sand or silt; usually more or less vertical.
Pocket	Inclusion of material of different texture that is smaller than the diameter of the sample.
Parting	Inclusion less than 1/8 inch thick extending through the sample.
Seam	Inclusion 1/8 inch to 3 inches thick extending through the sample.
Layer	Inclusion greater than 3 inches thick extending through the sample.
Laminated	Soil sample composed of alternating partings or seams of different soil type.
Interlayered	Soil sample composed of alternating layers of different soil type.
Intermixed	Soil sample composed of pockets of different soil type and layered or laminated structure is not evident.
Calcareous	Having appreciable quantities of carbonate.
Carbonate	Having more than 50% carbonate content.

SAMPLING METHODS

RELATIVELY UNDISTURBED SAMPLING

Cohesive soil samples are to be collected using three-inch thin-walled tubes in general accordance with the Standard Practice for Thin-Walled Tube Sampling of Soils (ASTM D1587) and granular soil samples are to be collected using two-inch split-barrel samplers in general accordance with the Standard Method for Penetration Test and Split-Barrel Sampling of Soils (ASTM D1586). Cohesive soil samples may be extruded on-site when appropriate handling and storage techniques maintain sample integrity and moisture content.

STANDARD PENETRATION TEST (SPT)

A 2-in.-OD, 1-3/8-in.-ID split spoon sampler is driven 1.5 ft into undisturbed soil with a 140-pound hammer free falling 30 in. After the sampler is seated 6 in. into undisturbed soil, the number of blows required to drive the sampler the last 12 in. is the Standard Penetration Resistance or "N" value, which is recorded as blows per foot as described below.

SPLIT-BARREL SAMPLER DRIVING RECORD

Blows Per Foot	Description
25	25 blows drove sampler 12 inches, after initial 6 inches of seating.
50/7"	50 blows drove sampler 7 inches, after initial 6 inches of seating.
Ref/3"	50 blows drove sampler 3 inches during initial 6-inch seating interval.

NOTE: To avoid damage to sampling tools, driving is limited to 50 blows during or after seating interval.

RESULTS OF SOIL SAMPLE ANALYSES

PROJECT NAME: Eastside Education & Training Center
San Antonio, Texas

FILE NAME: ASA20-039-00.GPJ 7/22/2020

Boring No.	Sample Depth (ft)	Blows per ft	Water Content (%)	Liquid Limit	Plastic Limit	Plasticity Index	USCS	Dry Unit Weight (pcf)	% -200 Sieve	Shear Strength (tsf)	Strength Test
B-1	1.0 to 2.5	10	27	63	21	42	CH		78		
	2.5 to 4.0	14	24								
	4.5 to 6.0	20	23	60	20	40	CH				
	6.5 to 8.0	14	19						59		
	8.5 to 10.0	33	13								
B-2	1.0 to 2.5	7	31	67	20	47	CH				
	2.5 to 4.0	10	27								
	4.5 to 6.0	12	16						64		
	6.5 to 8.0	19	14								
	8.5 to 10.0	41	12	21	16	5	CL				
B-3	1.0 to 2.5	8	23								
	2.5 to 4.0	10	29								
	4.5 to 6.0	16	23	35	14	21	CL				
	6.5 to 8.0	15	16								
	8.5 to 10.0	31	11	46	17	29	CL				

PP = Pocket Penetrometer TV = Torvane UC = Unconfined Compression FV = Field Vane UU = Unconsolidated Undrained Triaxial

CU = Consolidated Undrained Triaxial

PROJECT NO. ASA20-039-00

Project Number: ASA20-039-00
Test Date: July 9, 2020

DCP TEST DATA

B-1

Eastside Education & Training Center
San Antonio, Texas

Type of Ham.	No. of Blows	Penetration Incre. (mm)	Penetration Cumm. (in)	CBR (%)	M_R (ksi)	q_{ult} (ksf)
1	1	64	2.5	3	4.5	1.13
1	1	37	4	5	7.5	1.59
1	1	16	4.6	13	19.5	3.00
1	1	10	5	22	33	4.25
1	1	12	5.5	18	27	3.72
1	2	21	6.3	21	31.5	4.13
1	2	22	7.2	20	30	3.99
1	2	15	7.8	31	46.5	5.34
1	2	18	8.5	25	37.5	4.63
1	2	27	9.5	16	24	3.44
1	2	31	10.7	14	21	3.15
1	2	34	12.1	12	18	2.84
1	1	35	13.5	5	7.5	1.59
1	1	18	14.2	11	16.5	2.69
1	1	16	14.8	13	19.5	3.00
1	1	16	15.4	13	19.5	3.00
1	1	15	16	14	21	3.15
1	1	14	16.6	15	22.5	3.30
1	1	15	17.2	14	21	3.15
1	1	11	17.6	20	30	3.99
1	2	28	18.7	15	22.5	3.30
1	2	25	19.7	17	25.5	3.59
1	2	23	20.6	19	28.5	3.86
1	2	23	21.5	19	28.5	3.86
1	2	21	22.3	21	31.5	4.13
1	2	21	23.1	21	31.5	4.13
1	2	21	24	21	31.5	4.13
1	2	19	24.7	23	34.5	4.38
1	2	19	25.5	23	34.5	4.38
1	2	19	26.2	23	34.5	4.38
1	2	18	26.9	25	37.5	4.63
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NOTES: Hammer 17.6 lbs = 1 Hammer 10.1 lbs = 2

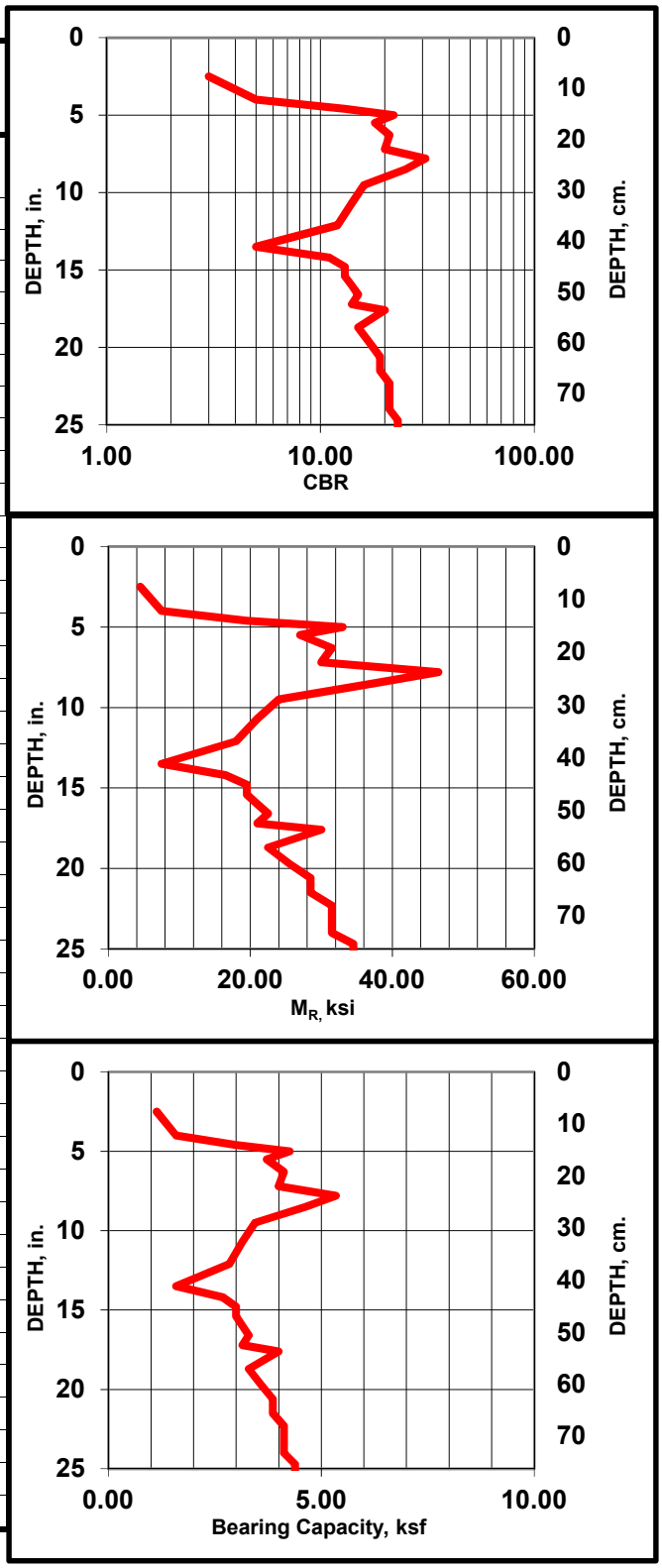

Figure 7a

Project Number: ASA20-039-00
Test Date: July 9, 2020

DCP TEST DATA

B-2

Eastside Education & Training Center
San Antonio, Texas

Type of Ham.	No. of Blows	Penetration Incre. (mm)	Penetration Cumm. (in)	CBR (%)	M_R (ksi)	q_{ult} (ksf)
1	1	60	2.4	3	4.5	1.13
1	1	28	3.5	7	10.5	1.99
1	1	23	4.4	9	13.5	2.35
1	1	21	5.2	10	15	2.52
1	1	21	6	10	15	2.52
1	1	21	6.9	10	15	2.52
1	1	19	7.6	11	16.5	2.69
1	1	15	8.2	14	21	3.15
1	1	17	8.9	12	18	2.84
1	1	14	9.4	15	22.5	3.30
1	1	14	10	15	22.5	3.30
1	1	13	10.5	17	25.5	3.59
1	1	13	11	17	25.5	3.59
1	2	26	12	17	25.5	3.59
1	2	25	13	17	25.5	3.59
1	2	23	13.9	19	28.5	3.86
1	2	23	14.8	19	28.5	3.86
1	2	23	15.7	19	28.5	3.86
1	2	23	16.6	19	28.5	3.86
1	2	23	17.5	19	28.5	3.86
1	2	21	18.3	21	31.5	4.13
1	2	20	19.1	22	33	4.25
1	2	20	19.9	22	33	4.25
1	2	21	20.7	21	31.5	4.13
1	2	21	21.6	21	31.5	4.13
1	2	19	22.3	23	34.5	4.38
1	2	19	23.1	23	34.5	4.38
1	2	21	23.9	21	31.5	4.13
1	2	20	24.7	22	33	4.25
1	2	20	25.5	22	33	4.25
1	2	18	26.2	25	37.5	4.63
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NOTES: Hammer 17.6 lbs = 1 Hammer 10.1 lbs = 2

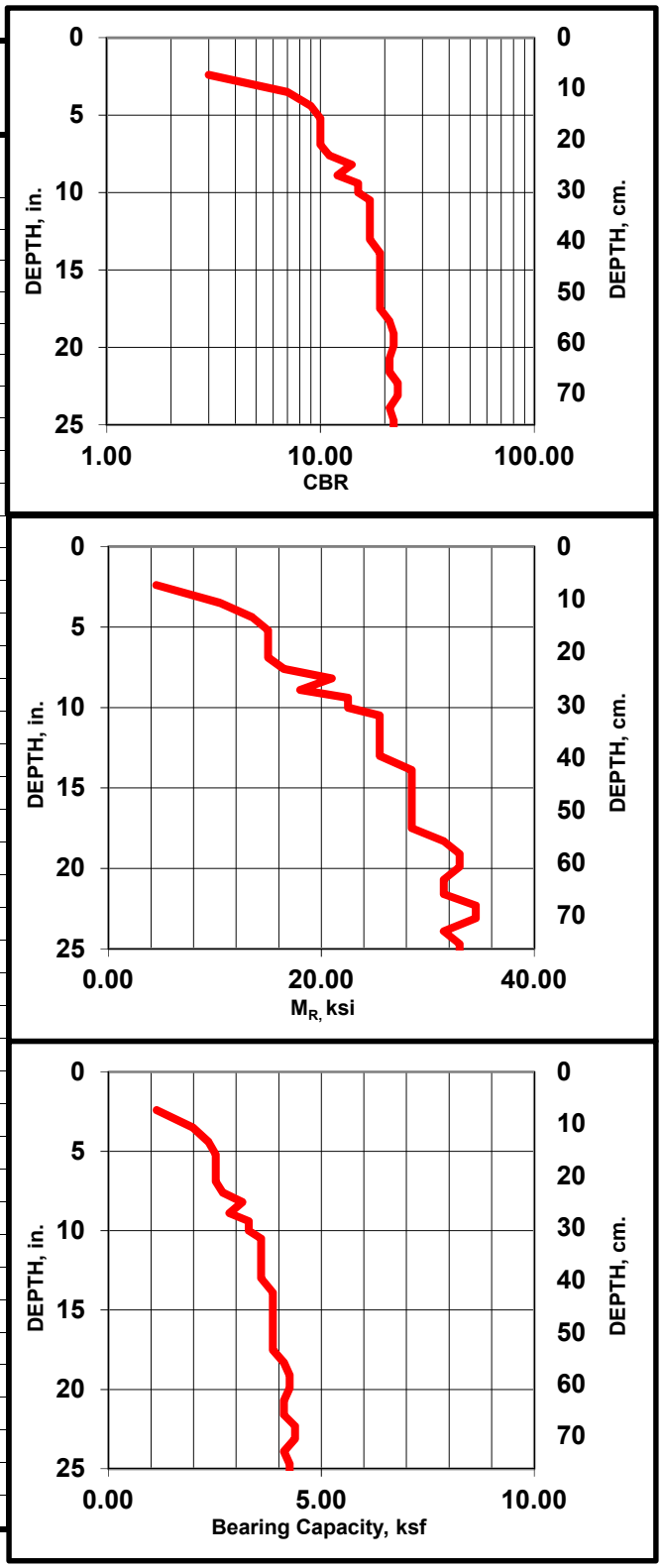

Figure 7b

Project Number: ASA20-039-00
Test Date: July 9, 2020

DCP TEST DATA

B-3

Eastside Education & Training Center
San Antonio, Texas

Type of Ham.	No. of Blows	Penetration Incre. (mm)	Penetration Cumm. (in)	CBR (%)	M_R (ksi)	q_{ult} (ksf)
1	1	30	1.2	6	9	1.80
1	1	16	1.8	13	19.5	3.00
1	1	14	2.4	15	22.5	3.30
1	1	13	2.9	17	25.5	3.59
1	1	12	3.3	18	27	3.72
1	2	28	4.4	15	22.5	3.30
1	2	30	5.6	14	21	3.15
1	2	30	6.8	14	21	3.15
1	2	29	8	15	22.5	3.30
1	2	28	9.1	15	22.5	3.30
1	2	23	10	19	28.5	3.86
1	2	22	10.8	20	30	3.99
1	2	21	11.7	21	31.5	4.13
1	2	19	12.4	23	34.5	4.38
1	2	20	13.2	22	33	4.25
1	2	14	13.7	33	49.5	5.57
1	2	17	14.4	27	40.5	4.87
1	3	26	15.4	26	39	4.75
1	3	25	16.4	27	40.5	4.87
1	3	26	17.4	26	39	4.75
1	3	24	18.4	28	42	4.99
1	3	25	19.4	27	40.5	4.87
1	3	24	20.3	28	42	4.99
1	3	23	21.2	30	45	5.23
1	3	23	22.1	30	45	5.23
1	3	23	23	30	45	5.23
1	3	22	23.9	31	46.5	5.34
1	3	19	24.6	37	55.5	6.01
1	3	20	25.4	35	52.5	5.79
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NOTES: Hammer 17.6 lbs = 1 Hammer 10.1 lbs = 2

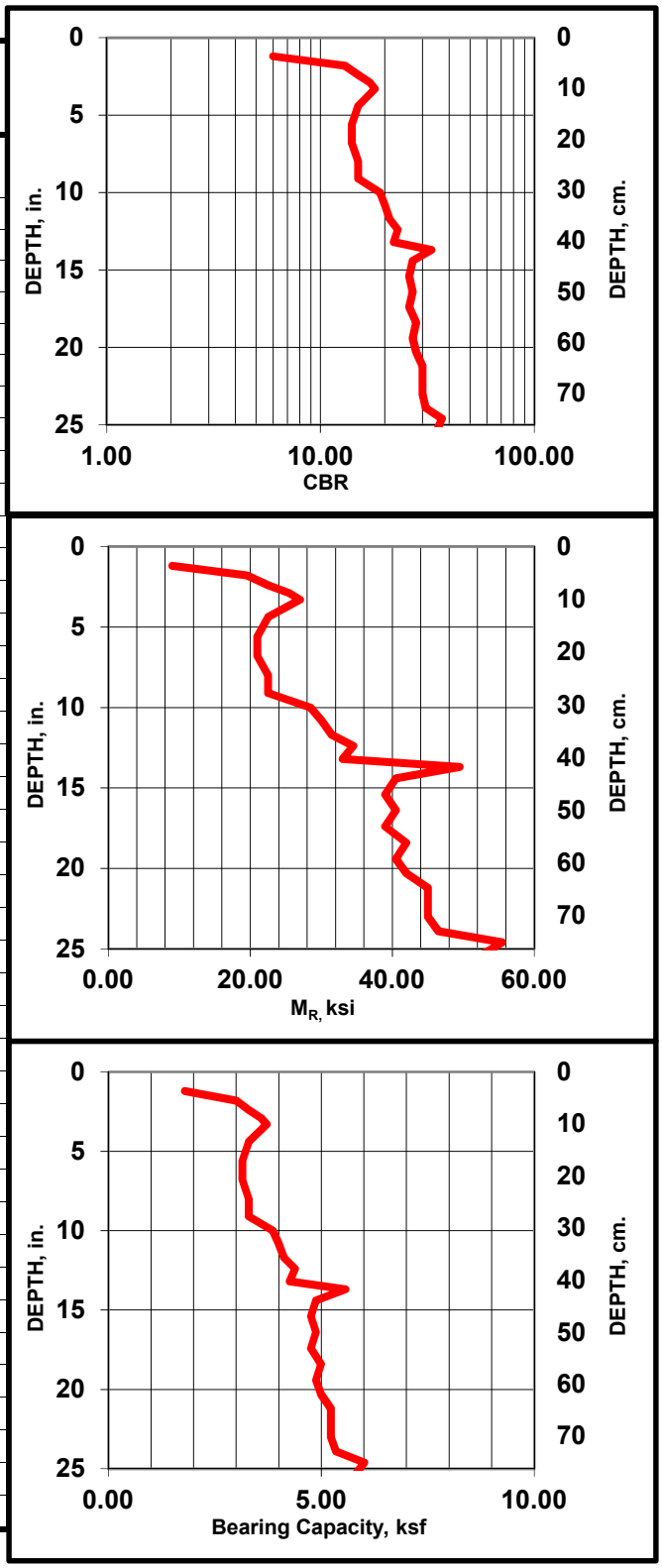

Figure 7c

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a civil engineer may not fulfill the needs of a constructor — a construction contractor — or even another civil engineer. Because each geotechnical- engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. No one except you should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* — should apply this report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical-engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

Geotechnical Engineers Base Each Report on a Unique Set of Project-Specific Factors

Geotechnical engineers consider many unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk-management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical-engineering report that was:

- not prepared for you;
- not prepared for your project;
- not prepared for the specific site explored; or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical-engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical-engineering report is based on conditions that existed at the time the geotechnical engineer performed the study. *Do not rely on a geotechnical-engineering report whose adequacy may have been affected by*: the passage of time; man-made events, such as construction on or adjacent to the site; or natural events, such as floods, droughts, earthquakes, or groundwater fluctuations. *Contact the geotechnical engineer before applying this report to determine if it is still reliable.* A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ — sometimes significantly — from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide geotechnical-construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are Not Final

Do not overrely on the confirmation-dependent recommendations included in your report. *Confirmation-dependent recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations *only* by observing actual subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's confirmation-dependent recommendations if that engineer does not perform the geotechnical-construction observation required to confirm the recommendations' applicability.*

A Geotechnical-Engineering Report Is Subject to Misinterpretation

Other design-team members' misinterpretation of geotechnical-engineering reports has resulted in costly

problems. Confront that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Constructors can also misinterpret a geotechnical-engineering report. Confront that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing geotechnical construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical-engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make constructors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give constructors the complete geotechnical-engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise constructors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure constructors have sufficient time* to perform additional study. Only then might you be in a position to give constructors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and constructors fail to recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Environmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform an *environmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold-prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, many mold- prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical- engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; *none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.*

Rely, on Your GBC-Member Geotechnical Engineer for Additional Assistance

Membership in the Geotechnical Business Council of the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project. Confer with you GBC-Member geotechnical engineer for more information.

GEOTECHNICAL BUSINESS COUNCIL
of the Geoprofessional Business Association

8811 Colesville Road/Suite G106, Silver Spring, MD 20910
Telephone: 301/565-2733 Facsimile: 301/589-2017
e-mail: info@geoprofessional.org www.geoprofessional.org

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RABA KISTNER

SECTION 02 41 13

SELECTIVE SITE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the selective removal and subsequent off-site disposal of, but is not limited to, removal of existing walks, curbs and pavements.

B. Related work specified elsewhere includes relocation of utilities, pipes, conduits, ducts, and other mechanical and electrical work, and is specified in other Sections.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of the Contract and Division 1 Specification Sections.

B. Submit Schedule: Indicating proposed sequence and phasing of operations for selective demolition work to Architect for review prior to start of work. Include coordination for shutoff, capping and continuation of utility services as required, together with details for dust and noise control protection.
   1. Provide detailed sequence of demolition and removal work to ensure uninterrupted progress of School operations.
   2. Coordination with Owner continuing occupation of existing building and with School's partial occupancy of new building.

C. Submit Photographs: Of existing conditions of structure surfaces, equipment, and adjacent improvements that might be misconstrued as damage related to removal operations. File with Owner’s representative prior to start of work.

1.4 JOB CONDITIONS

A. Occupancy: The School will occupy portions of the site adjacent to areas of selective demolition. Conduct selective demolition work in manner that will minimize need for disruption of school's normal operations. Provide minimum of seventy two (72) hours advance notice to Owner of demolition activities that will affect School's normal operations.

B. Condition of Structures: The Owner assumes no responsibility for actual condition of items or structures to be demolished.
   1. Conditions existing at time of inspection for bidding purposes will be maintained by Owner in so far as practicable. However, minor variations within structure may occur by Owner’s removal and salvage operations prior to start of selective demolition work.

C. Partial Demolition and Removal: Items indicated to be removed and which are of salvable value to Contractor may be removed as work progresses. Transport salvaged items from site as they are removed.
   1. Storage or sale of removed items on site will not be permitted.

D. Protections: Provide temporary barricades and other forms of protection to protect School personnel, students, visitors and general public from injury due to selective demolition work, whether or not these are shown in Drawings.
   1. Provide protective measures as required to provide free and safe passage of School's personnel, students, visitors and general public to existing building.
   2. Erect temporary covered passageways as required by authorities having jurisdiction.
   3. Provide shoring, bracing, or support to prevent movement, settlement, or collapse of structure or element to be demolished and adjacent facilities or work to remain.
   4. Protect from damage existing finish work that is to remain in place.
   5. Remove protections at completion of work.

E. Damages: Promptly repair damages caused to adjacent surfaces or facilities by demolition work.

F. Traffic: Conduct selective demolition operations and debris removal to ensure minimum interference with roads, streets, walks, and other adjacent facilities. Cooperate and coordinate with Owner officials.
   1. Do not close, block, or otherwise obstruct streets, walks, or other facilities without written permission from authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways as required by Owner and City of San Antonio.

G. Flame Cutting: Do not use cutting torches for removal until work area is cleared of flammable materials. Notify City of San Antonio Fire Department before initiating each flame cutting operation.

H. Utility Services: Maintain existing utilities indicated to remain in service and protect them against damage during demolition operations.
   1. Do not interrupt utilities serving occupied or used facilities, except when authorized in writing by the Owner. Provide temporary services during interruptions to existing utilities, as acceptable to Owner.
   2. Maintain fire protection services during selective demolition operations.

I. Environmental Controls: Use water sprinkling, temporary enclosures, and other methods to limit dust and dirt migration. Comply with governing regulations pertaining to environmental protection.
   1. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding, and pollution.

PART 2 - PRODUCTS

(Not Applicable)

PART 3 - EXECUTION

3.1 PREPARATION

A. General: Provide shoring, bracing, or support to prevent movement, settlement, or collapse of areas to be demolished and adjacent facilities to remain.
   1. Locate, identify, stub off, and disconnect utility services that are not indicated to remain.
      a. Provide bypass connections as necessary to maintain continuity of service to existing school building. Provide minimum of 72 hours' advance notice to Owner if shutdown of service is necessary during changeover.

3.2 DEMOLITION

A. General: Perform selective demolition work in a systematic manner. Use such methods as required to complete work indicated on Drawings in accordance with demolition schedule and governing regulations.
   1. Demolish concrete and masonry in small sections. Cut concrete and masonry at junctures with construction to remain using power-driven masonry saw or hand tools; do not use power-driven impact tools.
   2. Provide services for effective air and water pollution controls as required by local authorities having jurisdiction and by environmental regulations.
   3. Demolish concrete foundation beams, walls, footing, and piers to a depth of not less than 12" below existing ground surface. Demolish and remove below-grade wood or metal construction. Break up below-grade concrete slabs.
   4. For exterior slabs on grade, use removal methods that will not crack or structurally disturb adjacent slabs or partitions. Use power saw where possible.
   5. Completely fill below-grade areas and voids resulting from demolition work. Provide fill consisting of approved earth, gravel, or sand, free of trash and debris, stones over 6" in diameter, roots, or other organic matter.

B. If unanticipated mechanical, electrical, structural, or utility elements that conflict with intended function or design are encountered, investigate and measure both nature and extent of the conflict. Submit report to Owner’s representative in written, accurate detail. Pending receipt of directive from Owner’s representative, re-arrange selective demolition schedule as necessary to continue overall job progress without undue delay.

3.3 SALVAGED MATERIALS

A. Salvaged Items: Where items are indicated on Drawings to be salvaged and to remain the property of the Owner, carefully remove indicated items, clean, store, and turn over to Owner's representative and obtain receipt. Where items are to be re-used, carefully remove indicated items, clean and store until ready to be re-installed.

3.4 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove from project site debris, rubbish, and other materials resulting from demolition operations. Transport and legally dispose off Site.
   1. If hazardous materials are encountered on Project Site notify Owner.
   2. Burning of removed materials is not permitted on Project Site or elsewhere on School property.

3.5 CLEANUP AND REPAIR

A. General: Upon completion of demolition work, remove tools, equipment, and demolished materials from site and off School property. Remove protections and leave areas free of debris.

1. Repair demolition performed in excess of that required. Return elements of construction and surfaces to remain to condition existing prior to start of operations. Repair adjacent construction or surfaces soiled or damaged by selective demolition work.

END OF SECTION

SECTION 02 41 14

INTERIOR SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Demolishing designated building equipment and fixtures.
   2. Demolishing designated construction.
   3. Cutting and alterations for completion of the Work.
   4. Removing designated items for reuse and Owner’s retention.
   5. Protecting items designated to remain.
   6. Removing demolished materials.

B. Related Sections:
   1. Section 01 23 00 – Alternates.

1.2 CLOSEOUT SUBMITTALS

A. Section 01 30 00 - Administrative Requirements: Requirements for submittals.

B. Project Record Documents: Accurately record actual locations of capped utilities, concealed utilities discovered during demolition or subsurface obstructions.

C. Operation and Maintenance Data: Submit description of system, inspection data, and parts lists.

1.3 QUALITY ASSURANCE

A. Conform to applicable code for demolition work, dust control, products requiring electrical disconnection and re-connection.

B. Conform to applicable code for procedures when hazardous or contaminated materials are discovered.

C. Obtain required permits from authorities having jurisdiction.

D. Perform Work in accordance with City of San Antonio Public Work's standard.

1.4 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.5 SCHEDULING

A. Section 01 30 00 - Administrative Requirements: Requirements for scheduling.

B. Schedule Work to coincide with new construction.

C. Cooperate with Owner in scheduling noisy operations and waste removal that may impact Owners operation.

D. Perform noisy, malodorous, or dusty work after school hours, evenings or weekends.

E. Coordinate utility and building service interruptions with Owner.
   1. Do not disable or disrupt building fire or life safety systems without three days prior written notice to Owner.
   2. Schedule tie-ins to existing systems to minimize disruption.
   3. Coordinate Work to ensure fire sprinklers, fire alarms, smoke detectors, emergency lighting, exit signs and other life safety systems remain in full operation in occupied areas.

1.6 PROJECT CONDITIONS

A. Conduct demolition to minimize interference with adjacent and occupied building areas.

B. Cease operations immediately if structure appears to be in danger and notify Architect/Engineer. Do not resume operations until directed.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

3.1 PREPARATION

A. Notify affected utility companies before starting work and comply with their requirements.

B. Mark location and termination of utilities.

C. Erect, and maintain temporary barriers and security devices for protection of the public, Owner, and existing improvements indicated to remain. Erect and maintain temporary partitions to prevent spread of dust, odors, and noise to permit continued Owner occupancy.

D. Prevent movement of structure; provide temporary bracing and shoring required to ensure safety of existing structure.

E. Provide appropriate temporary signage including signage for exit or building egress.

F. Do not close or obstruct building egress path.

G. Do not disable or disrupt building fire or life safety systems without 3 days prior written notice to Owner.

3.2 SALVAGE REQUIREMENTS

A. Items that are to be salvaged by the Contractor for reuse on the project are noted on the Drawings.

B. The Owner shall identify salvageable building components and equipment and shall remove items prior to start of Work.

3.3 DEMOLITION

A. Conduct demolition to minimize interference with adjacent and occupied building areas.

B. Maintain protected egress from and access to adjacent existing buildings at all times.

C. Do not close or obstruct roadways without permits.

D. Cease operations immediately when structure appears to be in danger and notify Architect/Engineer.

E. Disconnect and remove designated utilities within demolition areas.

F. Cap and identify abandoned utilities at termination points when utility is not completely removed. Annotate Record Drawings indicating location and type of service for capped utilities remaining after demolition.

G. Demolish in orderly and careful manner. Protect existing improvements, supporting structural members and vegetation.

H. Carefully remove building components indicated to be reused.
   1. Disassemble components as required to permit removal.
   2. Package small and loose parts to avoid loss.
   3. Mark components and packaged parts to permit reinstallation.
   4. Store components, protected from construction operations, until reinstalled.

I. Remove demolished materials from site except where specifically noted otherwise. Do not burn or bury materials on site.

J. Remove materials as Work progresses. Upon completion of Work, leave areas in clean condition.

K. Remove temporary Work.

END OF SECTION

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SECTION 04 05 00

MASONRY MORTAR AND GROUT

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes mortar and grout for masonry.

B. Related Sections:
1. Section 04 20 00 – Unit Masonry Assemblies: Installation of mortar and grout.

1.2 REFERENCES

A. ASTM International:
1. ASTM C143 – Slump of Hydraulic Cement Concrete.
2. ASTM C144 - Aggregate for Masonry Mortar.
3. ASTM C150 - Portland Cement.
4. ASTM C207 - Hydrated Lime for Masonry Purposes.
5. ASTM C270 - Mortar for Unit Masonry.
6. ASTM C404 - Aggregates for Masonry Grout.
7. ASTM C476 - Grout for Masonry.
8. ASTM C780 - Test Method for Pre-construction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.
9. ASTM C1019 - Method of Sampling and Testing Grout.

B. The Masonry Society:
1. TMS MSJC - Building Code for Masonry Structures (ACI 530/ASCE 5/TMS 402), Specification for Masonry Structures (ACI 530.1/ASCE 6/TMS 602) and Commentaries.

1.3 SUBMITTALS

A. Section 01 33 00 – Submittal Procedures: Submittal procedures.

B. Samples: Submit two samples of mortar, illustrating mortar color and color range.

C. Design Data: Submit design mix when the Proportion specification of ASTM C270 is to be used, required environmental conditions, and admixture limitations.

D. Test Reports:
1. Submit reports on mortar indicating conformance of mortar to property requirements of ASTM C270 and test and evaluation reports to ASTM C780 for aggregate ratio and water content, air content, consistency and compressive strength.
2. Submit reports on grout indicating conformance of grout to property requirements of ASTM C476 and test and evaluation reports to ASTM C1019.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with TMS MSJC Code and TMS MSJC Specification.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Deliver, store protect and handle products to site under provisions of Section 01 60 00 - Product Requirements.

B. Hot and Cold Weather Requirements: TMS MSJC Specification.

PART 2 - PRODUCTS

2.1 MORTAR AND MASONRY GROUT MATERIALS

A. Portland Cement: ASTM C150, Type I, White color as required to achieve coloration acceptable to Architect.

B. Mortar Aggregate: ASTM C144, standard masonry type.

C. Hydrated Lime: ASTM C207, Type S.

D. Grout Aggregate: ASTM C404, fine and coarse.

E. Water: Clean and potable.

F. Plasticizer: Water reducing type, if recommended by Testing Laboratory.

G. Bonding Agent: Latex type.

2.2 MIXES

A. Mortar Mixes:
   1. Mortar For Non-Structural Masonry: ASTM C270, Type N using the Proportion specification consisting of the following:
      a. 1 part Portland cement.
      b. 1 part lime.
      c. 6 parts washed sand.
      d. Compressive Strength: 750 psi at 28 days.
   2. Pointing Mortar: ASTM C270, Type N using the Proportion specification.

B. Mortar Mixing:
   1. Thoroughly mix mortar ingredients in accordance with ASTM C270 in quantities needed for immediate use.
   2. Achieve uniformly damp sand immediately before the mixing process.
   3. Add admixtures if recommended by Testing Laboratory, in accordance with manufacturer’s instructions. Provide uniformity of mix and coloration.
   4. Do not use anti-freeze compounds to lower the freezing point of mortar.

5. If water is lost by evaporation, re-temper only within two hours of mixing.
6. Use mortar within two hours after mixing at temperatures of 90 degrees F (32 degrees C), or 2-1/2 hours at temperatures under 50 degrees F.

C. Grout Mixes: Grout for Bond Beams, Lintels, Fill Cores and Jambs: 3,000 psi strength at 28 days; 8-10 inches slump; mixed in accordance with ASTM C476 Fine grout.

D. Grout Mixing:
1. Thoroughly mix grout ingredients in quantities needed for immediate use in accordance with ASTM C476.
2. Add admixtures in accordance with manufacturer's instructions; mix uniformly.
3. Do not use anti-freeze compounds to lower the freezing point of grout.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 40 00 – Quality Requirements: Coordination and project conditions.

B. Request inspection of spaces to be grouted.

3.2 PREPARATION

A. Apply bonding agent to existing concrete surfaces.

B. Plug clean-out holes with block masonry units. Brace masonry for wet grout pressure.

3.3 INSTALLATION

A. Install mortar and grout in accordance with ASTM C270 and requirements of Section 04 20 00.

B. Testing of Mortar Mix: In accordance with ASTM C780 for aggregate ratio and water content, air content, consistency, and compressive strength.

C. Testing of Grout Mix: In accordance with ASTM C1019 for compressive strength and in accordance with ASTM C143 for slump.

END OF SECTION

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SECTION 04 20 00

UNIT MASONRY ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes face brick, concrete masonry units; reinforcement, anchorage, and accessories.

B. Related Sections:
1. Section 04 05 00 – Masonry Mortar and Grout: Product Requirements for Mortar and grout.
2. Section 07 92 00 – Joint Sealants: Rod and sealant at control and expansion joints.
3. Section 09 30 00 – Tiling.
4. Section 09 91 00 – Painting.

1.2 REFERENCES

A. ASTM International:
1. ASTM A153/A153M – Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
2. ASTM A580/A580M – Standard Specification for Stainless Steel Wire.
3. ASTM A641/A641M – Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
4. ASTM A653/A653M – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
5. ASTM A666 – Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
6. ASTM A951/A951M – Standard Specification for Steel Wire for Masonry Joint Reinforcement.
7. ASTM B370 – Standard Specification for Copper Sheet and Strip for Building Construction.
8. ASTM C90 – Standard Specification for Loadbearing Concrete Masonry Units.
9. ASTM C140/C140M – Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.
10. ASTM C216 – Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale).

B. The Masonry Society:
1. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures.

1.3 SUBMITTALS

A. Section 01 33 00 – Submittal Procedures: Submittal procedures.

B. Product Data: Submit data for masonry units and fabricated wire reinforcement, anchors, ties, flashings, joint materials and other accessories.

C. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with TMS 402/602.

1.5 QUALIFICATIONS

A. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.6 PRE-INSTALLATION MEETINGS

A. Section 01 33 00 - Submittals: Pre-installation meeting.

B. Convene minimum one week prior to commencing Work of this section.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 – Material and Equipment: Product storage and handling requirements.

B. Accept units on site. Inspect for damage.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 – Material and Equipment.

B. Hot and Cold Weather Requirements: TMS 402/602.

1.9 COORDINATION

A. Section 01 33 00 - Submittals: Coordination and project conditions.

B. Coordinate masonry work with installation of toilet fixtures and accessories.

PART 2 - PRODUCTS

2.1 UNIT MASONRY ASSEMBLIES

A. Manufacturer:
   1. Best Block
   2. Capitol Products
   3. Superior Block Company
   4. Substitutions: Section 01 60 00 - Product Requirements.

2.2 COMPONENTS

A. Hollow Load Bearing Concrete Masonry Units (CMU): ASTM C90, Type I - Moisture Controlled; medium weight.
   1. Concrete Masonry Unit Size and Shape: Nominal modular size of 8 by 8 by 16 inches. Furnish special units for 90 degree corners, bond beams, lintels, coved base, and bullnosed corners.

2.3 ACCESSORIES

A. Single Wythe Joint Reinforcement: Truss type; steel wire, ASTM A641/A641M mill galvanized, 9 gage side rods with 9 gage cross ties.
   1. H&B #220 Ladder MeshTruss Mesh or approved equal.

B. Reinforcing Steel: ASTM A615/A615M, 60 ksi yield grade, deformed billet bars, uncoated finish.

C. Strap Anchors: bent steel shape, 1-1/2 inch size x length required, 3/16 inch thick, hot dip galvanized to ASTM A153/A153M B2 finish.

D. Beam Anchors: 1-1/4 inches wide by 12 gauge thick by length required to suit condition; galvanized to ASTM A153/A153M B2 finish. H&B #357 or approved equal.

E. Mesh Wall Ties: ASTM A 185; 1/2 inch square mesh by 16 gauge, galvanized.

F. Mortar and Grout: As specified in Section 04 05 00.

G. Joint Filler: Closed cell polyethylene rubber; oversized 50 percent to joint width; self expanding; provide in maximum lengths.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: coordination and project conditions.

B. Verify field conditions are acceptable and are ready to receive work.

C. Verify items provided by other sections of work are properly sized and located.

D. Verify built-in items are in proper location, and ready for roughing into masonry work.

3.2 PREPARATION

A. Direct and coordinate placement of metal anchors supplied to other sections.

B. Furnish temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent support.

3.3 INSTALLATION

A. Establish lines, levels, and coursing indicated. Protect from displacement.

B. Closely inspect units as they are laid. Units with chipped corners, rough or warped faces, coarse surfaces, or walls with varying coarse and fine textures will not be acceptable.

C. Maintain masonry courses to uniform dimension. Form bed and head joints of uniform thickness.

D. Coursing of Concrete Masonry Units:
1. Bond: Running.
2. Coursing: One unit and one mortar joint to equal 8 inches.
3. Mortar Joints: Concave where exposed; flush at cavity walls and surfaces to receive ceramic tile.

E. Placing and Bonding:
1. Lay solid masonry units in full bed of mortar, with full head joints.
2. Lay hollow masonry units with face shell bedding on head and bed joints.
3. Buttering corners of joints or excessive furrowing of mortar joints are not permitted.
4. Excess mortar shall be struck continuously from the back of the brick veneer removed from the cavity as work progresses.
5. Interlock intersections and external corners at running bonds.
6. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment is required, remove mortar and replace.
7. Perform job site cutting of masonry units with proper tools to assure straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.
8. Cut mortar joints flush where wall tile is scheduled, cement parging is required, resilient base is scheduled, cavity insulation vapor barrier adhesive is applied or bitumen dampproofing is applied.
9. Isolate masonry from vertical structural framing members with SBS type flashing. Extend flashing 6 inches on each side of joint.
10. Isolate top of masonry from horizontal structural framing members and slabs or decks with compressible joint filler. Cover with SBS type flashing at exterior side of cavity walls. Extend flashing 6 inches on each side of joint.

F. Joint Reinforcement And Anchorage - Single Wythe Masonry:
1. Install horizontal joint reinforcement 16 inches on center.
2. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.
3. Place joint reinforcement continuous in first and second joint below top of walls.
4. Lap joint reinforcement ends minimum 6 inches.
5. Reinforce joint corners and intersections with strap anchors 16 inches on center.

G. Lintels:
1. Install reinforced unit masonry lintels over openings where steel concrete lintels are not scheduled or indicated.

2. Openings Up To 42 inches Wide: Place two, No. 4 reinforcing bars 1 inch from bottom web.
3. Openings From 42 inches Up To 78 inches Wide: Place two, No. 5 reinforcing bars 1 inch from bottom web.
4. Openings Over 78 inches: Reinforce openings as indicated on Drawings.
5. Do not splice reinforcing bars.
6. Support and secure reinforcing bars from displacement.
7. Place and consolidate grout fill without displacing reinforcing.
8. Allow masonry lintels to attain specified strength before removing temporary supports.
9. Maintain minimum 6 inch bearing on each side of opening.

H. Grouted Components:
1. Reinforce bond beam with 2, No. 4 bars, 1 inch from bottom web.
2. Lap splices bar diameters required by code.
3. Support and secure reinforcing bars from displacement.
4. Place and consolidate grout fill without displacing reinforcing.
5. At bearing locations, fill masonry cores with grout for minimum 12 inches both sides of opening.

I. Control and Expansion Joints:
1. Provide control and expansion joints where indicated on Drawings. Where not indicated, masonry walls shall not exceed 25 ft in length without a joint.
2. Do not continue horizontal joint reinforcement through control and expansion joints.
3. Size control joint in accordance with Section 07 92 00 for sealant performance.
4. Form expansion joint by omitting mortar and cutting unit to form open space.
5. Fill joint with closed cell foam backer rod and finish with sealant of color to match adjacent surface.

J. Built-In Work:
1. As work progresses, install built-in metal door frames, window frames, wood nailing strips, anchor bolts, plates, and other items to be built-in the work and furnished by other sections.
2. Install built-in items plumb and level.
3. Bed anchors of metal door frames in adjacent mortar joints. Fill frame voids solid with grout or mortar. Fill adjacent masonry cores with grout minimum 12 inches from framed openings.
4. Do not build in materials subject to deterioration.

K. Cutting And Fitting:
1. Cut and fit for chases, pipes, conduit, sleeves, grounds, electrical boxes, toilet accessories and fire cabinets. Coordinate with other sections of work to provide correct size, shape, and location.
2. Obtain Architect/Engineer’s approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.4 ERECTION TOLERANCES

A. Section 01 40 00 - Quality Control: Tolerances.

B. Maximum Variation From Alignment of Columns: 1/4 inch.

C. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.

D. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.

E. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.

F. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.

G. Maximum Variation of Joint Thickness: 1/8 inch in 3 ft.

H. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch.

I. Maximum Variation for Steel Reinforcement:
   1. Plus or minus 1/2 inch when distance from centerline of steel to opposite face of masonry is 8 inches or less.
   2. Plus or minus 1 inch when distance is between 8 and 24 inches.
   3. Plus or minus 1 1/4 inch when distance is greater than 24 inches.
   4. Plus or minus 2 inches from location along face of wall.

3.5 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Control: Testing and Inspection Services.

3.6 CLEANING

A. Section 01 77 00 – Project Closeout: Final cleaning.

B. Remove excess mortar and mortar smears as work progresses.

C. Replace defective mortar. Match adjacent work.

D. Clean soiled surfaces with cleaning solution.

E. Use non-metallic tools in cleaning operations.

END OF SECTION

SECTION 06 20 00

FINISH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Millwork for lavatory sides, support, apron and skirts.
2. Solid surface countertops.
3. Surfaces prepared for site finishing.

B. Related Requirements:
1. Section 09 30 00 – Tiling
2. Division 22 – Plumbing Components

1.2 REFERENCES

A. American National Standards Institute:
1. ANSI A135.4 - Basic Hardboard.
2. ANSI/HPVA HP-1 Standard for Hardwood and Decorative Plywood

B. Architectural Woodwork Institute and Woodwork Institute:
1. AWS - Architectural Woodwork Standards.

C. ASTM International:
1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

D. Hardwood Plywood and Veneer Association:
1. HP-1 - American National Standard for Hardwood and Decorative Plywood.

E. South Coast Air Quality Management District:
1. SCAQMD Rule 1168 - Adhesive and Sealant Applications.

F. National Fire Protection Association:
1. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth.

1.3 QUALITY ASSURANCE

A. Composite wood and agrifiber products used in casework construction shall meet requirements of the California Air Resources Board (CARB) Airborne Toxic Control Measure (ATCM) to Reduce Formaldehyde Emissions from Composite Wood Products (Section 93120-93120.12, Title 17, California Code of Regulations).

B. Perform Work in accordance with "Quality Standards" of the Architectural Woodwork Institute (AWI); custom grade. All exposed wood to receive clear finish shall be "clear face", free of knots, not finger jointed, no worm holes, no sap wood or gum spots.

1.4 SUBMITTALS

A. Submit shop drawings and product date under provisions of Section 01 33 00.

B. Include materials, component profiles, fastening methods, assembly methods, joint details, accessory listings and schedule of finishes. Show details at minimum scale of 1-1/2 inch to one foot, plans and elevations at minimum scale of 1/2 inch to one foot.

C. Submit two samples, 6 x 6 inches in size, illustrating range of each specified finish and color of each specified material.

1.5 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, handle and protect products under provisions of Section 01 60 00.

B. Protect products during transit, delivery, storage and handling to prevent damage.

C. No cracked, chipped, broken, stained or defective material will be accepted.

D. Store products within dry, enclosed area.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Maintain minimum temperature of 60 degrees F. continuously beginning 48 hours prior to installation.

1.8 FIELD MEASUREMENTS

A. Verify all dimensions by taking field measurement; proper fit and attachment of all parts is required.

1.9 COORDINATION

A. Coordinate the Work of this Section with other Sections whose Work will affect or be affected by this Work.

PART 2 - PRODUCTS

2.1 WOOD MATERIALS

A. Softwood Lumber: PS 20; graded in accordance with AWI; maximum moisture content of 6 percent; Yellow Pine.

B. Hardwood Lumber: NHLA, graded in accordance with AWI Custom; maximum moisture content 6 percent; natural birch, rotary cut, unless otherwise indicated.

2.2 SHEET MATERIALS

A. Softwood Plywood: PS-1; grade A veneer in accordance with AWI; Exterior Type; Fir Species; veneer core material.

B. Hardwood Plywood: PS 51; graded in accordance with AWI; core material of veneer, type of glue recommended for application; face veneer and cuts shall be plain sliced select white birch, custom grade, suitable for transparent finish.

C. Wood Fiberboard: AWI standard, minimum 45 lb. Fiberboard (MDF) core composed of wood chips, medium density, made with high waterproof resin binders; of grade to suit application; sanded faces.

D. Particleboard is not permitted.

2.3 ACCEPTABLE LAMINATE MANUFACTURERS

A. Formica: Plastic Laminate.

B. Nevamar: Plastic Laminate.

C. Wilson Art: Plastic Laminate (Basis of Design).

D. Substitutions: Under provisions of Section 01 60 00.

2.4 LAMINATE MATERIALS

A. Plastic Laminate (General): Low reflective textured surface finish; colors indicated in Color Schedule, Section 09995. Architect shall select colors from one of the manufacturers listed above.
   1. 0.050 inch thick general purpose grade.
   2. 0.042 inch thick post forming grade.
   3. 0.030 inch thick vertical grade.

B. Laminate Backing Sheet: LD3 BK20 Backing Grade, undecorated plastic laminate; smooth surface finish.

C. Color: #7960K-18 Studio Teak, Linearity Finish, as manufactured by Wilsonart, or approved equal.

2.5 SOLID SURFACE

A. Manufacturers:
   1. Du Pont de Nemours.
   2. Wilson Art Solid Surface (Basis of Design).
   3. Formica Brand Products; Surell Solid Surfacing Material.
   4. Substitutions: Under provisions of Section 01 33 00.

B. Sheet Material:
   1. Solid, cast, filled polymer, non-porous, homogeneously composed of natural minerals and acrylic or polyester resins; 1/2" as indicated on Drawings; laminated or of composite construction with through body colors meeting ANSI Z124.3 or ANSI Z124.6. Stain resistant to domestic chemicals and cleaners.
   2. Joint Sealant: Silicone type as recommended by manufacturer to provide best performance and color match.
   3. Adhesive: Type as recommended by manufacturer.
   4. Color: Triton #9212CM, as manufactured by Wilsonart, or approved equal.

2.6 ACCESSORIES

A. Wall Brackets: Steel; A&M Hardware, or approved equal; Provide minimum 18 x 24 inch size for 24 inch countertops.

B. Adhesive: As recommended by manufacturer; low emitting VOC in accordance with the current VOC content limits of South Coast Air Quality Mgt. District (SCAQMD) Rule #1168.

C. Fastener: Corrosion resistant; size and type best suited for intended application.

D. Bolts, Nuts, Washers, Lags, Pins and Screws; size and type best suited for intended application.

E. Concealed Joint Fasteners: Threaded steel.

2.7 FABRICATION

A. Shop assemble millwork for delivery to site in units easily handled and to permit passage through building openings.

B. Coordinate mounting of millwork to wall.

C. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

D. Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Make corners and joints hairline. Slightly bevel arises.

E. Cap exposed plastic laminate edges with material of same finish and pattern.

F. Coordinate openings in solid surfacing for drop-in sinks. Provide cutouts for plumbing fixtures, inserts, appliances, outlet boxes and other fixtures and fittings.

2.8 FACTORY FINISHING

A. Sand work smooth and set exposed nails.

B. Apply wood filler in exposed nail or screw indentations.

C. Seal, stain and varnish all concealed and semi-concealed surfaces not indicated to have other finish or not pre-finished.

D. Seal surfaces in contact with cementitious materials.

E. Backpriming: Apply one coat of sealer or primer compatible with finish coats to concealed surfaces of woodwork, including backs of trim, cabinets, paneling, and ornamental work and the underside of countertop substrate. Concealed surfaces of plastic laminate-clad woodwork do not require backpriming when backed with plastic laminate.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify adequacy of backing and support framing.

B. Verify plumbing items affecting this Section are placed and ready to receive this Work.

C. Beginning installation means acceptance of existing conditions.

3.2 PREPARATION

A. Protect adjacent Work from damage.

B. Coordinate locations for conduit, receptacles, switches, CRT, phone and other mechanical/electrical devices.

3.3 INSTALLATION

A. Set and secure casework in place rigid, plumb, and level.

B. Use purpose designed fixture attachments at concealed locations for wall mounted components.

C. Use threaded steel concealed joint fasteners to align and secure adjoining cabinet units and counter tops.

D. Carefully scribe casework which is against other building materials, leaving gaps of 1/32 inch maximum. Do not use additional overlay trim for this purpose.

E. Secure cabinet and counter bases to floor using appropriate angles and anchorages.

F. Countersink anchorage devices at exposed locations used to wall mount components and conceal with solid plugs of species to match surrounding wood. Finish flush with surrounding surfaces.

3.4 ADJUSTING AND CLEANING

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

END OF SECTION

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SECTION 07 92 00

JOINT SEALANTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Clean and prepare joint surfaces.

B. Sealant and backing materials.

1.2 RELATED SECTIONS

A. Section 04 22 00 – Unit Masonry Assemblies: Coordinate installation of sealants used in conjunction with masonry.

B. Section 08 81 00 – Glass and Glazing: Sealants used in conjunction with glazing methods.

C. Section 09 21 16 – Gypsum Board Systems: Sealants used in conjunction with acoustic treatment of partitions.

D. Section 09 30 00 – Tiling: Coordinate installation of sealant used in conjunction with tile finishes.

1.3 REFERENCES

A. SCAQMD – Rule 1168 for Adhesive and Sealant Applications (current edition).

B. ASTM C790 - Recommended Practices for Use of Latex Sealing Compounds.

C. ASTM C804 - Recommended Practice for Use of Solvent-Release Type Sealants.

D. ASTM D1056 - Flexible Cellular Materials - Sponge or Expanded Rubber.

E. FS TT-S-227E(3) - Sealing Compound, Elastomeric Type, Multi-Component.

F. FS TT-S-230A(1) - Sealing Compounds, Synthetic Rubber Base, Single Component, Chemically Curing.

G. FS TT-S-00230C(2) - Sealing Compound, Elastomeric Type, Single component.

1.4 QUALITY ASSURANCE

A. All products in this section shall meet the VOC content requirements in the applicable category of SCAQMD Rule 1168.

1.5 SUBMITTALS

A. Submit product data and samples in accordance with Section 01 33 00. Include VOC data for each product.

B. Submit manufacturer's surface preparation and installation instructions.

C. Submit samples of sealant colors.

D. Review all sealant specified or otherwise indicated in Contract Documents with sealant manufacturer. Verify in writing to Architect prior to ordering any sealant materials that all sealant shown, specified, and otherwise indicated issued appropriately, is compatible with adjacent contact surfaces, and conforms to be manufacturers' recommendations for intended use. Report in writing only deviations from manufacturer's recommendation, technical bulletin, quality standard or code.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, handle and protect products under provisions of Section 01 60 00.

1.7 WARRANTY

A. Provide one-year warranty in accordance with Section 01 77 00.

B. Warranty: Replace sealants which fail because of loss of cohesion or adhesion, or did not cure.

PART 2 - PRODUCTS

2.1 SEALANT MATERIALS

A. Sealant "A": Acrylic base, single component, solvent curing, conforming to FS TT-S-230; capable of being continuously immersed in water, withstand movement of up to 75 percent of joint width and satisfactorily applied throughout a temperature range of 40 to 80 degrees F shore A hardness of maximum 55; non-staining; non-bleeding; non-sagging; color as selected; "Mono" manufactured by Tremco or "Unicrylic 60+" manufactured by Pecora.

B. Sealant "B": Polyurethane base, multi-component, chemical curing; conforming to FS TT-S-227E, Class A, Type II (non-sagging) capable of being continuously immersed in water, withstand movement of up to 25 percent of joint width and satisfactorily applied throughout a temperature range of 40 to 80 degrees F, uniform, homogeneous, and free from lumps, skins, and coarse particles when mixed; Shore A hardness of minimum 15 and maximum 50, non-staining; non-bleeding; color as selected; "Sonolastic NP II" manufactured by Sonneborn or "Dynatrol II" manufactured by Pecora or "Dymeric" or "THC-901", by Tremco.

C. Sealant "C": Polyurethane base, single component, chemical curing; conforming with FS TT-S-230C, Type II, Class A (non-sagging); capable of being continuously immersed in water, withstand movement of up to 25 percent of joint width and satisfactorily applied throughout a temperature range of 40 to 80 degrees F; Shore A hardness of minimum 15 and maximum 50; non-staining; non-bleeding; color as selected; "Sonolastic NPI" manufactured by Sonneborn, "Dymonic" manufactured by Tremco or "Dynatrol I" manufactured by Pecora.

D. Sealant "D": Acrylic emulsion base, single component, complying with ASTM C834; capable of withstanding movement of up to 7.5 percent of joint width and satisfactorily applied throughout a temperature range of 40 to 80 degrees F; Shore A hardness of maximum 60; non-staining; non-bleeding; non-sagging; color as selected; "Sonolac" manufactured by Sonneborn, or "Acrylic Latex Caulk AC20" manufactured by Pecora, or "Acrylic Latex Caulk" manufactured by Tremco.

E. Sealant "E": Silicone base, single component, mildew resistant, capable of withstanding movement of up to 25 percent of joint width and satisfactorily applied through a temperature range of 40 to 80 degrees F; Shore A hardness of maximum 50; non-staining; color as selected by the Architect; Silicone Sanitary 1700 Sealant manufactured by General Electric Co.

F. Substitutions: In Accordance with Section 01 60 00.

2.2 ACCESSORIES

A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.

B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

C. Joint Filler: ASTM D1056; round, closed cell polyethylene foam rod, oversized 30 to 50 percent; "Sonofoam" Backer Rod manufactured by Sonneborn.

D. Expansive Sealant: Will-Seal 250 Manufactured by Will-Seal Construction Foams.

E. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify joint dimensions, physical and environmental conditions are acceptable to receive work of this Section.

B. Beginning of installation means acceptance.

3.2 PREPARATION

A. Clean, prepare and size joints in accordance with manufacturer's instructions. Remove any loose materials and other foreign matter which might impair adhesion of sealant.

B. Test all materials to be used on substrates such as insulation behind spandrel glass by applying to samples typical of specified window wall assembly, separately and in combination. Test typical details in locations selected by the Architect.

C. Verify that joint shaping materials and release tapes are compatible with sealant.

D. Examine joint dimensions and size materials to achieve required width/depth ratios.

E. Use joint filler to achieve required joint depths, to allow sealants to perform properly.

F. Use bond breaker where required or where recommended by sealant manufacturer.

3.3 INSTALLATION

A. Perform work in accordance with ASTM C804 for solvent release and C790 for latex base sealants.

B. Install sealant in accordance with manufacturer's instructions.

C. Apply sealant within recommended temperature ranges. Consult manufacturer when sealant cannot be applied within recommended temperature ranges.

D. Tool joints concave.

E. Joints: Free of air pockets, foreign embedded matter, ridges and sags.

3.4 SCHEDULE

A. Control Joints in Masonry: Sealants "B" or "C".

B. Reglets, control joints and other flashing conditions: Sealant "C".

C. Joints between materials on Exterior, as around window frames, door frames; joints between and below coping stones: Sealants "A" or "C".

D. Joints between materials on Interior, such as between masonry and concrete, around door frames: Sealant "D" (indicated on drawings as "caulk").

E. Exterior sealant condition not included above: Sealants "A" or "C".

F. Interior sealant of control joints in ceramic tile: Sealant "E".

G. Interior sealant at window sills, jambs, casework tops/splashes with sinks, around lavatory and toilet fixtures: Sealant "E".

H. Interior sealant at joints larger than 1/16" between casework and walls or other dissimilar material abuttings: Sealant "D".

I. Interior sealant or caulking not included above or in other Section of the Specifications: Sealant "D".

END OF SECTION

SECTION 08 14 16

FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes flush wood doors; flush and flush glazed configuration; non-rated.

B. Related Sections:
1. Section 01 23 00 – Alternates: Alternate No. 2 – Replace existing doors.
2. Section 08 71 00 – Finish Hardware.

1.2 REFERENCES

A. American Society for Testing and Materials:
1. ASTM E413 - Standard Classification for Rating Sound Insulation.

B. Architectural Woodwork Institute:
1. AWI - Quality Standards Illustrated.

C. Hardwood Plywood and Veneer Association:

1. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood.

D. National Fire Protection Association:
1. NFPA 80 - Standard for Fire Doors, Fire Windows.
2. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies.

E. Underwriters Laboratories Inc.:
1. UL 10B - Fire Tests of Door Assemblies.
2. UL - Building Materials Directory.

F. Warnock Hersey:
1. WH - Certification Listings.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Illustrate door opening criteria, elevations, sizes, types, swings, undercuts required, special beveling, special blocking for hardware, factory machining criteria, factory finishing criteria, identify cutouts for glazing and louvers.

C. Product Data: Submit information on door core materials and construction, and on veneer species, type and characteristics.

D. Samples:
1. Submit two samples of door veneer, 8 x 8 inch in size illustrating wood grain, stain color, and sheen.

E. Manufacturer's Installation Instructions: Submit special installation instructions.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with AWI Quality Standard Section 1300, Premium grades identified in section.

B. Finish doors in accordance with AWI Quality Standard Section 1500, grades identified in section.

1.5 QUALIFICATIONS

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

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Package, deliver and store doors in accordance with AWI Section 1300.

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 when stored more than one week.
   1. Break seal on site to permit ventilation.

1.7 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Coordinate Work with existing door opening construction, door frame and door hardware installation.

1.8 WARRANTY

A. Section 01 77 00 – Project Closeout: Product warranties and product bonds.

B. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

C. Furnish manufacturer’s “Life of Installation” warranty for interior doors.

PART 2 - PRODUCTS

2.1 FLUSH WOOD DOORS

A. Manufacturers:
   1. Algoma Hardwoods Inc.
   2. Buell Door Company.

3. Eggers Industries.
4. Marshfield Door systems.
5. VT Industries.
6. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description: Solid core flush wood doors, five ply; wood veneer facing material; 1-3/4 inches thick, non-rated types; factory pre-fit; shop finished.
1. Verify overall size with existing door frames.

2.2 COMPONENTS

A. Solid Core, Non-Rated: AWI Section 1300, Type PC5 - Particleboard.

B. Interior Veneer Facing: AWI Premium quality wood, rotary sliced, with balanced match book matched grain, for transparent finish. Pair match multiple door leaves in single opening.
1. Wood: Select White Birch.

C. Facing Adhesive: Type I - waterproof.

2.3 ACCESSORIES

A. Glazing Stops: Rolled steel channel shape, mitered corners; prepared for countersink style tamper proof screws.

2.4 FABRICATION

A. Fabricate non-rated doors in accordance with AWI Quality Standards requirements.

B. Stiles shall be minimum 1-1/2 x 1-1/2 inch hardwood stained, bonded to core.

C. Rails shall be minimum 1-1/8 inch, bonded to core.

D. Furnish lock blocks at lock edge and top of door for closer for hardware reinforcement.

E. Factory machine doors for finish hardware in accordance with hardware requirements and dimensions. Do not machine for surface hardware. Furnish solid blocking for through bolted hardware.

F. Factory fit doors for frame opening dimensions identified on shop drawings.

G. Cut and configure exterior door edge to receive recessed weather stripping devices.

H. Provide edge clearances in accordance with AWI 1300.

2.5 SHOP FINISHING

A. Factory finish doors in accordance with AWI Quality Standard Section 1500 to the following finish designations; color as selected:
1. Transparent Finish TR-6: Catalyzed polyurethane, Custom quality, satin sheen. Seal door top edge with clear sealer to match door facing.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify 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 AWI Quality Standard, NFPA 80, and to requirements for fire rating label by UL or Warnock Hersey.

B. Trim non-rated door width by cutting equally on both jamb edges.

C. Trim door height by cutting bottom edges to maximum of 3/4 inch.

D. Machine cut doors for hardware installation.

E. Coordinate installation of doors with existing frames and hardware specified in Section 08 71 00.

F. Coordinate installation of glass and glazing specified in Section 08 81 00.

3.3 INSTALLATION TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Conform to AWI requirements for fit and clearance tolerances.

C. Conform to AWI Section 1300 requirements for maximum diagonal distortion.

3.4 ADJUSTING

A. Section 01 77 00 – Project Closeout: Testing, adjusting, and balancing.

B. Adjust door for smooth and balanced door movement.

C. Adjust closer for full closure in compliance with TAS Guidelines.

3.5 SCHEDULE

A. Refer to Door Schedule on Drawings.

END OF SECTION

SECTION 08 31 13
ACCESS DOORS AND PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes non-rated access doors with frames.
   1. Provide for access to controls, valves, traps, dampers, cleanouts, and similar items requiring operation behind inaccessible finished surfaces.
   2. Coordinate exact locations with various trades in Division 22, 23, and 26 to assure proper placement of access doors and panels.

B. Related Sections:
   1. Section 04 22 00 – Unit Masonry Assemblies.
   2. Section 09 21 16 – Gypsum Board Systems
   3. Section 09 22 16 – Non-structural Metal Stud Framing System.
   4. Section 09 91 00 – Paints and Coatings: Field paint finish.

1.2 REFERENCES

A. Underwriters Laboratories Inc.: UL - Building Materials Directory.

B. Warnock Hersey: WH - Certification Listings.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate exact position of access door units.

C. Product Data: Submit literature indicating sizes, types, finishes, hardware, scheduled locations, fire resistance listings, and details of adjoining Work.

D. Manufacturer's Installation Instructions: Submit installation requirements and rough-in dimensions.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 77 00 – Project Closeout: Closeout procedures.

B. Project Record Documents: Record actual locations of access units.

1.5 QUALIFICATIONS

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

1.6 COORDINATION

A. Coordinate Work under provisions of Section 01 26 00 – Contract Coordination.

B. Coordinate Work with work requiring controls, valves, traps, dampers, cleanouts, and similar items requiring operation being located behind finished surfaces.

PART 2 - PRODUCTS

2.1 ACCESS DOORS AND PANELS

A. Manufacturers:
1. Bilco, Inc.
2. J. L. Industries.
3. Karp Associates, Inc.
4. Nystrom Products Co.
5. Milcor LTD, Partnership.
6. Substitutions: Section 01 60 00 - Product Requirements.

B. Non-rated Flush Access Doors:
1. Door: 14-gauge cold rolled sheet steel.
2. Frame: 16-gauge cold rolled sheet steel. Provide 1/4” mounting holes.
   a. Provide 1 inch flange (NT) at all surfaces except gypsum wallboard.
   b. Provide 22-gauge galvanized drywall bead at perimeter (NW) at gypsum wallboard surfaces.
3. Size: 10 x 10 minimum size, except where otherwise indicated.
   a. Provide 24 x 24 inch minimum size where full access is required.
4. Hinge: Concealed pin type, spring loaded to allow for door removal, set to open 175 degrees.
5. Finish: Phosphate dipped with factory applied prime coat except as otherwise noted. Paint in accordance with Section 09 91 00.
   a. Stainless steel, No. 4 finish at toilet room access doors.
6. Model: N Series as manufactured by Nystrom, or approved equal.

2.2 FABRICATION

A. Fabricate units of continuous welded construction; weld, fill, and grind joints to assure flush and square unit.

B. Wall and Ceiling Access Door and Panel Hardware:
1. Hinge: Standard continuous or concealed spring pin type, 175 degree steel hinges.
2. Lock: Self-latching lock. Screw driver slot for quarter turn cam lock Removable wrench lift handle.

C. Size Variations: Obtain acceptance of manufacturer’s standard size units which vary slightly from sizes shown or scheduled.

2.3 SHOP FINISHING

A. Base Metal Protection: Bituminous coating applied to the exterior of frame.

B. Aluminum: Mill finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify rough openings for access doors and panels are correctly sized and located.

3.2 INSTALLATION

A. Secure frames rigidly in place, plumb and level in opening, with plane of door and panel face aligned with adjacent finished surfaces.
   1. Set concealed frame type units flush with adjacent finished surfaces.

B. Position unit to provide convenient access to concealed work requiring access.

END OF SECTION

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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 College District 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

Specified elsewhere that should be examined for its effect upon this section:

A. Section 01 23 00 – Alternates: Alternate No. 2 – Replace existing doors.

B. Section 08 14 16 – Flush Wood Doors: Alternate No. 2 – Replace existing doors.

C. Section 09 91 00 – Painting.

D. Division 26 – Electrical

E. Division 27 – Technology: Electronic Access Control.

1.4 REFERENCES SPECIFIED

In this section subject to compliance as directed:

A. NFPA-80 - Standard for Fire Doors and Windows

B. NFPA-101 - Life Safety Code

C. ADA - The Americans with Disabilities Act - Title III - Public Accommodations

D. ANSI-A 117.1 - American National Standards Institute - Accessible and Usable Buildings and Facilities

E. ANSI-A 156.5 - American National Standards institute -Auxiliary Locks and Associated Products

F. UFAS - Uniform Federal Accessibility Standards

G. UL - Underwriter’s Laboratories

H. WHI - Warnock Hersey International, Testing Services

I. State and Local Codes including Authority Having Jurisdiction

J. UL10C – Positive Pressure

K. IBC-2018 - International Building Code

L. BHMA – Builder’s Hardware Manufacturer’s Association

M. DHI – Door and Hardware Institute

N. 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.

B. Submit manufacturer's cut/catalog sheets on all hardware items and any required special mounting instructions with the hardware schedule.

C. Certification of Compliance:
   1. Submit any information necessary to indicate compliance to 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.

D. Submit any samples necessary as required by the Architect.

E. 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.

F. Electronic Security Hardware: Coordinate installation of the electronic security with the Architect and provide installation and technical data to the Architect and other related sub-contractor(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 performed.

G. 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.

H. 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

Any part of the finish hardware required by the frame or door manufacturers or other suppliers that is needed 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

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 life of installation 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

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 3.2 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 3.2 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 3.2 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 3.2 Hardware Sets.

F. Were required to clear the trim and/or to permit the doors to swing 180 degrees furnish hinges of enough 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 3.2 Hardware Sets.
   2. At hollow metal doors, hinges are to be aluminum or stainless steel at exterior out-swinging doors, unless otherwise specified in 3.2 Hardware Sets.

J. Continuous hinges shall be as specified.

2.4 LOCK AND LOCK TRIM

A. All locksets, latch sets, and trim to be of one manufacturer as hereafter listed for continuity of design and consideration of warranty. Locks, passage and privacy sets shall be the product of Schlage Lock Co., "ND" series with Rhodes Vandlgard lever (No Substitutions). 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 College District. Verify the key section with the Alamo College District 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 ¾" latch projection.

C. Mechanical Locks shall meet ANSI Operational Grade 1, Series 4000 as specified in 3.2 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 ¾" 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 “0” bitted with four (4) blank or “0” bitted keys per core directly to the Alamo College District (signature required for proof of delivery). All permanent keying shall be done by the Alamo College District. The Alamo College District shall install all permanent cores and return all the construction cores to the general contractor (Verify Keyway required prior to fabrication with Alamo College District). The general contractor shall return the construction cores to the hardware supplier for credit. Permanent keys delivered to Alamo College District as “0” bitted, shall be rejected. Key blanks must be “0” bitted for the Alamo College District to use the key as specified. Cores shall be Schlage large format (No Substitution).

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 without 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 otherwise.

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 enough 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.

I. Finish: Sprayed enamel finish shall match other hardware.

J. Closers shall be LCN 4040XP as specified (No Substitutions).

2.8 AUTOMATIC DOOR OPENERS

A. All automatic door openers shall be LCN 9500 Series as shown below:
   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. Provide Mullion Mounted Actuator if required and requested in lieu of the 8310-853T listed above.

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 stop 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 Ives, 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 and 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 3.2 Hardware Sets.

D. Seals shall comply with the requirements of the Wood Door Manufacturer's certification requirements.

2.13 KEYED REMOVABLE MULLIONS

A. Keyed removable mullions shall be Von Duprin KR4954 & KR9954 type with FSIC mortise cylinders. Finish shall be sprayed aluminum (SP28). Provide one (1) Mullion Storage Bracket MT54 and 154 Stabilizers with every mullion supplied (No Substitutions).

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. Provide a Lund key cabinet #1200 for installation by the contractor as instructed by the Architect and ACD. Key cabinet shall be of such size as to hold 100% of the total number of keys supplied, plus 100% expansion. If requested by ACD the hardware supplier shall (On the Project Site) assist and train the owner's staff in the proper use of the key cabinet. This shall include the tagging of all keys, instructing the ACD staff as to the proper use of the key cabinet and how they can best maintain the key system. The hardware supplier shall send the Architect written confirmation that this has been completed. Confirmation shall include the date training occurred and names of all staff members trained.

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 College District.

C. Architect and Alamo College District 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.

3.2 HARDWARE SETS

HARDWARE SET #001

SIDE ENTRY DOOR OPENING

1) Remove existing Exit Devices, Power Loops, Push Plates use to cover holes in existing door and Surface Closers
2) Plug & Bondo all existing screw holes in the Doors & Frames. Sand and Re-Paint Doors & Frames as required to appear as being new to the maximum degree as possible.
3) Install New Hardware listed for this opening.
4) Provided all wires, wire connections and surface applied conduit required to complete and provide a Functional Card Access Controlled opening. Conduit to connect to the center electric hinge area and run to a junction box above the ceiling.
5) 120 volt in-line power required at each power supply

Hardware Set #1

2 EA	ELECTRIC HINGES	5BB1HW 4.5 X 4.5 TW8	630	IVES
4 EA	HINGES	5BB1HW 4.5 X 4.5	630	IVES
1 EA	KEYED REMOVABLE MULLION	KR4954-B-154-MT54	SP28	VD
1 EA	ELECTRIC EXIT DEVICE	QEL-RX-99-NL-SNB	628	VD
1 EA	ELECTRIC EXIT DEVICE	QEL-RX-99-DT-SNB	628	VD
1 EA	MORTIE CYLINDER (MULLION)	AS REQ'D FOR KEYING	626	SCH
1 EA	RIM CYLINDER (EXI DEVICE)	AS REQ'D FOR KEYING	626	SCH
2 EA	PERMANENT CORES	AS REQ'D FOR KEYING	626	VERIFY
2 EA	SURFACE CLOSERS	4040XP SCUSH TBSRT ST-1595	689	LCN
1 EA	HEADER WEATHER STRIP	429S-1 PC HEADER WIDTH AA		ZERO
2 EA	JAMB WEATHER STRIP	328S-2 PCS JAMB HEIGHT AA		ZERO
2 EA	DOOR BOTTOMS	39A-DOOR WIDTH A		ZERO
1 EA	THRESHOLD	AS REQ'D BY EXISTING CONDITIONS		ZERO
1 EA	POWER SUPPLY	PS904 900-4R 900-4RL	GREY	VD
1 EA	CARD READER	MT-15 (BY SECURITY CONTR)	BLK	OTHER
1 EA	JUNCTION BOX	8" X 8" X 4"	GREY	OTHER

Remove rust and Re-use the existing top and bottom hinges.

HARDWARE SET #002

MAIN ENTRY DOOR OPENING

1) Remove existing Exit Devices, Power Loops, Push Plates use to cover holes in existing door and Surface Closers
2) Plug & Bondo all existing screw holes in the Doors & Frames. Sand and Re-Paint Doors & Frames to appear as being new to the maximum degree as possible.
3) Install New Hardware listed for this opening.
4) Provided all wires, wire connections and surface applied conduit required to complete and provide a Functional Card Access Controlled opening. Conduit to connect to the center electric hinge area and run to a junction box above the ceiling.
5) 120 volt in-line power required at each power supply

Hardware Set #2

2 EA	ELECTRIC HINGES	5BB1HW 4.5 X 4.5 TW8	630	IVES
4 EA	HINGES	5BB1HW 4.5 X 4.5 NRP	630	IVES
1 EA	KEYED REMOVABLE MULLION	KR4954-B-154-MT54	SP28	VD
1 EA	ELECTRIC EXIT DEVICE	QEL-RX-99-NL-SNB	628	VD
1 EA	ELECTRIC EXIT DEVICE	QEL-RX-99-DT-SNB	628	VD
1 EA	MORTIE CYLINDER (MULLION)	AS REQ'D FOR KEYING	626	SCH
1 EA	RIM CYLINDER (EXI DEVICE)	AS REQ'D FOR KEYING	626	SCH
2 EA	PERMANENT CORES	AS REQ'D FOR KEYING	626	VERIFY
2 EA	SURFACE CLOSERS	4040XP SCUSH TBSRT ST-1595	689	LCN
1 EA	HEADER WEATHER STRIP	429S-1 PC HEADER WIDTH AA		ZERO
2 EA	JAMB WEATHER STRIP	328S-2 PCS JAMB HEIGHT AA		ZERO
2 EA	DOOR BOTTOMS	39A-DOOR WIDTH A		ZERO
1 EA	THRESHOLD	AS REQ'D BY EXISTING CONDITIONS		ZERO
1 EA	POWER SUPPLY	PS904 900-4R 900-4RL	GREY	VD
1 EA	CARD READER	MT-15 (BY SECURITY CONTR)	BLK	OTHER
1 EA	JUNCTION BOX	8" X 8" X 4"	GREY	OTHER

Remove rust and Re-use the existing top and bottom hinges


Other Door
Keep Arms Width Apart
While Shopping at the Agency


Keep Arms Width Apart
While Shopping at the Agency
DON'T SPREAD
GERMS AT WORK

HARDWARE SET #003

IDF ROOM & WAITING ROOM

1) Remove Lockset
2) Drill a raceway through the existing door for the New Electric Lock to Connect to the Electric Hinge.

Hardware Set #3

2 EA	HINGE	5BB1 4.5 X 4.5	630	IVES
1 EA	ELECTRIC HINGE	5BB1 4.5 X 4.5 TW8 (CENTER HINGE)	630	IVES
1 EA	ELEC. STOREROOM LOCK	ND80EU CORE PREP AS REQ RHO	626	SCH
1 EA	PERMANENT CORES	AS REQUIRED FOR KEYING	626	VERIFY
1 EA	SURFACE CLOSERS	4040XP RW/PA TBSRT	689	LCN
1 EA	POWER SOURCE	BY SECURITY CONTR		OTHER
1 EA	CARD READER	BY SECURITY CONTR		OTHER
1 EA	JUNCTION BOX	8” X 8” X 4”		OTHER

Contractor to verify with GBA if an 18” x 18” louver is required in the IDF Room Door

END OF SECTION 08 71 00

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SECTION 08 81 00

GLASS AND GLAZING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Provide glazing of the types, sizes and locations indicated on Drawings and specified herein. The work includes glass and glazing for:
1. Spandrel panels at existing exterior doors.

B. DEFINITIONS: "Glass" includes prime glass, processed glass, and fabricated glass products, including glazing plastics. "Glazing" includes glass installation and materials used to install glass.

1.2 RELATED WORK IN OTHER SECTIONS

A. Section 07 92 00 – Joint Sealants: Sealant and backer rods.

1.3 REFERENCES

A. Consumer Product Safety Commission (CPSC):
1. CPSC 16 CFR 1201: Safety Standard for Architectural Glazing Materials.

B. Glass Association of North America (GANA)
1. GANA – Glazing Manual.
2. FGMA – Sealant Manual.

C. The International Building Code – 2018 edition.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's technical data for each glazing material and fabricated glass product required, including installation and maintenance instructions.

B. Samples: Submit 12 inch square samples of each type of glass indicated.

C. Certificate: Submit certificates from respective manufacturers attesting that glass and glazing materials furnished for project comply with requirements.
1. Separate certification will not be required for glazing materials bearing manufacturer's permanent labels designating type and thickness of glass, provided labels represent a quality control program involving a recognized certification agency or independent testing laboratory acceptable to authorities having jurisdiction.

1.5 QUALITY ASSURANCE:

A. Glazing Standards: Comply with recommendations of Flat Glass Marketing Association (FGMA) "Glazing Manual" and "Sealant Manual" except where more

stringent requirements are indicated. Refer to those publications for definitions of glass and glazing terms not otherwise defined in this section or other referenced standards.

1. Safety Glass Standard: CPSC 16 CFR 1201 and ANSI Z97.1.
2. Prime Glass Standard: FS DD-G-451.
3. Heat-Treated Glass Standard: FS DD-G-1403.

B. Labels: Install glass with factory or shop applied identification labels indicating manufacturer and glass quality. Leave labels in place until removal and final cleaning is approved by the Architect.

1.6 DELIVERY, STORAGE, AND HANDLING:

A. Protect glass and glazing materials during delivery, storage and handling to comply with manufacturer's directions and as required to prevent edge damage to glass, and damage to glass and glazing materials from effects of moisture including condensation, of temperature changes, of direct exposure to sun, and from other causes.

1.7 JOB CONDITIONS:

A. Pre-Installation: Meet with Glazier and other trades affected by glass installations, prior to beginning of installation.

B. Do not perform work under adverse weather or job conditions. Install liquid sealants when temperatures are within lower or middle third of temperature range recommended by manufacturer.

1.8 PRODUCT WARRANTY:

A. Warranties shall be in addition to, and not a limitation of, other rights the Owner may have under the Contract Documents.

B. General Warranty: Provide a two year guarantee signed by the Installer that materials and workmanship are free of defects. Installations having water leakage, dust penetration or obvious air loss or infiltration shall be considered defective and shall be corrected at no additional cost to the Contract.

1. The use of surface applied sealant shall not be an acceptable remedy under this Warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Primary Glass Products:

1. Oldcastle Building Envelope
2. Viracon
3. Vitro Architectural Glass

B. Substitutions: In accordance with Section 01 60 00.

2.2 GLASS PRODUCTS, GENERAL

A. Primary Glass Standard: Provide primary glass which complies with ASTM C1036 requirements, including those indicated by reference to type, class, quality, and, if applicable, form, finish, mesh and pattern.

B. Heat-Treated Glass Standard: Provide heat-treated glass which complies with ASTM C1048 requirements, including those indicated by reference to kind, condition, type, quality, class, and, if applicable, form, finish, and pattern. Glass manufacturer shall be responsible for providing heat-treated panes of kind as follows:
1. Kind HS, heat-strengthened panes where determined by manufacturer to satisfy wind loading or thermal stress requirements.
2. Kind FT, tempered panes where indicated on drawings, or if not indicated, where safety glass is required to satisfy safety glazing requirements.

C. Sizes: Fabricate glass to sizes required for glazing openings indicated, with edge clearances and tolerances complying with recommendations of glass manufacturer. Provide thicknesses indicated or, if not otherwise indicated, as recommended by glass manufacturer for application indicated.

2.3 MONOLITHIC SPANDREL GLASS:

A. Minimum Thickness: 1/4 inch

B. Heat Treatment: FT

C. Ceramic Frit: On #2 Surface; color as selected from Manufacturer’s standard colors.

D. Fall Out Resistance: In accordance with ASTM C1048.

2.4 GLAZING SEALANTS AND COMPONENTS:

A. Provide color of exposed sealant/compound indicated or if not otherwise indicated, as selected by Architect from manufacturer's standard colors, or black if no color is so selected. Comply with manufacturer's recommendations for selection of hardness, depending upon the location of each application, conditions at time of installation, and performance requirements as indicated. Select materials, and variations or modifications, carefully for compatibility with surfaces contacted in the installation.

B. General: Provide products of type indicated and complying with the following requirements:
1. Compatibility: Select glazing sealants and tapes of proven compatibility with other materials with which they will come into contact, including glass products, seals of insulating glass units, and glazing channel substrates, under conditions of installation and service, as demonstrated by testing and field experience.

2. Suitability: Comply with recommendations of sealant and glass manufacturers for selection of glazing sealants and tapes which have performance characteristics suitable for applications indicated and conditions at time of installation.
3. Elastomeric Sealant Standard: Provide manufacturer's standard chemically curing, elastomeric sealant of base polymer indicated which complies with ASTM C920 requirements, including those for Type, Grade, Class and Uses.
4. Colors: Provide color of exposed sealants indicated or, if not otherwise indicated, as selected by Architect from manufacturer's standard colors.

C. 2-Part Polysulfide Glazing Sealant: Elastomeric polysulfide sealant complying with FS TT-S-227, Class A, Type 2; specially compounded and tested to show a minimum of 20 years resistance to deterioration in normal glazing applications.

D. 1-Part Non-Acid-Curing Silicone Glazing Sealant: Elastomeric silicone sealant complying with FS TT-S-001543, Class A, nonsag. Provide acid type recommended by manufacturer where only nonporous bond surfaces are contacted; provide nonacid type recommended by manufacturer where one or more porous bond surfaces are contacted.

E. 1-Part Polysulfide Glazing Sealant: Polysulfide elastomeric sealant complying with FS TT-S-00230, Class A, Type II; compounded specifically for exterior exposed glazing.

F. Preformed Butyl-Polyisobutylene Glazing Tape: Provide manufacturer's standard solvent-free butyl-polyisobutylene formulation with a solids content of 100 percent; complying with AAMA A 804.1; in extruded tape form; non-staining and non-migrating in contact with nonporous surfaces; packaged on rolls with a release paper on one side; with or without continuous spacer rod as recommended by manufacturers of tape and glass for application indicated.

2.5 MISCELLANEOUS GLAZING MATERIALS

A. Cleaners, Primers and Sealers: Type recommended by sealant or gasket manufacturer.

B. Setting Blocks: Neoprene or EPDM, 70-90 durometer hardness, with proven compatibility with sealants used.

C. Spacers: Neoprene or EPDM, 40-50 durometer hardness with proven compatibility with sealants used.

D. Compressible Filler (Rod): Closed-cell or waterproof-jacketed rod stock of synthetic rubber or plastic foam, proven to be compatible with sealants used, flexible and resilient, with 5-10 psi compression strength for 25 percent deflection.

PART 3 - EXECUTION

3.1 PERFORMANCE

A. Watertight and airtight installation of each glass product is required, except as otherwise shown. Each installation must withstand normal temperature changes, wind loading, impact loading (for operating sash and doors), without failure including loss or breakage of glass, failure of sealants or gaskets to remain watertight and airtight, deterioration of glazing materials and other defects in the work.

B. Protect glass from edge damage during handling and installation, and subsequent operation of glazed components of the work. During installation, discard units with significant edge damage or other imperfections.

C. Cure Glazing: Cure glazing compounds in compliance with the manufacturer's instructions and recommendations to obtain high early bond strength, internal cohesive strength and surface durability.

3.2 PREPARATION FOR GLAZING

A. Clean glazing channel and other framing members to receive glass, immediately before glazing. Remove coatings which are not firmly bonded to substrate. Remove lacquer from metal surfaces where elastomeric sealants are used.

B. Apply primer or sealant to joint surfaces where recommended by sealant manufacturer.

3.3 GLAZING

A. Set units of glass in each series with uniformity of pattern, draw, bow and similar characteristics. Inspect each piece of glass immediately before installation and eliminate any which have observable edge damage or face imperfections.

B. Install all items in accordance with recommendations of the manufacturer and to conform to the drawings. Assure that openings are square and without twist. Measure each opening in the field and cut glass to fit the actual openings with required clearances and bite on all sides. Place movable items such as operating sash in closed and locked position until glazing compound has thoroughly set. Inspect rebates and repair any condition detrimental to the final appearance or performance of the glass. Set glass with equal bearing along the entire perimeter, in full beds of glazing putty or compound or with other full perimeter seal, with proper clearances and setting blocks. Set so as to prevent displacement.

C. Setting Blocks: Install setting blocks of proper size in sill rabbet, located a distance of one fourth of the overall glass width from each corner. Set blocks in thin course of heel-bead compound, if any.

D. Spacers: Provide spacers inside and out, of proper size and spacing, for glass sizes larger than 50 united inches, except where gaskets or pre-shimmed tapes are used for glazing. Provide 1/8 inch minimum bite of spacers on glass and use thickness

equal to sealant width, except with sealant tape use thickness slightly less than final compressed thickness of tape.

E. Voids and Filler Rods: Prevent exudation of sealant or compound by forming voids or installing filler rods in channel at heel of jambs and head (do not leave voids in sill channels), except as otherwise indicated and depending on light size, thickness and type of glass, and complying with manufacturer's recommendations. Force sealants into channel to eliminate voids and to ensure complete "wetting" or bond of sealant to glass and channel surfaces.

F. Sealants: Force sealants into channel to eliminate voids and to ensure complete "wetting" or bond of sealant to the glass and channel surfaces.
1. Tool exposed surfaces of glazing liquids and compounds to provide a substantial "wash" away from glass. Install pressurized tapes and gaskets to protrude slightly out of channel, so as to eliminate dirt and moisture pockets.
2. Clean and trim excess glazing materials from glass and stops or frames promptly after installation, and eliminate stains and discolorations.
3. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage to ensure that gasket will not "walk" out when installation is subjected to movement. Anchor gasket to stop with matching ribs, or by proven adhesives, including embedment of gasket tail in cured heel bead.

G. Gasket Glazing: Miter cut and bond ends together at corners where gaskets are used for channel glazing, so that gaskets will not pull away from corners and result in voids or leaks in glazing system.

3.4 CURE, PROTECTION AND CLEANING

A. Protect exterior glass from breakage immediately upon installation, by use of crossed streamers attached to framing and held away from glass. Do not apply markers to surfaces of glass. Remove nonpermanent labels and clean surfaces. Cure sealants for high early strength and durability.

B. Damaged Glazing: Remove and replace glass which is broken, chipped, cracked, abraded or damaged in other ways during construction period, including natural causes, accidents and vandalism.

C. Washing Glass: Wash and polish glass on both faces not more than four days prior to date scheduled for inspections intended to establish date of substantial completion in each area of project. Comply with glass product manufacturer's recommendations for final cleaning.

END OF SECTION

SECTION 09 21 16

GYPSUM BOARD SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Gypsum board.

B. Tile backer board.

C. Metal channel ceiling framing.

D. Joint Treatment.

E. Acoustic insulation.

1.2 RELATED SECTIONS

A. Section 09 22 16 – Non-Structural Metal Framing.

B. Section 09 30 00 – Tiling.

C. Section 09 91 00 – Painting.

1.3 REFERENCES

A. American Society of Testing and Materials (ASTM):
1. ASTM C36 - Standard Specification for Gypsum Wallboard.
2. ASTM C79 - Standard Specification for Gypsum Sheathing Board.
3. ASTM C442 - Standard Specification for Gypsum Backing Board and Coreboard.
4. ASTM C475 - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
5. ASTM C630 - Standard Specification for Water-Resistant Gypsum Backing Board.
6. ASTM C645 - Standard Specification for Non-Load (Axial) Bearing Steel Studs, Runners (Track), and Rigid Furring Channels for Screw Application of Gypsum Board.
7. ASTM C665 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
8. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Board.
9. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board.
10. ASTM C1002 - Standard Specification for Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases.
11. ASTM C1178 – Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel; 2008.

12. ASTM C1280 – Standard Specification for Application of Gypsum Sheathing; 2009.
13. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne-Sound Transmission Loss of Building Partitions.
14. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.

B. Gypsum Association:
1. GA-201 - Using Gypsum Board for Walls and Ceilings.
2. GA-214 - Recommended Specification: Levels of Gypsum Board Finish.
3. GA-216 - Recommended Specifications for the Application and Finishing of Gypsum Board.

C. SCAQMD – Rule 1168 for Adhesive and Sealant Applications (current edition).

D. UL - Fire Resistance Directory.

1.4 SUBMITTALS FOR REVIEW

A. Section 01 33 00 - Submittals: Procedures for submittals.

B. Shop Drawings: Indicate special details associated with horizontal separations and acoustic seals.

C. Product Data: Provide data on gypsum board, acoustical insulation, and accessories.

D. Samples: Submit two samples of each corner and edge reinforcement.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with ASTM C754, GA-201, GA-214, and GA-216.

B. Applicator Qualifications: Company specializing in performing the work of this section with minimum three years documented experience.

C. Gypsum wallboard construction materials, including wallboard, accessories, fasteners and finishing materials shall be produced by one manufacturer.

1.6 REGULATORY REQUIREMENTS

A. Conform to UL - Fire Resistance Directory for fire rated assemblies in conjunction with Section 09 22 16.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Gypsum Board System:
1. Georgia Pacific Corporation.

2. National Gypsum Co. (Gold Bond)
3. Temple-Inland Inc.
4. United States Gypsum (USG) Co.

B. Gypsum Sheathing:
1. Georgia Pacific Corporation.

C. Substitutions: Refer to Section 01 60 00 – Product Requirements.

2.2 FRAMING MATERIALS

A. Studs and Tracks: Refer to Section 09 22 16 – Non-Structural Metal Framing.

B. Resilient Channels: Formed steel; minimum 25 gage thick; size and length as required, serrated face, flattened 'Z' profile.

C. Hangers: Galvanized annealed steel, 8 gage minimum, type to suit application, to rigidly support ceiling components in place, to deflection limits as indicated.

D. Fasteners: ASTM C1002 and GA-216.

E. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.

F. Adhesive: ASTM C557 and GA-216.

2.3 GYPSUM BOARD MATERIALS

A. Gypsum Board: ASTM C1396, fire resistive type, UL rated; 5/8 inch thick, maximum available length in place; ends square cut, tapered edges. Use fire rated type for all construction.

B. Tile Backer Boards:
1. Fiber Mat Reinforced Cement Tile Backer Board: ASTM C1325; high density, glass fiber reinforced; ½ inch thick; **mold resistant**.
2. Tile Backer Board Joint Tape: 2 inch (50 mm) wide, coated glass fiber tape for joints and corners; type as recommended by Board Manufactuer.

2.4 ACCESSORIES

A. Interior:
1. Acoustic Insulation: ASTM C665; preformed glass fiber, friction fit type, unfaced, 3-1/2 inch thick; Noise Barrier or Sonobatts Sound Attenuation Blankets manufactured by Owens-Corning Fiberglass.
2. Acoustic Sealant: Non-hardening, non-skinning, for use in conjunction with gypsum board; gunnable type as recommended by the gypsum manufacturer. Comply with the VOC content requirements in the applicable category of SCAQMD Rule 1168.
3. Corner Beads: Galvanized metal; smooth rigid nose, perforated and knurled metal flanges; CB-114 x 114.
4. Edge Trim: GA-201 and GA-216; Type L and U exposed reveal bead.

5. Control Joint: Extruded vinyl formed with V shaped slot covered with removable flexible vinyl strip and complying with ASTM C1047.
6. Joint Materials: GA-201 and GA-216; reinforcing tape, joint compound, adhesive, and water.
7. Fasteners: ASTM C1002, Type S12 and GA-216.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 – Administrative Requirements: Verification of existing conditions before starting work.

B. Verify that site conditions are ready to receive work and opening dimensions are as indicated on shop drawings.

3.2 METAL STUD INSTALLATION

A. Install metal studs in accordance with Section 09 22 16.

3.3 WALL FURRING INSTALLATION

A. Erect wall furring for direct attachment to masonry and clay tile walls.

B. Erect furring channels vertically; space maximum 16 inches oc, not more than 4 inches from floor and ceiling lines or abutting walls. Secure in place on alternate channel flanges at maximum 24 inches on center.

3.4 CEILING FRAMING INSTALLATION

A. Install in accordance with ASTM C754, GA-201 and GA-216.

B. Coordinate location of hangers with other work.

C. Install ceiling framing independent of walls, columns, and above ceiling work.

D. Reinforce openings in ceiling suspension system which interrupt main carrying channels or furring channels, with lateral channel bracing. Extend bracing minimum 24 inches past each end of openings.

E. Laterally brace entire suspension system.

3.5 ACOUSTIC ACCESSORIES INSTALLATION

A. Install resilient channels at maximum 24 inches on center. Locate joints over framing members.

B. Where scheduled on Drawings, place acoustic insulation in partitions tight within spaces, around cut openings, behind and around electrical and mechanical items within or behind partitions, and tight to items passing through partitions.

C. Install acoustic sealant at gypsum board perimeter.

D. Base layer of double layer gypsum board.

E. Face layer of single layer gypsum board.

F. Caulk all penetrations of partitions by conduit, pipe, duct work and rough-in boxes.

3.6 GYPSUM BOARD INSTALLATION

A. Install gypsum board in accordance with GA-201 and GA-216.

B. Erect single layer gypsum board vertically, with ends and edges occurring over firm bearing.

C. Erect exterior gypsum sheathing horizontally, with edges butted tight and ends occurring over firm bearing.

D. Use screws when fastening gypsum board to metal furring or framing.

E. Double Layer Applications: Place first layer perpendicular to framing or furring members. Place second layer perpendicular to first layer. Insure joints of second layer do not occur over joints of first layer.

F. Treat cut edges and holes in exterior gypsum soffit board with sealant.

G. Place control joints consistent with lines of building spaces and as directed by Architect. Coordinate to match with tile control joint where applicable.

H. Place corner beads at external corners. Use longest practical length. Place edge trim where gypsum board abuts dissimilar materials and at other locations where detailed. Install reinforcing tape at internal corners.

3.7 JOINT TREATMENT

A. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.

B. Feather coats on to adjoining surfaces so that camber is maximum 1/32 inch.

C. Tape and fill at concealed parts of partitions extending above ceiling, but sanding is not required.

D. Fill dimples at fastener heads and marred spots on face of board with one coat of joint compound and two coats finishing compound, in same manner as at joints.

E. Provide a Level 4 finish in accordance with GA-214. Coordinate with provisions of Section 09 91 00 - Painting.

F. Remove and re-install defective work.

END OF SECTION

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SECTION 09 22 16

NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Formed metal stud framing at interior and exterior locations.

B. Framing accessories.

1.2 RELATED SECTIONS

A. Section 09 21 16 - Gypsum Board Systems: Wall board partitioning and sheathing.

B. Section 09 22 13 – Metal Furring and Lathing.

1.3 REFERENCES

A. ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

B. ASTM A525 - Standard Specification for General Requirements For Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.

C. ASTM A591/A591M - Standard Specification for Steel Sheet, Electrolytic Zinc-Coated, for Light Coating Mass Applications.

D. ASTM C645 - Standard Specification for Non-Load (Axial) Bearing Steel Studs, Runners (Track), and Rigid Furring Channels for Screw Application of Gypsum Board.

E. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Board.

F. ASTM C1002 - Standard Specification for Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases.

G. ML/SFA 540 - (Metal Lath/Steel Framing Association, Division of National Association of Architectural Metal Manufacturers) - Lightweight Steel Framing Manual.

H. SSPC Paint 20 (Steel Structures Painting Council) - Zinc Rich Primers.

1.4 SYSTEM DESCRIPTION

A. Exterior Wall Dead and Live Loads: Design and size components to withstand loads caused by positive and negative pressure of wind acting normal to plane of wall in accordance with 2012 International Building Code to a design pressure of 20 lb/sq ft.

B. Interior Walls: Metal stud framing system with batt type acoustic insulation where scheduled on Drawings and specified in Section 09 21 16.

C. Maximum Allowable Deflection:
1. 1:240 span at exterior metal wall panels.
2. 1:600 span at exterior masonry veneer systems.

D. Wall System:
1. Design to provide for movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects when subject to seasonal or cyclic day/night temperature ranges.
2. Design system to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.

1.5 SUBMITTALS FOR REVIEW

A. Section 01 30 00 - Submittals: Procedures for submittals.

B. Shop Drawings:
1. Indicate prefabricated work, component details and accessories or items required of other related work.
2. Describe method for securing studs to tracks, and for blocking and reinforcement to framing connections.
3. Provide calculations for loadings and stresses of exterior walls under a Professional Structural Engineer's seal in the State of Texas.

C. Product Data: Provide data describing standard framing member materials and finish, product criteria, load charts and limitations.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with ASTM C754 and ML/SFA 540.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience.

C. Design structural elements under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in the State of Texas.

D. Form, fabricate, install, and connect components in accordance with ML/SFA 540.

E. Asbestos Free Material/Product: Prior to approval of the material/product to be used, the manufacturer/supplier shall furnish the Architect with Certification that the material/product contains no asbestos. This certification is mandatory before approval will be issued. Submittals furnished without the asbestos -free Certification will be returned to the Contractor with no action taken until such Certification is provided.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Dietrich Industries, Inc.

B. California Expanded Metal Company (Cemco).

C. Delta Metal Products, Inc.

D. Substitutions: In accordance with Section 01 60 00.

2.2 STUD FRAMING MATERIALS

A. Studs: ASTM A525 Coating Class C, non-load bearing rolled steel, channel shaped, containing 30 to 35 percent recycled steel; punched for utility access as follows:
   1. Depth: As indicated on Drawings.
   2. Thickness: 20 gage thick minimum, except as otherwise indicated, or required to comply with allowable deflection limitations.
      a. Exterior walls: 18 gage minimum.

B. Tracks and Headers: Same material and thickness as studs, bent leg retainer notched to receive studs.

C. Ceiling Runners: With extended leg retainer.

D. Furring and Bracing Members: Of same material as studs; thickness to suit purpose.

E. Fasteners: ASTM C1002, self drilling, self tapping screws.

F. Sheet Metal Backing: 0.036 inch galvanized steel.

G. Anchorage Devices: Power actuated, drilled expansion bolts, screws with sleeves as required to suit application.

H. Acoustic Sealant: As specified in Section 09260.

I. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20 Type I Inorganic or Type II Organic zinc rich.

2.3 FABRICATION

A. Fabricate components of sizes and profiles required; with framing members fitted, reinforced, and braced to suit design requirements.

B. Fit and assemble in largest practical sections for delivery to site, ready for installation.

2.4 FINISHES

A. Studs, Tracks and Headers: Galvanize to G60 coating class.

B. Accessories: Same finish as framing members.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 40 00 – Quality Requirements: Verification of existing conditions before starting work.

B. Verify that rough-in utilities are in proper location.

3.2 ERECTION

A. Align and secure top and bottom runners at 16 inches oc.

B. Achieve an air tight seal between runners and substrate with acoustic sealant in conjunction with Section 07 92 00.

C. Achieve an air tight seal between studs and adjacent vertical surfaces with acoustic sealant in conjunction with Section 07 92 00.

D. Fit runners under and above openings; secure intermediate studs to same spacing as wall studs.

E. Install studs vertically at 16 inches, except as otherwise indicated on Drawings.

F. Align stud web openings horizontally.

G. Secure studs to tracks using fastener method. Do not weld.

H. Stud splicing not permissible except where stud height exceed maximum fabrication lengths. Splice studs with 8 inch nested lap, secure each stud flange with flush head screw.

I. Fabricate corners using a minimum of three studs.

J. Double stud at wall openings, door and window jambs, not more than 2 inches from each side of openings.

K. Brace stud framing system rigid.

L. Coordinate erection of studs with requirements of door frames, window frames, and other openings; install supports and attachments.

M. Coordinate installation of wood bucks, anchors, and wood blocking with electrical and mechanical work to be placed within or behind stud framing.

N. Blocking:
   1. Secure wood blocking to studs.
   2. Secure steel backing to studs using three #10 screws.
   3. Install blocking for support of plumbing fixtures, toilet partitions, wall cabinets, toilet accessories, hardware, opening frames, and other locations indicated on Drawings.

O. Refer to Drawings for indication of partitions extending stud framing through the ceiling to the structure above. Maintain clearance under structural building members to avoid deflection transfer to studs. Provide extended leg ceiling runners.

P. At partitions which extend and terminate 6 inches above finished ceiling, provide sway bracing at 48 inches O.C.

Q. Coordinate placement of insulation in stud spaces after stud frame erection.

3.3 ERECTION TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Maximum Variation From True Position: 1/8 inch in 10 feet.

C. Maximum Variation From Plumb: 1/8 inch in 10 feet.

END OF SECTION

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SECTION 09 30 00

TILING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes ceramic tile wall applications.

B. Wall adhesives and grouted joints.

C. Related Sections:
1. Section 09 21 16 – Gypsum Wallboard Systems: Wall substrate.
2. Section 22 41 00 – Plumbing Fixtures.

1.2 REFERENCES

A. American National Standards Institute:
1. ANSI A108.1 - Installation of Ceramic Tile, A collection.
2. ANSI A108.4 - Specifications for Ceramic Tile Installed with Organic Adhesives or Water-Cleanable Tile Setting Epoxy Adhesive.
3. ANSI A108.5 - Specifications for Ceramic Tile Installed with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar.
4. ANSI A118.1 - Standard Specification for Dry-Set Portland Cement Mortar.
5. ANSI A118.4 - Latex-Portland Cement Mortar.
6. ANSI A118.6 - Ceramic Tile Grouts.
7. ANSI A136.1 - Organic Adhesives for Installation of Ceramic Tile.
8. ANSI A137.1 - Ceramic Tile.

B. Tile Council of America: TCA - Handbook for Ceramic Tile Installation.

1.3 SUBMITTALS

A. Section 01 30 00 – Administrative Requirements.

B. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, ceramic accessories, and setting details.

C. Product Data: Submit instructions for using grouts and adhesives.

D. Samples: Submit tile and grout to illustrate color, pattern, and color variations.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 77 00 – Project Closeout: Closeout procedures.

B. Operation and Maintenance Data: Submit recommended cleaning methods, cleaning materials, stain removal methods, and polishes and waxes.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with TCA Handbook and ANSI A108 Series/A118 Series.

B. All adhesives and sealants installed in the building interior (defined as inside of the weatherproofing system and applied on-site) shall meet the testing and product requirements of the California Department of Health Services Standard Practice for The Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda.

1.6 QUALIFICATIONS

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

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience and approved by tile manufacturer.

1.7 MOCKUP

A. Section 01 40 00 - Quality Requirements: Requirements for mockup.

B. Construct mock-up, 6 feet long by 6 feet wide, with waterproofing, finish grout, and specified accessories.

C. Locate where directed by Architect/Engineer.

D. Incorporate accepted mockup as part of Work.

1.8 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Protect adhesives and grouts from freezing or overheating.

1.10 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Do not install adhesives and grouts in unventilated environment.

C. Maintain ambient and substrate temperature of 50 degrees F during installation of mortar materials.

1.11 EXTRA MATERIALS

A. Section 01 77 00 – Project Closeout: Spare parts and maintenance products.

B. Supply 10 sq ft of each size, color, and surface finish of tile specified.

PART 2 - PRODUCTS

2.1 TILE MANUFACTURERS

A. Manufacturers:
1. American Olean Tile Co.
2. Crossville, Inc. (Basis of Design)
3. Dal-Tile International.
4. Substitutions: Section 01 60 00 - Product Requirements.

2.2 TILE

A. Ceramic Wall Tile (Field) : ANSI A137.1, conforming to the following:
1. Moisture Absorption: 0 to 0.5 percent.
2. Size: 4 x 8 x 1/4 inch.
3. Shape: Rectangular.
4. Edge: Cushioned.
5. Surface Finish: Gloss.
6. Basis of Design: Color by Numbers® as manufactured by Crossville, or approved equal.
7. Color: WT18 - 1812 Overture.

B. Ceramic Wall Tile (Accent): ANSI A137.1, conforming to the following:
1. Moisture Absorption: 0 to 0.5 percent.
2. Size: 1 x 1 x 1/4 inch.
3. Shape: Square.
4. Edge: Cushioned.
5. Surface Finish: Gloss.
6. Basis of Design: Glass Blox Design Solutions as manufactured by Crossville, or approved equal.
7. Color: G024 Sapphire from the Bright Solids Collection.

2.3 SETTING MATERIALS

A. Manufacturers:
1. Laticrete International.
2. Bonsal American, Inc.
3. Custom Building Products.
4. Tex-Rite, Texas Cement Products.
5. Substitutions: In accordance with Section 01 60 00.

B. Adhesive Materials:
1. ANSI A136.1, Type 1, thin set bond type; solvent-free, low VOCs.
2. Products:
a. Mapei Ultramastic ECO High-Performance Floor and Wall Tile

Adhesive.

b. Custom Building Products “VersaBond Flex” thin-set mortar or approved equal.

c. Substitutions: In accordance with Section 01 60 00.

C. Grout Materials:

1. Standard Grout: Latex-Portland cement type as specified in ANSI A118.6.

a. Color Admixture: Custom Building Products, Laticrete, or approved equal.

b. Color: As selected by Architect from Manufacturer’s complete range of colors.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify surfaces are ready to receive work.

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. Prepare substrate surfaces for adhesive installation.

D. Install cementitious backer board. Tape joints and corners, cover with skim coat of dry-set mortar to feather edge.

3.3 INSTALLATION

A. Install tile and grout in accordance with applicable requirements of ANSI A108.1 through A108.10, and TCA Handbook recommendations.

B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.

C. Place transition strips at exposed tile edges.

D. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly.

E. Place tile with joints uniform in width, subject to variance in tolerance allowed in tile size. Make joints watertight, without voids, cracks, excess mortar, or excess grout.

F. Form internal angles coved and external angles bullnosed.

G. Sound tile after setting. Replace hollow sounding units.

H. Keep expansion and control joints free of adhesive or grout. Apply sealant to joints.

I. Allow tile to set for a minimum of 48 hours prior to grouting.

J. Grout tile joints. Use standard colored grout unless otherwise indicated.

K. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.

L. Installation - Wall Tile, General:
1. Over cementitious backer board on metal studs, install in accordance with TCA Handbook Method W223, thin-set with organic adhesive, unless otherwise indicated.
2. Over concrete and masonry install in accordance with TCA Handbook Method W223, thin-set with organic adhesive cement bond coat.

3.4 CLEANING

A. Section 01 77 00 – Project Closeout: Final cleaning.

B. Clean tile and grout surfaces.

3.5 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 77 00 – Project Closeout: Protecting installed construction.

END OF SECTION

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SECTION 09 51 10

SUSPENDED ACOUSTICAL CEILINGS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Suspended metal grid ceiling system and perimeter trim.

B. Acoustical units.

C. Non-fire rated assembly.

1.2 RELATED SECTIONS

A. Section 09 21 16 - Gypsum Wallboard Systems: partition system.

B. Section 26 51 00 - Interior Luminaries: Light fixtures in ceiling system.

1.3 REFERENCES

A. ASTM C635 - Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.

B. ASTM C636 - Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.

C. ASTM E1264 - Classification of Acoustical Ceiling Products.

D. Ceilings and Interior Systems Contractors Association (CISCA) - Acoustical Ceilings: Use and Practice.

E. UL - Fire Resistance Directory and Building Material Directory.

1.4 QUALITY ASSURANCE

A. Asbestos Free Material/Product: Prior to approval of the material/product to be used, the manufacturer/supplier shall furnish the Architect with Certification that the material/product contains no asbestos. This certification is mandatory before approval will be issued. Submittals furnished without the asbestos-free Certification will be returned to the Contractor with no action taken until such Certification is provided.

1.5 SUBMITTALS

A. Submit under provisions of Section 01 30 00.

B. Product Data: Provide data on metal grid system components and acoustical units including preconsumer and post-consumer recycled content.

C. Samples: Submit two samples 12 x 12 inch in size illustrating material and finish of acoustical units.

D. Samples: Submit two samples each, 12 inches long, of suspension system main runner, cross runner and edge trim.

E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.6 QUALIFICATIONS

A. Qualification of Installer: Minimum of three years documented experience in installations of similar scope.

1.7 REGULATORY REQUIREMENTS

A. Conform to applicable code for combustibility requirements for materials.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Maintain uniform temperature of minimum 60 degrees F degrees C, and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

1.9 SEQUENCING

A. Sequence Work under the provisions of Section 01 11 00.

B. 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.

C. Install acoustical units after interior wet work is dry.

1.10 EXTRA MATERIALS

A. Furnish under provisions of Section 01 77 00.

B. Provide two (2) percent of total acoustical unit area of extra panels to Owner.

C. Provide one (1) unopened box of suspension material.

PART 2 - PRODUCTS

2.1 MANUFACTURERS - SUSPENSION SYSTEM

A. Armstrong World Industries, Inc; Prelude 15/16” Exposed Tee

B. USG Interiors, Donn Suspension Systems.

C. Chicago Metallic.

D. Substitutions: Under provisions of Section 01 60 00.

2.2 SUSPENSION SYSTEM MATERIALS

A. Non-fire Rated Grid: ASTM C635, intermediate duty; exposed Tee; components die cut and interlocking.

B. Grid Materials: Double-web steel construction; commercial quality cold rolled steel with galvanized coating.

C. Exposed Grid Surface Width: 15/16 inch.

D. Grid Finish: Baked polyester finish; Color as selected by Architect.

E. Accessories: Specifically designed as an integral part of grid system as per manufacturer's recommendations.

F. Support Channels and Hangers: Primed steel; size and type to suit application and ceiling system flatness requirement specified.

2.3 MANUFACTURERS - ACOUSTICAL UNITS

A. Armstrong World Industries, Inc.

B. Owens-Corning – Conwed Designscape Corporation.

C. USG Interiors, Inc.

D. Substitutions: Under provisions of Section 01 60 00.

2.4 ACOUSTICAL UNIT MATERIALS

A. Acoustical Tile (AT/1): ASTM E1264, conforming to the following:
1. Size: 24 x 24 inches.
2. Thickness: 5/8 inch.
3. Composition: Wet form mineral fiber.
4. Light Reflectance: Actual LR 0.80.
5. NRC Range: 0.55.
6. Ceiling Attenuation Class (CAC Range): Minimum 35.
7. Fire Hazard Classification: Class A.
8. Edge: Square-cut.
9. Surface Color: White.
10. Surface Finish: Factory applied vinyl latex paint.
11. Recycled Content: 26%.
12. Manufacturer: USG Fissured Basic # 562, or approved equal.

2.5 ACCESSORIES

A. Touch-up Paint: Latex; type and color to match acoustical and grid units.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify site conditions under provisions of Section 01 40 00.

B. Verify that layout of hangers will not interfere with other Work.

3.2 INSTALLATION - LAY-IN GRID SUSPENSION SYSTEM

A. Install suspension system in accordance with manufacturer's instructions and as supplemented in this Section.

B. Install suspension system to rigidly secure acoustical ceiling system including integral mechanical and electrical components with maximum deflection of 1/360.

C. Locate system on room axis according to Reflected Ceiling Plan.

D. Install after major above ceiling Work is complete. Coordinate the location of hangers with other Work.

E. Hang suspension system from steel joists and supplemental carrying members spaced in between joists.

F. 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.

G. 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.

H. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability. Support fixture loads by supplementary hangers located within 6 inches of each corner; or support components independently.

I. Do not eccentrically load system, or produce rotation of runners.

J. Install edge molding at intersection of ceiling and vertical surfaces, using longest practical lengths. Miter corners. Provide edge moldings at junctions with other interruptions.

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. Lay directional patterned units in pattern directed by Architect. 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. Cut panels to fit irregular grid and perimeter edge trim.

G. Where round obstructions occur, provide preformed closers to match edge molding.

H. Install hold-down clips to retain panels tight to grid system within 20 ft of any exterior door.

3.4 ERECTION TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.

B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

END OF SECTION

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SECTION 09 65 00
RESILIENT FLOORING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Section includes resilient tile flooring and base.

1.2 RELATED SECTIONS

A. Section 02 41 14 – Interior Selective Demolition.

1.3 REFERENCES

A. ASTM International:
   1. ASTM E662 - Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials.
   2. ASTM F1066 - Standard Specification for Vinyl Composition Floor Tile.
   3. ASTM F1344 - Standard Specification for Rubber Floor Tile.
   4. ASTM F1861 - Standard Specification for Resilient Wall Base.

B. Federal Specification Unit:
   1. FS RR-T-650 - Treads, Metallic and Nonmetallic, Skid Resistant.

C. National Fire Protection Association: NFPA 253 - Standard Method of Test for Critical Radiant Flux for Floor Covering Systems Using a Radiant Heat Energy Source.

D. South Coast Air Quality Management District:
   1. SCAQMD Rule 1168 - Adhesive and Sealant Applications.

1.4 QUALITY ASSURANCE

A. Installer shall have no less than three years documented experience in applications of similar material and quantity.

B. Adhesives and sealants shall be low emitting in accordance with the current VOC content limits of South Coast Air Quality Mgt. District (SCAQMD) Rule #1168.

1.5 SUBMITTALS

A. Submit samples in accordance with Section 01 30 00.
   1. Include duplicate 3 by 3 inch sized samples of each flooring material, color and pattern selected.
   2. Include duplicate samples of base and edge strips selected.

B. Submit manufacturer’s product data, including recycle content, certifications, and environmental data.

C. Submit manufacturer's installation instructions under provisions of Section 01 30 00. Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, handle and protect products under provisions of Section 01 60 00.

1.7 WARRANTY

A. Provide Manufacturer’s limited wear warranty for five years for heavy traffic.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Vinyl Composition Tile:
1. Armstrong Commercial Flooring (Basis of Design).
2. Azrock Industries, Inc.

B. Substitutions: Under provisions of Section 01 60 00.

2.2 MATERIALS - TILE FLOORING

A. Vinyl Composition Tile (General): ASTM F1066, Class 2:
1. Construction: Through-pattern composition tile.
2. Size: 12 by 12 inch.
3. Thickness: 0.125 inch.
4. FloorScore Indoor Air Quality: SCS Certified.
5. NSF/ANSI-332 Certification: Gold.
6. Warranty: Limited 5 year commercial warranty.
7. Product: Armstrong Standard Excelon Imperial Texture, or approved equal.
8. Color: #51821 Caribbean Blue or approved equal.

2.3 ACCESSORIES/ADHESIVES/SEALERS

A. Sub-Floor filler: Cementitious; type recommended by adhesive material manufacturer.

B. Adhesive: Thin-spread, solvent-free, asphalt emulsion/latex-based adhesive; low emitting in accordance with the current VOC content limits of South Coast Air Quality Mgt. District (SCAQMD) Rule #1168:
1. Henry 130 Thin Spread Floor Tile Adhesive.
2. Substitutions: In accordance with Section 01 60 00.

C. Sealer and Wax: By Owner.

PART 3 - EXECUTION

3.1 SITE AND SUBSTRATE CONDITIONS

A. Ensure floor surfaces are smooth and flat with maximum variation of 1/8 inch in 10 feet.

B. Ensure concrete floors are dry (maximum 7 percent moisture content) and exhibit negative alkalinity, carbonization or dusting.

C. Verify floor and lower wall surfaces are free of substances that may impair adhesion of new adhesive and finish materials.

D. Maintain minimum 70 degrees F. air temperature at flooring installation area for 3 days prior to, during, and for 24 hours after installation.

E. Store flooring materials in area of application. Allow 3 days for material to each equal temperature as area; allow 8 days for rubber flooring.

3.2 LEVELING

A. Remove sub-floor ridges and bumps. Fill low spots, cracks, joints, holes and other defects with sub-floor filler.

B. Clean floor and apply, trowel and float filler to leave smooth, flat hard surface. Prohibit traffic until filler is cured.

3.3 INSTALLATION - FLOORING

A. Open floor tile cartons, enough to cover each area, and mix tile to ensure shade variations do not occur within any one area.

B. Clean substrate. Spread cement evenly in quantity recommended by manufacturer to ensure adhesion over entire area of installation. Spread only enough adhesive to permit installation of flooring before initial set.

C. Set flooring in place; press with heavy roller to ensure full adhesion.

D. Lay flooring with joints and seams parallel to building lines to produce symmetrical tile pattern.

E. Install tile with minimum tile width 1/2 full size at room or area perimeter, to square grid pattern with all joints aligned, with pattern grain alternating with adjacent unit to produce basket weave pattern.

F. Scribe flooring to walls, columns, cabinets, floor outlets and other appurtenances to produce tight joints.

G. Terminate resilient flooring at centerline of door opening(s) where adjacent floor finish is dissimilar.

H. Install edge strips at unprotected or exposed edges where flooring terminates.

I. At movable partitions or accordion doors, install flooring under partitions without interrupting floor pattern.

J. Install feature strips and floor markings where indicated. Fit joints tightly.

3.4 CLEANING

A. Section 01 77 00 – Contract Closeout: Cleaning installed work.

B. Remove excess adhesive from floor, base, and wall surfaces without damage.

C. Clean and seal resilient flooring products in accordance with manufacturer's instructions.

3.5 PROTECTION

A. Prohibit traffic from floor finish for 48 hours after installation.

END OF SECTION

SECTION 09 67 23

RESINOUS FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Resinous flooring systems to includes penetrating epoxy primer, elastomeric epoxy waterproof membrane; epoxy formulation consisting of resin, hardener and reactive flow enhancers; colored, quartz silica aggregate and a clear epoxy sealer.

B. Related Requirements:
1. Section 09 30 00 – Tiling; wall tile.

1.2 REFERENCES:

A. ASTM International:
1. ASTM C307 - Standard Test Method for Tensile Strength of Chemical-Resistant Mortar, Grouts, and Monolithic Surfacing.
2. ASTM C412 - Standard Specification for Concrete Drain Tile.
3. ASTM C413 - Standard Test Method for Absorption of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes.
4. ASTM C579 - Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes.
5. ASTM C580 - Standard Test Method for Flexural Strength and Modulus of Elasticity of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes.
6. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position.
7. ASTM D638 - Standard Test Method for Tensile Properties of Plastics.
8. ASTM D2047 - Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine.
9. ASTM D2240 - Standard Test Method for Rubber Property—Durometer Hardness.
10. ASTM D2794 - Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
11. ASTM D4060 - Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser.
12. ASTM D4541 - Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical data, installation instructions, and general recommendations for each resinous flooring material required. Include certification indicating compliance of materials with requirements.

B. Samples: Submit, for verification purposes 6-inch square samples of each type of resinous flooring required, applied to a rigid backing, in color and finish indicated.
   1. For initial selection of colors and finishes, submit manufacturer's color charts showing full range of colors and finishes available.

1.4 QUALITY ASSURANCE

A. Single Source Responsibility: Obtain primary resinous flooring materials including primers, resins, hardening agents, finish or sealing coats from a single manufacturer with not less than ten years of successful experience in manufacturing and installing principal materials described in this section. Contractor shall have completed at least five projects of similar size and complexity; Provide secondary materials only of type and from source recommended by manufacturer of primary materials.

B. Pre-Installation Conference
   1. Contractor shall arrange a meeting not less than thirty days prior to starting work.
   2. Attendance
   3. Contractor
   4. Architect/Owner's Representative
   5. Manufacturer/Installer's Representative

C. ISO 9002: All materials, including primers, resins, curing agents, finish coats, aggregates and sealants are manufactured and tested under an ISO 9002 registered quality system.

1.5 DELIVERY, STORAGE AND HANDLING

A. Material shall be delivered to job site and checked by flooring contractor for completeness and shipping damage prior to job start.

B. All materials used shall be factory pre-weighed and pre-packaged in single, easy to manage batches to eliminate on site mixing errors. No onsite weighing or volumetric measurements allowed.

C. Material shall be stored in a dry, enclosed area protected from exposure to moisture. Temperature of storage area shall be maintained between 65 and 85 degreesF/18 and 30 degrees C.

1.6 PROJECT CONDITIONS

A. Concrete substrate shall be properly cured for a minimum of 30 days. A vapor barrier must be present for concrete subfloors on or below grade. Otherwise, an osmotic pressure resistant grout must be installed prior to the resinous flooring.

B. Utilities, including electric, water, heat (air temperature between 60 and 90 degrees F/16 and 32 degrees C) and finished lighting to be supplied by Contractor.

C. Job area to be free of other trades during, and for a period of 24 hours, after floor installation.

D. Protection of finished floor from damage by subsequent trades shall be the responsibility of the Contractor.

1.7 WARRANTY

A. Manufacturer shall furnish a single, written warranty covering both material and workmanship for a period of one (1) full year from date of installation.

B. Sample warranty letter to be included in the Bid Package or Bid may be disqualified.

PART 2 - PRODUCTS

2.1 RESINOUS FLOORING:

A. Manufacturer and System:
1. Stonshield HRI as manufactured by Stonhard, Inc., Maple Shade, NJ, (800) 257-7953.
2. Arizona Polymer Flooring, www.apfepoxy.com.
3. Substitutions in accordance with Section 01 62 00.

B. System Description: A nominal 3/16" (5 mm) thick system comprised of a penetrating two-component epoxy primer; 100% solids elastomeric epoxy waterproof membrane; quartz silica aggregate and a high performance, UV resistant, clear epoxy sealer. Incorporate antimicrobial chemical additive. Include coved base.
1. Physical Properties: Provide flooring system in which physical properties of topping including aggregate, when tested in accordance with standards or procedures referenced below, are as follows:

Compressive Strength	10,000 psi
(ASTM C579)	after 7 days
Flexural Strength	4,300 psi
(ASTM C580)	
Tensile Strength	2,000 psi
(ASTM C307)	
Hardness	85-90
(ASTM D2240/Shore D Durometer)	
Bond Strength/Adhesion	>300 psi
(ASTM D4541)	(100% concrete failure)
Impact Resistance	>160 in lbs
(ASTM D2794)	
Abrasion Resistance	0.06 gm max. weight loss
(ASTM D4060, Taber Abrader CS-17 wheel)	
Coefficient of Friction	0.7 min.
(ASTM D2047)	
Flammability	Self Extinguishing
(ASTM D635)	Extent of burning 0.25 inches max.
Water Absorption	0.1%
(ASTM C413)	

2.2 COVE BASE

A. Provide an integral seal at the joint between the floor base and the wall.

B. Cove base to be 4" in height or top of curb where curbs are present.

C. Color to match flooring.

D. Flush based surface with wall tile.

2.3 JOINT SEALANT MATERIALS

A. Type produced by manufacturer of resinous flooring system for type of service and joint condition indicated.

2.4 SUPPLEMENTAL MATERIALS

A. Anti-Microbial Additive: Incorporate antimicrobial chemical additive to control growth of most bacteria, fungi, algae and actinomycetes.

2.5 COLORS

A. Colors: Mortar Base Gotham Gray – Medium Texture.

PART 3 - EXECUTION

3.1 PREPARATION

A. Substrate: Concrete preparation shall be by mechanical means and include use of a scabbler, scarifier or shot blast machine for removal of bond inhibiting materials such as curing compounds or laitance.

3.2 APPLICATION

A. General: Apply each component of resinous flooring system in compliance with manufacturer's directions to produce a uniform monolithic wearing surface of thickness indicated, uninterrupted except at divider strips, sawn joints or other types of joints (if any), indicated or required.

B. Primer: Mix and apply primer over properly prepared substrate with strict adherence to manufacturer's installation procedures and coverage rates.

C. Membrane Base: Mix and apply membrane base over fully cured primer using manufacturer's specially designed squeegees and rollers.

D. Undercoat: Mix and apply undercoat over fully cured membrane with strict adherence to manufacturer's installation procedures and coverage rates.

E. Broadcast: Immediately broadcast quartz silica aggregate into the undercoat using manufacturer's specially designed spraycaster. Strict adherence to manufacturer's installation procedures and coverage rates is imperative.

F. Sealer: Remove excess unbonded granules by lightly brushing and vacuuming the floor surface. Mix and apply sealer with strict adherence to manufacturer's installation procedures.

3.3 FIELD QUALITY CONTROL

A. The right is reserved to invoke the following material testing procedure at any time, and any number of times during period of flooring application.

B. The Owner will engage service of an independent testing laboratory to sample materials being used on the job site. Samples of material will be taken, identified and sealed, and certified in presence of Contractor.

C. Testing laboratory will perform tests for any of characteristics specified, using applicable testing procedures referenced herein, or if none referenced, in manufacturer's product data.

D. If test results show materials being used do not comply with specified requirements, Contractor may be directed by Owner to stop Work; remove non-complying materials; pay for testing; reapply flooring materials to properly prepared surfaces which had previously been coated with unacceptable materials.

3.4 CURING, PROTECTION AND CLEANING

A. Cure resinous flooring materials in compliance with manufacturer's directions, taking care to prevent contamination during stages of application and prior to completion of curing process. Close area of application for a minimum of 24 hours.

B. Protect resinous flooring materials from damage and wear during construction operation. Where temporary covering is required for this purpose, comply with manufacturer's recommendations for protective materials and method of application. Contractor is responsible for protection and cleaning of surfaces after final coats.

C. Cleaning: Remove temporary covering and clean resinous flooring just prior to final inspection. Use cleaning materials and procedures recommended by resinous flooring manufacturer.

3.5 SCHEDULE

A. Girls & Boys Restrooms: 3/16 inch thick system and cove base with high performance top sealer/coating.

END OF SECTION

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SECTION 09 77 20

FIBERGLASS REINFORCED WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Prefinished polyester glass reinforced plastic sheets and adhered to previously painted gypsum wallboard.
   1. PVC trim.

B. Products Not Furnished or Installed under This Section:
   1. Gypsum substrate board.
   2. Resilient Base.

1.2 REFERENCES

A. American Society for Testing and Materials: Standard Specifications (ASTM)
   1. ASTM D 256 - Izod Impact Strengths (ft #/in)
   2. ASTM D 570 - Water Absorption (%)
   3. ASTM D 638 - Tensile Strengths (psi) & Tensile Modulus (psi)
   4. ASTM D 790 - Flexural Strengths (psi) & Flexural Modulus (psi)
   5. ASTM D 2583- Barcol Hardness
   6. ASTM D 5319 - Standard Specification for Glass-Fiber Reinforced Polyester Wall and Ceiling Panels.
   7. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

1.3 SUBMITTALS

A. Product Data: Submit sufficient manufacturer's data to indicate compliance with these specifications, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

B. Shop Drawings: Submit elevations of each wall showing location of paneling and trim members with respect to all discontinuities in the wall elevation.

C. Selection Samples: Submit manufacturer’s standard color pattern selection samples representing manufacturer's full range of available colors and patterns.

D. Samples for Verification: Submit appropriate section of panel for each finish selected indicating the color, texture, and pattern required.
   1. Submit complete with specified applied finish.
   2. For selected patterns show complete pattern repeat.
   3. Exposed Molding and Trim: Provide samples of each type, finish, and color.

E. Manufacturers Material Safety Data Sheets (MSDS) for adhesives, sealants and other pertinent materials prior to their delivery to the site.

1.4 QUALITY ASSURANCE

A. Conform to building code requirements for interior finish for smoke and flame spread requirements as tested in accordance with ASTM E 84 (Method of test for surface burning characteristics of building Materials)
   1. Wall Required Rating – Class A.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver materials factory packaged on strong pallets.

B. Store panels and trim lying flat, under cover and protected from the elements. Allow panels to acclimate to room temperature (70°) for 48 hours prior to installation.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Building are to be fully enclosed prior to installation with sufficient heat (70°) and ventilation consistent with good working conditions for finish work

B. During installation and for not less than 48 hours before, maintain an ambient temperature and relative humidity within limits required by type of adhesive used and recommendation of adhesive manufacturer.
   1. Provide ventilation to disperse fumes during application of adhesive as recommended by the adhesive manufacturer.

1.7 WARRANTY

A. Furnish one year guarantee against defects in material and workmanship.

PART 2 - PRODUCTS

2.1 PANELS

A. ACCEPTABLE MANUFACTURERS
   1. Marlite; 202 Harger Street, Dover, OH 44622. 800-377-1221 Email: info@marlite.com www.marlite.com. (Basis of Design).
   2. Nudo Fiberlite FRP.
   3. Kal-Lite.
   4. Substitutions: In accordance with Section 01 60 00 – Product Requirements

B. Product: Standard FRP.

2.2 COMPOSITION

A. Fiberglass reinforced thermosetting polyester resin panel sheets complying with ASTM D 5319.
   1. Coating: Multi-layer print, primer and finish coats or applied over-layer.
   2. Dimensions:
      a. Thickness – 0.090 “ (2.29mm) nominal
      b. Width - 4'-0” (1.22m) nominal
      c. Length – As indicated on the drawings.
   3. Tolerance:
      a. Length and Width: +/-1/8 “ (3.175mm)
      b. Square - Not to exceed 1/8 “ for 8 foot (2.4m) panels or 5/32 “ (3.96mm) for 10 foot (2.4m) panels

B. Properties: Resistant to rot, corrosion, staining, denting, peeling, and splintering.
1. Flexural Strength - 1.0×10^4 psi per ASTM D 790.
2. Flexural Modulus - 3.1×10^5 psi per ASTM D 790.
3. Tensile Strength - 7.0×10^3 psi per ASTM D 638.
4. Tensile Modulus - 1.6×10^5 psi per ASTM D 638.
5. Water Absorption - 0.72% per ASTM D 570.
6. Barcol Hardness (scratch resistance) of 35 55 as per ASTM D 2583.
7. Izod Impact Strength of 72 ft. lbs./in ASTM D 256

C. Back Surface: Smooth.

D. Front Finish: Embossed; Color: Colors as selected by Architect from Manufacturer's standard palette of colors.
1. Surface: Standard FRP; Pebbled.
2. Fire Rating: Class A Fire Rating.

E. Size: As indicated on drawings.

2.3 MOLDINGS

A. PVC Trim: Thin-wall semi-rigid extruded PVC.
1. M 350 Inside Corner.
2. M 365 Division.
3. M 370 Edge.
4. Color: Match panel color.

2.4 ACCESSORIES

A. Fasteners: Non-staining nylon drive rivets.
1. Match panel colors.
2. Length to suit project conditions.

B. Adhesive: Either of the following construction adhesives complying with ASTM C 557.
1. Marlite C-551 FRP Adhesive - Water- resistant, non-flammable adhesive.
2. Marlite C-375 Construction Adhesive - Flexible, water-resistant, solvent based adhesive, formulated for fast, easy application.
3. Titebond Advanced Polymer Panel Adhesive – VOC compliant, non-flammable, environmentally safe adhesive.

C. Sealant: Clear Silicone Sealant.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine backup surfaces to determine that corners are plumb and straight, surfaces are smooth, uniform, clean and free from foreign matter, nails countersunk, joints and cracks filled flush and smooth with the adjoining surface.

B. Repair defects prior to installation.
1. Level wall surfaces to panel manufacturer's requirements. Remove protrusions and fill indentations.

3.2 INSTALLATION

A. Comply with manufacturer's recommended procedures and installation sequence.

B. Cut sheets to meet supports allowing 1/8” (3 mm) clearance for every 8 foot (2.4m) of panel.
   1. Cut and drill with carbide tipped saw blades or drill bits, or cut with shears.
   2. Pre-drill fastener holes 1/8” (3mm) oversize with high-speed drill bit.
      a. Space at 8” (200mm) maximum on center at perimeter, approximately 1” from panel edge.
      b. Space at in field in rows 16’ on center, with fasteners spaced at 12” maximum on center.

C. Apply panels to board substrate, above base, vertically oriented with seams plumb and pattern aligned with adjoining panels.
   1. Install panels with manufacturer's recommended gap for panel field and corner joints.
      a. Adhesive trowel and application method to conform to adhesive manufacturer’s recommendations.
      b. Drive fasteners for snug fit. Do not over-tighten.

D. Apply panel moldings to all panel edges using silicone sealant providing for required clearances.
   1. All moldings must provide for a minimum 1/8 “ (3mm) of panel expansion at joints and edges, to insure proper installation.
   2. Apply sealant to all moldings, channels and joints between the system and different materials to assure watertight installation.

3.3 CLEANING

A. Remove excess sealant from panels and moldings. Wipe panel down using a damp cloth and mild soap solution or cleaner.

B. Refer to manufacturer's specific cleaning recommendations Do not use abrasive cleaners.

END OF SECTION

SECTION 09 90 00

PAINTING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Extent of Work: The extent of work to be painted or finished include the following:
1. All surfaces of materials, either on the exterior or interior of the building, except where painting or finishing are excluded as listed herein below.
2. Paint or finish all surfaces left unfinished by other trades.
3. Touch-up all damaged, defaced, or scratched areas. Touch-up all screwheads, boltheads, etc. as required.
4. All new exposed mechanical piping, ductwork, plumbing and electrical associated with air conditioning of Gymnasiums.

B. Surfaces Not To Be Painted, Unless Specifically Specified, Noted, or Scheduled Otherwise:
1. Any drywall or CMU permanently concealed from view.
2. Complete factory applied finish.
3. Finish hardware except where primed for paint finish.
4. Aluminum.
5. Plumbing fixtures and toilet room accessories.
6. Lighting fixtures.
7. Acoustical surfaces, except as scheduled to be field painted.
8. Any glass, plastics, floor and wall tiles, rubber bases, face bricks, and vinyl wall coverings.
9. Steel deck and joist in concealed locations.
10. Concrete floor.

C. Surface preparation, priming and coats of paint specified are in addition to shop-priming and surface treatment specified under other sections.

D. "Paint" as used herein means all coating systems materials, including primers, emulsions, enamels, sealers and fillers, and other applied materials whether used as prime, intermediate or finish coats.

1.2 RELATED SECTIONS

A. Section 01 23 00 – Alternates: Alternate #1

B. Section 09 21 16 – Gypsum Board Systems

C. Section 32 17 23 - Pavement Markings.

1.3 REFERENCES

A. SSPC-SP 1 - Solvent Cleaning

B. SSPC-SP 2 - Hand Tool Cleaning

C. SSPC-SP 3 - Power Tool Cleaning

D. SSPC-SP 13 / Nace No. 6 Surface Preparation for Concrete

E. EPA-Method 24

F. GreenGuard

G. Collaborative for High Performance Schools- CHPS EQ2.2

H. CDHS - Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 addenda.

I. South Coast Air Quality Management District (SCAQMD): Standard 1113- for architectural coatings.

1.4 VOLATILE ORGANIC COMPOUNDS (VOC) COMPLIANCE

A. Products provided under this Section shall meet VOC requirements of the South Coast Air Quality Management District Standard 1113 for architectural coatings, www.scaqmd.gov and CDHS Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 addenda.

B. The Collaborative for High Performance Schools (CHPS) rating program criteria scoring includes points for Low-emitting Materials under Credit EQ 2.2. This credit requires products to be tested in accordance with the California Department of Health Services (CDHS) Standard Practice, as referenced below, and meet its allowable emission limits. Section 6 of the CDHS Standard Practice defines the provisions required for “Acceptable Alternatives to its Practice”.
   1. As an acceptable alternative, products certified under GREENGUARD Children & Schools Program (C&S) are eligible for CHPS EQ2.2 points provided that all of the following terms and conditions agreed to by CHPS and Greenguard Environmental Institute (GEI) www.greenguard.org.

1.5 QUALITY ASSURANCE

A. Include on label of containers:
   1. Manufacturer's name
   2. Type of paint
   3. Manufacturer's stock number
   4. Color
   5. Instructions for reducing, where applicable; Note that improper reducing may negatively affect the VOC rating of the product. Products found to have VOC emissions in excess of those specified herein, or by the manufacturer, shall be considered to be defective and shall be removed and replaced with conforming products at the Contractor's expense.
   6. Label Analysis: (Federal Specification Number)

B. Sampling of Materials, when requested by the Architect:
   1. Obtain test samples from material stored at project site or source of supply.
   2. Furnish from materials designated by the Architect/Engineer as follows: 1 quart from batches of 50 gal. or less.
   3. Select samples at random from sealed containers.

C. Fungus Control for Mildew Resistant Materials: Organic coating shall show no fungus growth when tested as specified in Federal Test Method Standard No. 141, Method 6271.1.

D. Field Quality Control:
   1. Request review of first finished room, space, or item of each color scheme required by Architect for color, texture, and workmanship.

E. Contractor shall be required to remove and replace all substrates whose moisture content exceeded those recommended by the paint manufacturer or the substrate manufacturer at the time painting was performed.

F. The building must be under full climatic control prior to painting.

G. Notify Architect at least 24 hours prior to painting.

H. Asbestos Free Material/Product: Prior to approval of the material/product to be used, the manufacturer/supplier shall furnish the Architect with Certification that the material/product contains no asbestos. This certification is mandatory before approval will be issued. Submittals furnished without the asbestos -free Certification will be returned to the Contractor with no action taken until such Certification is provided.

1.6 SUBMITTALS

A. Color Samples:
   1. Size shall be at least 8-1/2 by 11 inches.
   2. Colors shall be in accordance with furnished schedules. Provide samples of every color and finish required.
   3. Prepare at project site on a material similar in texture to that to which it is to be applied.
   4. Submit in duplicate for approval by the Architect.
   5. Manufacturer's printed VOC data.

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery of Materials: Deliver sealed containers with labels legible and intact.

B. Storage of Materials:
   1. Store only acceptable project materials on project site.
   2. Store in a suitable location.
   3. Restrict storage to paint materials and related equipment.
   4. Comply with health and fire regulations.

C. Deliver and store in accordance with Section 01 60 00.

1.8 JOB CONDITIONS

A. Environmental Requirements:
1. Comply with manufacturer's recommendations as to environmental conditions under which coatings and coating systems can be applied.
2. Do not apply finish in areas where dust is generated.

B. Protection:
1. Cover or otherwise protect finished work of other trades and surfaces not being painted concurrently or not to be painted.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Except as otherwise specified, materials shall be VOC compliant materials as manufactured by:
1. Sherwin-Williams Co. (Basis of Design)
2. Benjamin Moore.
3. Glidden Professional.
4. PPG.
5. Flame Control Coatings, LLC, 4120 Hyde Park Blvd., Niagara Falls, NY 14305 (Intumescent Fire Retardant Paint).
6. Substitutions in accordance with Section 01 60 00.

B. Materials selected for coating systems for each type surface shall be the product of a single manufacturer.

2.2 SUBSTITUTIONS

A. Comply with Conditions of the Contract and Division 1.

B. Submit substitute paint schedule listing all surfaces and proposed products. VOC numbers may not exceed those listed in paragraphs 2.4 and 2.5.

C. Obtain review prior to purchase and delivery.

2.3 MATERIALS

A. Secondary products not specified by name and required for the job such as thinners and putty shall be "best grade" or "first line", lowest commercially available VOC products of a reputable manufacturer.

B. All interior paint shall be semi-gloss enamel unless specifically noted otherwise.

2.4 INTERIOR PAINTING - ENAMEL FINISH

		Film Thickness Mils dft/coat	VOC g/L
A. Gypsum Board (Enamel Finish)			
1. Smooth Texture			
2. Primer:	ProMar 200 Zero VOC Interior Latex Primer B28W02600	1.5	0

3. Finish: ProMar 200 Zero VOC Interior Latex Semi-gloss B31-2600 (two coats)	1.7	0

B. Interior Galvanized Metal

1. Primer: Pro Industrial Pro-Cryl Universal Acrylic Primer B66-310	4.0	<100
2. Finish: Pro Industrial 0 VOC Semi-Gloss Acrylic B66-650 (two coats)	3.0	0

C. Interior Ferrous Metal (primed and unprimed)

1. Primer: Pro Industrial Pro-Cryl Universal Acrylic Primer B66-310	4.0	<100
2. Finish: Pro Classic Interior WB Acrylic-Alkyd B31 Semi-gloss B34-850 (two coats)	1.6	49

D. Interior Wood (Transparent/Clear Finish)

1. Finish: Minwax Polycrylic Protective Finish (two coats)	.6	275

2.5 EXTERIOR PAINTING

A. Exterior Galvanized Metal:

1. Primer: ProCryl Universal Water Based Primer B66-310	3.0	<10
2. Finish: Sher-Cryl HPA Acrylic, B66-300 Semi-gloss (two coats)	3.0	<200

B. Exterior Ferrous Metal:

1. Primer: ProCryl Universal Water Based Primer B66-310	3.0	<100
2. Finish: Sher-Cryl HPA Acrylic, B66-300 Semi-gloss (two coats)	3.0	<200
3. Topcoat: Sher-Clear 1K Acrylic Clear Coat B66C380	2.0	<100

2.6 COLORS

A. Interior/Exterior Finish Colors are scheduled at the end of this section. Colors of paints (including stains) shall match control samples.

B. Traffic Paint: Refer to Section 32 17 23 – Pavement Markings.

2.7 MIXING AND TINTING

A. Deliver paints and enamels ready-mixed to job site.

B. Accomplish job mixing and job tinting only when acceptable to the Architect/Engineer. No mixing or tinting shall be allowed inside the building.

C. Mix only in mixing pails placed in suitably sized non-ferrous or oxide resistant metal pans.

D. Use tinting colors recommended by manufacturer for the specific type of finish.

E. Fungicidal agent shall be incorporated into the paint by the manufacturer.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine surfaces scheduled to receive paint and finishes for conditions that will adversely affect execution, permanence or quality of work and which cannot be put into an acceptable condition through preparatory work as included in Paragraph 3.2, PREPARATION OF SURFACES.

B. Do not proceed with surface preparation or coating application until conditions are suitable.

3.2 PREPARATION OF SURFACES

A. General:
   1. Perform all preparation and cleaning procedures in strict accordance with paint manufacturer's instructions and as herein specified for each substrate.
   2. Remove or provide suitable masking of all hardware, hardware accessories, machined surfaces, labels, nameplates, etc. prior to surface preparation and painting. Reinstall the removed items by workmen skilled in the trades involved.
   3. Do not apply initial coating until moisture content of surface is within limitations recommended by paint manufacturer.
      a. Test with moisture meter.
   4. Priming coats on woodwork shall be applied as required and as soon as possible after woodwork is delivered to the building.
   5. Top and bottom edges of all wood doors shall be stained and given one good coat of varnish after fitting and before final hanging.
   6. All interior wood trim and finish, etc., set over or on masonry shall be backprimed before erection with a good coat of shellac.

B. Woods:
   1. Clean soiled surfaces in accordance with manufacturer's instructions.
   2. Sand to smooth and even surface, then dust off.
   3. Fill nail holes, cracks, open joints and other defect with putty after priming coat has dried. Color to match finish color.

C. Gypsum Board Surfaces exposed to view, not scheduled to receive wallcovering:
   1. Fill narrow, shallow cracks and small holes with spackling compound.
   2. Rake deep, wide cracks and deep holes.
      a. Dampen with clear water.
      b. Fill with thin layers of drywall joint cement.
   3. Allow to dry.
   4. Sand smooth. Do not raise nap of paper on wallboard.
   5. Finish: GA-214, Level 5.
   6. Texture: Smooth.

D. Ferrous Metal Surfaces:
   1. Prepare surface in accordance with recommendations of directions of manufacturer of rust-inhibitive primer.
   2. Feather edges of sound paint by grinding, if necessary.

E. Galvanized Metal:
   1. Clean surface with mineral spirits to remove oil residue.
   2. Dry with clean cloth.

3.3 WORKMANSHIP - MINIMUM REQUIREMENTS

A. Application of materials shall be by skilled mechanics. Spread paint evenly and brush out thoroughly. Flow-on lacquer, varnish and enamel evenly and smoothly, and free from brush marks. Workmanship shall be in accordance with the best practices recognized for class of work, grade, type and kinds of materials specified.

3.4 APPLICATION

A. General Requirements:
   1. Oil finish shall be used as it comes from manufacturer's containers without thinning or adulterating.
   2. Apply paint enamel and epoxy finish with suitable brushes or rollers.
      a. Rate of application shall not exceed that as recommended by paint manufacturer for the surface involved less ten percent allowance for losses.
      b. Keep brushes and rollers clean, dry, free from contaminates and suitable for the finish required.
   3. Comply with recommendation of product manufacturer for drying time between succeeding coats.
   4. Vary slightly the color of successive coats.
   5. Sand and dust between each coat to remove defects visible from a distance of 5 feet.
   6. Finish coats shall be smooth, free of brush marks, streaks, laps or pile up of paints, and skipped or missed areas.
      a. Finished metal surfaces shall be free of skips, voids or pinholes in any coat when tested with a low voltage detector.
   7. Inspection:
      a. Do not apply additional coats until completed coat has been inspected by the Architect.
      b. Only inspected coats of paint will be considered in determining number of coats applied.
      c. Leave all parts of moldings and ornaments clean and true to details with no undue amount of paint in corners and depressions.
      d. Make edges of paint adjoining other materials or colors clean and sharp with no overlapping.
      e. Apply primer on all work before glazing.
      f. Change colors at corner of stop where colors differ between adjoining spaces or rooms and where door frames match wall colors.
      g. Refinish whole wall where portion of finish has been damaged or is not acceptable.

h. Minimum Total Dry Film Thickness:
   1) Apply material at not less than manufacturer's recommended spreading rate.
   2) Provide not less than 5 mils thickness for the entire coating system of prime and finish coats for 3-coat system.
i. Provide not less than 3.5 mils thickness for the entire coating system of prime and finish coats for 2-coat system.
j. Do not paint over U.L. labels on doors and frames.
k. Environmental conditions such as temperature and humidity shall be within ranges recommended by product manufacturer.
l. Finish materials shall be compatible with the surface to which it is applied. Prepare wood surfaces as recommended by manufacturer prior to any finish application.

B. Mechanical and Electrical Equipment:
   1. General:
      a. This sub-contractor shall paint all mechanical and electrical equipment, piping, conduit, insulation, ductwork, hangers, accessories, etc., that are exposed to view.
      b. All Mechanical/Electrical equipment delivered to job with suitable factory prime or baked enamel protective finishes shall be painted after installation as hereinafter specified.
      c. Factory prime coat finish shall receive two field coats of alkyd enamel. Factory baked enamel finishes shall be field painted by touching up abraded surfaces and applying a final coat of alkyd enamel.
      d. All machinery and equipment not finished at the factory shall be cleaned, primed and then finish painted two coats of alkyd enamel.
      e. Internal surfaces of ducts or surfaces above ceiling where exposed to view behind grilles or registers shall be painted with one or more coats to cover of flat black.
      f. Electrical panelboards shall be given one coat of alkyd enamel unless approved as being with a satisfactory finish when ready for acceptance.
      g. Emergency panel covers and doors shall be painted red.
      h. Nameplates, instruments, gauges, etc., shall not be painted and suitable protection shall be afforded to these items to prevent their being rendered illegible during the painting operations. Following the paintwork, all masking, etc., shall be removed, leaving these items in "as new" condition.

3.5 CLEANING

A. Touch up and restore finish where damaged.

B. Remove spilled, splashed, or splattered paint from all surfaces.

C. Do not mar surface finish of item being cleaned.

D. Leave storage space clean and in condition required for equivalent spaces in project.

E. During the progress of the work, remove from the project site at the end of each day, all discarded paint materials, rubbish, cans and rags.

PART 4 - SCHEDULE

4.1 INTERIOR COLORS (Refer to Drawings for Location)

A. P-1: SW 7634 Pediment

B. P-2: SW 7009 Pearly White

4.2 EXTERIOR COLORS

A. Exterior Doors and Frames: Match Existing.

END OF SECTION

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SECTION 10 21 20

PLASTIC TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes solid plastic toilet compartments and urinal screens.

B. Attachment hardware.

C. Related Sections:
1. Section 10 28 13 - Toilet Accessories.

1.2 REFERENCES

A. American Society for Testing and Materials:
1. ASTM A666 - Standard Specification for Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
2. ADA-ADAAG – Americans With Disabilities Act Accessibility Guidelines.
3. TAS – Texas Accessibility Standard.

1.3 QUALITY ASSURANCE

A. Asbestos Free Material/Product: Prior to approval of the material/product to be used, the manufacturer/supplier shall furnish the Architect with Certification that the material/product contains no asbestos. This certification is mandatory before approval will be issued. Submittals furnished without the asbestos -free Certification will be returned to the Contractor with no action taken until such Certification is provided.

1.4 SUBMITTALS

A. Section 01 33 00 – Administrative Requirements: Submittal procedures.

B. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall and floor supports, door swings.

C. Product Data: Submit data on panel construction, hardware, and accessories.

D. Samples: Submit two 2 x 3 inch in size illustrating panel finish, color, and sheen.

E. Manufacturer's Installation Instructions: Submit special procedures, perimeter conditions requiring special attention.

1.5 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Coordinate Work with placement of support framing and anchors in wall and ceiling.

PART 2 - PRODUCTS

2.1 SOLID PLASTIC TOILET COMPARTMENTS

A. Manufacturers:
1. ASI Accurate Partitions Corp.
2. ASI Global Partitions (Basis of Design).
3. Scranton Products; Hiny Hiders.
4. Columbia Partitions, a Division of PSiSC.
5. Substitutions: Refer to Section 01 60 00 – Product Requirements.

B. Product Description: Floor mounted, overhead braced, solid polymer.

C. Materials: 100 percent recycled high density polyethylene sheet shall be from resins under high pressure forming a single component section.
1. Colors shall be homogeneous, uniform, extending from the surface throughout the material thickness. Colors shall be selected from manufacturers custom color selections.
2. Panels shall be waterproof, non-absorbent and have a self-lubricating finish that resists marking with pens, pencils, or other writing utensils.
3. Sheet material used for doors, panels and pilasters shall be 1" thick with all edges machined to.25" radius.

D. Wall brackets shall be continuous, full length of panel made from aluminum extrusion (6063-T6 alloy) with mill finish.

2.2 COMPONENTS

A. Toilet Compartments: Solid molded plastic panels, doors, and pilasters, floor-mounted headrail-braced.
1. Color (Basis of Design): Olive, #9223 as manufactured by ASI, or approved equal. Provide manufacturer’s complete color palette.

B. Door and Panel Dimensions:
1. Thickness: 1 inch
2. Height Above Floor: 14 inches.
3. Door Width: 24 inch
4. Accessible Door Width: 36 inch min. allowing for a 32 inch clear opening; out-swinging.
5. Height: 55 inch
6. Height of Pilasters: 82 inch.

C. Privacy and Urinal Screens: Wall hung.
1. Screen Panel Size: 24 inches wide by 48 inches high.

2.3 ACCESSORIES

A. Pilaster Shoe: Formed solid plastic of same material as pilaster, 3 inch high, concealing floor fastenings. Provide adjustment for floor variations with screw jack through steel saddles integral with pilaster.
1. Anchor to floor with No. 5 plaster anchors and No. 14 stainless steel Phillip’s head screws.

B. Wall Brackets: Full length continuous, Use for panel to panel and wall to panel connection.

C. Head Rails: Hollow mill finished aluminum tube, 1 x 1-5/8 inch size, with anti-grip profiles and cast socket wall brackets.
   1. Headrail Brackets: Satin stainless steel, 16 gauge minimum thickness.

D. Attachments, Screws, and Bolts: Stainless steel, tamper proof type.
   1. For attaching panels and pilasters to brackets: Through-bolts and nuts; one-way sex bolts.

E. Hardware: Polished Satin chrome plated non-ferrous cast metal: Stainless steel:
   1. Pivot hinges, gravity type, adjustable for door close positioning; two for each door.
   2. Nylon bearings.
   3. Thumb turn door latch with exterior emergency access feature.
   4. Door strike and keeper with rubber bumper; mounted on pilaster in alignment with door latch.
   5. Coat hook with rubber bumper; one for each compartment, mounted on door panel.
   6. Furnish door pull for outswinging doors.
   7. Furnish metal heat sink at bottom of doors and partitions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify field measurements are as indicated on shop drawings.

C. Verify correct spacing of and between plumbing fixtures.

D. Verify correct location of built-in framing, anchorage, and bracing.

3.2 INSTALLATION

A. Maintain 3/8 to 1/2 inch space between wall and panels and between wall and end pilasters.

B. Attach panel brackets securely to walls using anchor devices.

C. Attach panels and pilasters to brackets. Locate head rail joints at pilaster center lines.

D. Field touch-up of scratches or damaged finish will not be permitted. Replace damaged or scratched materials with new materials.

3.3 ERECTION TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Maximum Variation From Indicated Position: 1/4 inch.

C. Maximum Variation From Plumb: 1/8 inch.

3.4 ADJUSTING

A. Section 01 77 00 – Project Closeout: Testing, adjusting, and balancing.

B. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch.

C. Adjust hinges to position doors in partial opening position of 15 degrees when unlatched. Return out-swinging doors to closed position.

D. Adjust adjacent components for consistency of line or plane.

END OF SECTION

SECTION 10 28 13

TOILET ROOM ACCESSORIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Toilet room accessories.

B. Accessories at custodial closets, utility rooms and sinks.

C. Related Sections:
1. Section 09 30 00 – Tiling.
2. Section 10 21 20 – Plastic Toilet Compartments.

1.2 REFERENCES

A. American Society for Testing and Materials:
1. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
2. ASTM A269 - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
3. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
4. ASTM A666 - Standard Specification for Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
5. ASTM C1036 - Standard Specification for Flat Glass.

B. Federal Specification Unit:
1. FS A-A-3002 - Mirrors, Glass.

C. Accessibility Guidelines:
1. ADAAG – Americans With Disabilities Act Accessibility Guidelines.
2. TAS – Texas Accessibility Standards.

1.3 SUBMITTALS

A. Section 01 33 00 – Administrative Requirements: Submittal procedures.

B. Product Data: Submit data on accessories describing size, finish, details of function, attachment methods.

C. Samples: Submit two samples of each accessory, illustrating color and finish.

D. Manufacturer's Installation Instructions: Submit special procedures, conditions requiring special attention.

1.4 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Coordinate the Work with placement of internal wall reinforcement and reinforcement of toilet partitions to receive anchor attachments.

PART 2 - PRODUCTS

2.1 TOILET AND BATH ACCESSORIES

A. Manufacturers - General:
1. Bobrick Washroom Equipment (BWE).
2. Bradley Corporation.
3. GOJO Industries (GJ)
4. Kimberly-Clark (KC)
5. Truebro Inc.
6. Koala Care (Koala).
7. Substitutions: Section 01 60 00 - Product Requirements.

2.2 COMPONENTS

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.
2. Fabricate units made of metal sheet of seamless sheets, with flat surfaces.

B. Keys: Furnish five keys for each accessory to Owner. Master key all accessories.

C. Stainless Steel Sheet: ASTM A666, Type 304.

D. Stainless Steel Tubing: ASTM A269, stainless steel.

E. Galvanized Sheet Steel: ASTM A653, G90 zinc coating.

F. Mirror Glass: Float glass, Type I, Class 1, Quality q2 (ASTM C 1036), with silvering, copper coating, and suitable protective organic coating to copper backing in accordance with FS A-A-3002.

G. Adhesive: Contact type, waterproof.

H. Fasteners, Screws, and Bolts: Hot dip galvanized, tamper-proof.

I. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

2.3 FACTORY FINISHING

A. Stainless Steel: No. 4 satin brushed finish, unless otherwise noted.

B. Chrome/Nickel Plating: ASTM B456, Type SC 2, satin finish, unless otherwise noted.

C. Baked Enamel: Pretreat to clean condition, apply one coat primer and minimum two coats epoxy baked enamel.

D. Galvanizing for Items other than Sheet: ASTM A123/A123M to 1.25 oz/sq yd. Galvanize ferrous metal and fastening devices.

E. Shop Primed Ferrous Metals: Pretreat and clean, spray apply one coat primer and bake.

F. Back paint components where contact is made with building finishes to prevent electrolysis.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify exact location of accessories for installation.

C. Verify field measurements are as indicated on product data.

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 plumb and level, securely and rigidly anchored to substrate.

B. Mounting Heights and Locations: As required by accessibility regulations and manufacturer's instructions.

3.4 SCHEDULE

Mark	Description	Model No.	Mfg.
TA-1	Mirror - stainless steel frame, concealed wall hangers; 18" x 36"	B-290-1836	BWE
TA-2	Grab Bar, 36 inch - satin finish, concealed mounting, snap flange	B-5806x36	BWE
TA-3	Grab Bar, 42 inch - satin finish, concealed mounting, snap flange	B-5806x42	BWE
TA-4	Liquid Soap Dispenser (Owner Furnished - Owner Installed)	LTX-12	GJ
TA-5	Toilet Paper Dispenser; Combination (Owner Furnished – Contractor Installed)	09951	KC
TA-6	Mop and Broom Holder	B-223x36	BWE
TA-7	Paper Towel Dispenser; manual, touchless (Owner Furnished – Owner Installed)	34346	KC
TA-8	Hand Sanitizer Dispenser; touchless (Owner Furnished – Owner Installed)	1920-04 LTX	GJ

TA-9	Sanitary Napkin Disposal; partition mounted	B-354	BWE
TA-10	Sanitary Napkin Disposal; surface mounted	B-254	BWE
TA-11	Waste Receptacle; surface mounted	WR-2	GAMCO
TA-12	(Not Used)		
TA-13	Baby Changing Station; horizontal, 200 lb. load capacity; ADA compliant	KB200-00 – Cream	Koala
TA-14	Floor Drain	Ref: MEP Dwgs.	---

END OF SECTION

SECTION 22 00 06

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

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 22 01 00

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, 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 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
   1. Submittals shall be in pdf format. The first page 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.

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
1. 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 re-submitted. 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.
3. 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 later 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 certification 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

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.

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
   Local and State Health Code (TDSH)
2. 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):
    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. (UL)
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.
      l. 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.

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 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.

2.3 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. 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. 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 specification 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 05 00

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

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-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.
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, carbon-steel 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 B-line, 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, cam-style 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 05 19

METERS AND GAGES FOR PLUMBING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following meters and gages for plumbing systems:
   1. Thermometers.
   2. Gages.
   3. Test plugs
   4. Temperature and Pressure Test Kit

B. Related Sections include the following:
   1. Specification Section "Domestic Water Piping" for domestic water appurtenances.

1.2 SUBMITTALS

A. Product Data: For each type of product to be installed.

B. Operation and Maintenance Data: For all products to be installed.

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-CASE, LIQUID-IN-GLASS THERMOMETERS

A. Manufacturers:
   1. Palmer - Wahl Instruments Inc.
   2. Trerice, H. O. Co.
   3. Weiss Instruments, Inc.
   4. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.

B. Case: Black-finished Aluminum, 9 inches long.

C. Tube: Red or blue reading, organic-liquid filled, with magnifying lens.

D. Tube Background: Satin-faced, nonreflective aluminum with permanently baked on scale markings on lens (U.V. protected).

E. Window: Glass.

F. Connector: Adjustable type, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device.

G. Stem: Brass for thermowell installation and of length to suit installation.

H. Accuracy: Plus or minus 1 percent of range or plus or minus 1 scale division to maximum of 1.5 percent of range.

2.3 THERMOWELLS

A. Manufacturers:
1. Palmer – Wahl Instruments Inc.
2. Trerice, H. O. Co.
3. Weiss Instruments, Inc.
4. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.

B. Manufacturers: Same as manufacturer of thermometer being used.

C. Description: Pressure-tight, socket-type metal fitting made for insertion into piping and of type, diameter, and length required to hold thermometer. Provide extended neck to accommodate insulation thickness.

2.4 PRESSURE GAGES

A. Manufacturers:
1. Palmer – Wahl Instruments, Inc.
2. Trerice, H. O. Co.
3. Weiss Instruments, Inc.
4. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.

B. Direct Mounting, Dial-type Dry or Liquid Filled Pressure Gages: Indicating-dial type complying with ASME B40.100.
1. Case: Dry or Liquid-filled type, stainless steel, 4-inch diameter. Weatherproof.
2. Pressure-Element Assembly: Bourdon tube, unless otherwise indicated.
3. Pressure Connection: Brass, NPS 1/4, bottom-outlet type unless back-outlet type is indicated.
4. Movement: Mechanical, with link to pressure element and connection to pointer.
5. Dial: Satin-faced, nonreflective aluminum with baked on scale markings.
6. Pointer: Red or other dark-color metal.
7. Window: Glass
8. Ring: Stainless
9. Accuracy: Grade B, plus or minus 2 percent of middle half scale.
10. Vacuum-Pressure Range: 30-in. Hg of vacuum to 15 psig of pressure.
11. Range of Fluids under Pressure: Two times operating pressure.

C. Pressure-Gage Fittings:
1. Valves: NPS ¼ brass or stainless-steel needle type.
2. Syphons: NPS ¼ coil of brass tubing with threaded ends.
3. Snubbers: ASME B40.5,NPS ¼ brass bushing with corrosion-resistant, porous-metal disc of material suitable for system fluid and working pressure.

2.5 TEST PLUGS (PT PORTS)

A. Manufacturers:
   1. Palmer – Wahl Instruments, Inc.
   2. Trerice, H. O. Co.
   3. Weiss Instruments, Inc.
   4. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.

B. Description: Corrosion-resistant brass or stainless-steel body with core inserts and gasketed and threaded cap, with extended stem for units to be installed in insulated piping.

C. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F

D. Core Inserts: One or two self-sealing rubber valves.
   1. Insert material for air, water, oil, or gas service at 20 to 200 deg F shall be CR.
   2. Insert material for air or water service at minus 30 to plus 275 deg F shall be EPDM.

2.6 TEMPERATURE AND PRESSURE TEST KIT

A. Test Kit: Furnish (1) test kit containing one pressure gage and adaptor, two (2) thermometers, and carrying case. Pressure gage, adapter probes, and thermometer sensing elements shall be of diameter to fit test plugs and of length to project into piping.
   1. Pressure Gage: Small bourdon-tube insertion type with 2- to 3-inch diameter dial and probe. Dial range shall be 0 to 200 psig.
   2. Low-Range Thermometer: Small bimetallic insertion type with 1- to 2-inch diameter dial and tapered-end sensing element. Dial ranges shall be 25 to 125 deg F.
   3. High-Range Thermometer: Small bimetallic insertion type with 1- to 2-inch diameter dial and tapered-end sensing element. Dial ranges shall be 0 to 220 deg F.
   4. Carrying case shall have formed instrument padding.

PART 3 - EXECUTION

3.1 THERMOMETER APPLICATIONS

A. Install liquid-in-glass thermometers in the following locations:
   1. Inlet and outlet of each storage tank.
   2. Outlet of all domestic water heaters or boilers.
   3. On hot water return line after circulation pump.
   4. At the following locations for mixing valves:
      a. HW (inlet to valve).
      b. HWR (inlet to valve).
      c. Tempered (outlet of valve).

B. Provide the following temperature ranges for thermometers:
   1. Domestic Hot Water: 30 to 180 deg F, with 2-degree scale divisions.

2. Domestic Cold Water: 0 to 100 deg F, with 2-degree scale divisions.

3.2 PRESSURE GAGE APPLICATIONS

A. Install dry-case-type pressure gages for discharge of each pressure-reducing valve and inlet and outlet of all backflow preventers (Domestic water).

B. Dry type pressure gages to be used on domestic water systems (inlet and outlets of heaters mixing valves, booster pumps and water softeners).

3.3 INSTALLATIONS

A. Install direct-mounting thermometers and adjust vertical and tilted positions.

B. Install thermowells with socket extending to center of pipe and in vertical position in piping tees where thermometers are indicated.

C. Install direct-mounting pressure gages in piping tees with pressure gage located on pipe at most readable position.

D. Install ¼" NPT, ¼ turn ball-valve and snubber fitting in piping for each pressure gage for fluids.

E. Install test plugs in tees in piping.

3.4 CONNECTIONS

A. Install meters and gages adjacent to machines and equipment to allow service and maintenance for meters, gages, machines, and equipment.

3.5 ADJUSTING

A. Calibrate meters according to manufacturer's written instructions, after installation.

B. Adjust faces of meters and gages to proper angle for best visibility.

END OF SECTION

SECTION 22 05 23

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. Ductile iron Butterfly valves.
3. Bronze swing check valves.
4. Iron swing check valves.
5. Bronze globe valves.
6. Ductile iron globe 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 BUTTERFLY VALVES

A. 200 CWP, Ductile Iron, Lug Style-Flanged Butterfly Valves, potable rated:
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-67, Type I.
b. CWP Rating: 200 psig.
c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
d. Body Material: ASTM A 536, ductile iron.
e. Seat: EPDM.
f. Stem: One- or two-piece stainless steel.

g. Disc: Aluminum Bronze
h. Flange bolts to be 316 stainless steel.

2.4 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.

2.5 IRON SWING CHECK VALVES

A. Class 250, Iron Swing Check Valves with Metal Seats, potable rated:
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-71, Type I.
b. CWP Rating: 500 psig.
c. Body Design: Clear or full waterway.
d. Body Material: ASTM A 126, gray iron with bolted bonnet.
e. Ends: Flanged.
f. Trim: Bronze.
g. Gasket: Asbestos free.
h. Flange bolts to be 316 stainless steel.

2.6 BRONZE GLOBE VALVES

A. Class 150, Bronze Globe Valves with Nonmetallic 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 2.
   b. CWP Rating: 300 psig.
   c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
   d. Ends: Threaded.
   e. Stem: Bronze.
   f. Disc: PTFE or TFE.
   g. Packing: Asbestos free.
   h. Handwheel: Malleable iron, bronze, or aluminum.

2.7 DUCTILE IRON GLOBE VALVES

A. Class 150, Ductile Iron Globe Valves, potable rated:
   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-85, Type I.
      b. CWP Rating: 200 psig.
      c. Body Material: ASTM A395, ductile iron.
      d. Ends: Flanged.
      e. Trim: Bronze.
      f. Packing and Gasket: PTFE.
      g. Flange bolts to be 316 stainless steel.

2.8 CHAINWHEELS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Babbitt Steam Specialty Co.
   2. Roto Hammer Industries.
   3. Trumbull Industries.

B. Description: Valve actuation assembly with sprocket rim, brackets, and chain.
   1. Brackets: Type, number, size, and fasteners required to mount actuator on valve.
   2. Attachment: For connection to butterfly valve stems.
   3. Sprocket Rim with Chain Guides: Ductile iron, of type and size required for valve.
   4. Chain: Hot-dip, galvanized steel, of size required to fit sprocket rim.

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. Install chainwheels on operators for butterfly valves NPS 4 and larger and more than 120 inches above finished floor. Extend chains to 96 inches above finished floor.

G. All valves NPS 3 and smaller shall be installed within 120 inches above finished floor.

H. Install check valves for proper direction of flow and as follows:
   1. Swing Check Valves: In horizontal position with hinge pin level.

I. For all valves on insulated piping, provide insulated stem extension.

J. Install shutoff valves immediately upstream of each dielectric fitting.

K. 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.

L. 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 valve-end 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.
   3. Bronze Globe Valves: With brass short nipple and brass union connection at downstream side (outlet).

B. Pipe NPS 2-1/2 and Larger:
   1. Ductile Iron, Butterfly Valves.
   2. Iron Swing Check Valves.
   3. Ductile Iron Globe Valves.

END OF SECTION

SECTION 22 05 29

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. 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. Epoxy Coatings: Copper colored epoxy coating on carbon steel hangers and supports for use on noninsulated copper piping only.

G. 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/ft^3 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 or epoxy 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 ½ 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 loads 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 05 53

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 ¼ inch letters piping system abbreviation and ½ 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 07 16

PLUMBING 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 plumbing insulation for 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 tape.
   7. Field-applied jackets.
   8. Securements.

B. Related Sections include the following:
   1. Specification Section “Hangers and Supports” for high-density inserts at hangers; wood inserts at hangers are not acceptable.
   2. Specification Section “Special Conditions for All Plumbing Work”.
   3. Specification Section “Basic Plumbing 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, 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. Phenolic:
   1. Products
      a. Insul-phen
   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. Products:
      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 0.29 (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. 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.)

I. Mineral-Fiber Blanket Insulation:
1. Products:
   a. Johns Manville; Microlite.
   b. Knauf Insulation; Duct Wrap
   c. Owens-Corning; All-Service Duct Wrap.
2. Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, 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.

J. Mineral-Fiber, Preformed Pipe Insulation:
1. Products:
   a. Johns Manville; Micro-Lok.
   b. Knauf Insulation; 1000° Pipe Insulation.
   c. Owens Corning; Fiberglas Pipe Insulation.
2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. 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.

K. 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.
   1. Products:
      a. K-Flex: 720 LVOC or equal

D. Phenolic: Water based adhesive with a service temp of minus 20°F to 700°F.
   1. Products:
      a. Foster 97-15

E. 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

A. Domestic Hot and Recirculated Hot Water:
   1. Concealed Locations:
      a. 0 through 1-1/4" Pipe Size: Insulation shall be any of the following:
         1) Mineral Fiber Preformed: Type 1: 1-inch thick.
         2) Phenolic (2.5 lb/ft^3), 1-inch thick.
         3) Cellular Glass: 1-1/2 inches thick.
      b. 1-1/2" and Larger Pipe Size: Insulation shall be any of the following:
         4) Mineral Fiber Preformed: Type 1: 1-1/2"-inch thick.
         5) Phenolic (2.5 lb/ft^3), 1-1/2"-inch thick.
         6) Cellular Glass: 1-1/2 inches thick.

   2. Exposed Locations: (including inside mechanical rooms):
      a. 0 through 1-1/4" Pipe Size: Insulation shall be any of the following:
         1) Phenolic (3.5 lb/ft^3), 1-inch thick.
         2) Cellular Glass: 1-1/2 inches thick.
         3) Mineral Fiber Preformed: Type 1: 1-inch thick.
      b. 1-1/2" and Larger Pipe Size: Insulation shall be any of the following:
         4) Phenolic (3.5 lb/ft^3), 1-1/2-inch thick.
         5) Cellular Glass: 1-1/2 inches thick.
         6) Mineral Fiber Preformed: Type 1: 1-1/2"-inch thick.

B. Condensate, Equipment Drain, Floor Drains, Traps and Waste Water below 60 Deg F:
   1. All PVC Piping exposed to and in a Return Air Plenum: Insulation shall be any of the following:
      a. Fire rated wrap.
   2. All Other Pipe: Insulation shall be any of the following:
      a. Cellular Glass: 1-1/2 inches thick.
      b. Phenolic (2.5 lb/ft^3): 1-1/2 inches thick.

C. Horizontal Storm Water Piping (continuous from roof drain body to first vertical drop):
   1. All PVC Piping exposed to and in a Return Air Plenum: Insulation shall be any of the following:
      a. Fire rated wrap.
   2. All Other Pipe: Insulation shall be any of the following:
      a. Cellular Glass: 1-1/2 inches thick.
      b. Phenolic (2.5 lb/ft^3): 1-1/2 inches thick.
      c. Mineral Fiber, Preformed, Type 1: 1-inch thick.

D. Roof Drain Body:
   1. PVC Roof Drain Body exposed to and in a Return Air Plenum: Insulation shall be any of the following:
      a. Fire rated wrap.
   2. All Other Roof Drain Bodies: Insulation shall be any of the following:
      a. Mineral-Fiber Blanket Insulation: 1-1/2 inch thick.

E. Sanitary Waste & Vent; Domestic Water piping:
   1. All PVC Piping exposed to and in a Return Air Plenum: Insulation shall be any of the following:
      a. Fire rated wrap.

3.12 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE (ATTIC AND CRAWL SPACE INCLUDED)

A. Domestic Cold, Hot and Recirculated Hot Water:
   1. All Pipe Sizes: Insulation shall be any of the following:
      a. Pre-insulated Pipe: 1-1/2” thick (underfloor, outdoors and buried)
      b. Cellular Glass: 2 inches thick (outdoors, not acceptable indoors)
      c. Phenolic (5 lb/ft³): 2 inches thick (outdoors, not acceptable indoors)
      d. Mineral Fiber Preformed, Type 1: 1-1/2 inch thick (uninsulated Attic space)

B. Condensate, Equipment Drain, Floor Drains, Traps and Waste Water below 60 Deg. F:
   1. All Pipe Sizes: Insulation shall be any of the following:
      a. Cellular Glass: 1-1/2 inches thick
      b. Phenolic (5 lb/ft³): 1-1/2 inches thick
   2. Insulation shall be continuous until the connection to the sanitary system.

C. Fire Protection:
   1. All Pipe Sizes: Insulation shall be any of the following:
      a. Cellular Glass: 1-1/2 inches thick
      b. Phenolic (5 lb/ft³): 1-1/2 inches thick

3.13 INSIDE EXTERIOR WALL PIPING INSULATION SCHEDULE

A. Domestic Cold, Hot and Recirculated Hot Water:
   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 inch thick
      c. Mineral Fiber Preformed, Type 1: 1 inch thick, coat entire ASJ jacket with vapor mastic

B. Condensate, Equipment Drain, Floor Drains, Traps and Waste Water below 60 Deg. F:
   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

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 11 16

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, wrought-copper, 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, wrought-copper, solder fittings.

C. Copper Pipe, Pre-insulated:
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Insul-Pipe Systems, Inc.
      b. Insul-tek
      c. Thermal Pipe Systems, Inc.
      d. Thermacor Process L.P.
   2. Description: Factory pre-insulated double-wall pipe system.
   3. Carrier Pipe: Drawn-Temper Copper Tubing: ASTM B 88, Type L (ASTM B 88M, Type B).
   4. Wrought-Copper Fittings: ASME B16.22.
   5. Pipe Insulation: Foamed-in-place polyurethane, 90% closed cell, poured in place, "K" = 0.14 per inch @ 75 degrees F, with a density of not less than 2.5 lbs. per cubic foot. Insulation shall be completely encased within a seamless jacket.
      a. Insulation at each end of each length of pipe shall be protected with an end seal bonded both to the carrier pipe and the outer jacket. Piping cuts made in the field must be provided with end-seals equal to factory type.
      b. Insulation thickness, minimum: 1.12-inches for NPS 2 and smaller; 1.67-inches for NPS 2-1/2; 1.42-inches for NPS 3; 1.93-inches for NPS 4; and 1.93-inches for NPS 6.
   6. Jacket: PVC; ASTM D-1784, Class 12454-B, of not less than .060 inches thick and able to withstand H-20 highway loading.
   7. Fitting insulation: Coupling joints on straight runs shall be field wrapped with a mold/jacket of roll PVC, sealed with self seal tape and filled with field mixed pour poly-urethane foam. Fittings shall be field insulated using a field mixed polyurethane poured between the fitting and a PVC fitting cover supplied by the manufacturer that is sealed with self seal tape. Vapor barrier jacketing material for fittings and joints shall be of the same material as the pipe jacketing. Installation shall be as per manufacturer's instructions.

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 general-duty 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.
1. 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-to-metal 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 11 19

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. Wall hydrants.
   2. Water hammer arresters (shock arrestors).
   3. Flexible connectors.
   4. Drain Valves.

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 WALL HYDRANTS

A. Nonfreeze Wall Hydrants:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Josam Company.
b. MIFAB, Inc.
c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
d. Watts Drainage Products Inc.
e. Woodford Manufacturing Company.
f. Zurn Plumbing Products Group.
2. Standard: ASME A112.21.3M for self-draining wall hydrants.
3. Pressure Rating: 125 psig.
4. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
5. Inlet: NPS 3/4 or NPS 1.
6. Other requirements: Refer drawing schedules and provide equivalency to model and manufacturer listed.

B. Nonfreeze, Hot- and Cold-Water Wall Hydrants:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Josam Company.
b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
c. Watts Drainage Products Inc.
d. Woodford Manufacturing Company.
e. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.21.3M for self-draining wall hydrants.
3. Pressure Rating: 125 psig.
4. Casings and Operating Rods: Of length required to match wall thickness. Include wall clamps.
5. Inlets: NPS 3/4 or NPS 1.
6. Vacuum Breaker: Nonremovable, manual-drain-type, hose-connection vacuum breaker complying with ASSE 1011 and with garden-hose thread complying with ASME B1.20.7 on outlet.
7. Other requirements: Refer drawing schedules and provide equivalency to model and manufacturer listed.

2.2 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:
1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 600-psig minimum CWP.
3. Size: NPS 3/4.
4. Body: Bronze.
5. Ball: Stainless steel.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded.

9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2.3 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.

2.4 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 stainless-steel 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 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."

B. Install water hammer arresters in water piping according to PDI-WH 201 and applicable drawing details.

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. Check plumbing specialties and verify proper settings, adjustments, and operation.

END OF SECTION

SECTION 22 13 16

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 wastewater from mechanical equipment, including cooling towers, evaporative coolers, evaporative condensers, chilled-water systems, etcetera, 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. Standard, Shielded, Stainless-Steel Couplings: CISPI 310, with stainless-steel corrugated 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) Fernco, Inc.
         3) Ideal Div.; Stant Corp.
         4) Mission Rubber Co.
         5) Tyler Pipe; Soil Pipe Div.
   2. 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 STEEL PIPE AND FITTINGS

A. Steel Pipe Nipples: ASTM A 53/A 53M, Type E or S, Grade A or B, Standard Weight or Schedule 40, galvanized. Include ends matching joining method.

2.6 COPPER TUBE AND FITTINGS

A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.
   1. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.

B. Hard Copper Tube: ASTM B 88, Types L, water tube, drawn temper.
   1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.

C. Soft Copper Tube: ASTM B 88, Types L, water tube, annealed temper.
   1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.

2.7 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.

2.8 PEX PIPING AND FITTINGS

A. PEX Tubing: ASTM F876 & F877 Grade A.
   1. Redbrass Male Threaded Adapter
      a. Manufacturers:
         1) Uponor Aqua Pex

2.9 SPECIAL PIPE FITTINGS

A. Flexible, Nonpressure Pipe Couplings: Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition pattern. Include shear ring, ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.
   1. Manufacturers:
      a. Dallas Specialty & Mfg. Co.

b. Fernco, Inc.
c. Logan Clay Products Company (The).
d. Mission Rubber Co.
e. NDS, Inc.
f. Plastic Oddities, Inc.

2. Sleeve Materials:
a. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
b. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
c. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

B. Shielded Nonpressure Pipe Couplings: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
1. Manufacturers:
a. Cascade Waterworks Mfg. Co.
b. Mission Rubber Co.

C. Flexible Ball Joints: Ductile-iron fitting with combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153. Include gasketed ball-joint section and ductile-iron gland, rubber gasket, and steel bolts.
1. Manufacturers:
a. EBAA Iron Sales, Inc.

D. Expansion Joints: Two or three-piece, ductile-iron assembly consisting of telescoping sleeve(s) with gaskets and restrained-type, ductile-iron, bell-and-spigot end sections complying with AWWA C110 or AWWA C153. Select and assemble components for expansion indicated. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.
1. Manufacturers:
a. EBAA Iron Sales, Inc.
b. Romac Industries, Inc.
c. Star Pipe Products; Star Fittings Div.

E. Wall-Penetration Fittings: Compound, ductile-iron coupling fitting with sleeve and flexing sections for up to 20-degree deflection, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.
1. Manufacturers:
a. SIGMA Corp.

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. Indirect drainage piping for equipment connections shall be any of the following:
   1. Copper DWV tube, copper drainage fittings, and soldered joints

C. Below-floor (crawl space), condensate drain and vent piping shall be any of the following:
   1. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and hubless-coupling joints.
   2. Solid-wall, Schedule 40, PVC pipe; PVC socket fittings; and solvent-cemented joints.
   3. Dissimilar Pipe-Material Couplings: Flexible, nonpressure pipe couplings for joining dissimilar pipe materials with small difference in OD.

D. Above-floor, condensate drain and vent piping shall be any of the following:
   1. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and hubless-coupling joints.
   2. Copper DWV tube, copper drainage fittings, and soldered joints.
   3. Dissimilar Pipe-Material Couplings: Flexible, nonpressure pipe couplings for joining dissimilar pipe materials with small difference in OD.

E. Underground, condensate drain and vent piping shall be any of the following:
   1. Extra-Heavy class, cast-iron soil piping, hub and spigot; and gasketed joints.
   2. Solid-wall, Schedule 40, PVC pipe; PVC socket fittings; and solvent-cemented joints.
   3. Dissimilar Pipe-Material Couplings: Flexible, nonpressure pipe couplings for joining dissimilar pipe materials with small difference in OD.

F. Below-floor (crawl space), soil, waste and vent piping shall be any of the following:
   1. Hubless cast-iron soil pipe and fittings; heavy duty, shielded, stainless-steel couplings; and hubless-coupling joints. (Required for use in Boiler Room, Kitchen and for Greasewaste)
   2. Solid-wall, Schedule 40, PVC pipe; PVC socket fittings; and solvent-cemented joints. (not permitted in Boiler Room, Kitchen or for Greasewaste)
   3. Copper DWV tube, copper drainage fittings, and soldered joints.
   4. Dissimilar Pipe-Material Couplings: Flexible, nonpressure pipe couplings for joining dissimilar pipe materials with small difference in OD.

G. Above-floor, soil, waste and vent piping shall be any of the following:
   1. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and hubless-coupling joints.
   2. Galvanized steel nipples.
   3. Copper DWV tube, copper drainage fittings, and soldered joints.
   4. Dissimilar Pipe-Material Couplings: Flexible, nonpressure pipe couplings for joining dissimilar pipe materials with small difference in OD.

H. 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)

2. Solid-wall, Schedule 40, PVC pipe; PVC socket fittings; and solvent-cemented joints. (Not permitted in Boiler Room, Kitchen or for Greasewaste)
3. Dissimilar Pipe-Material Couplings: Flexible, nonpressure pipe couplings for joining dissimilar pipe materials with small difference in OD.

I. Above and below floor (crawl space), 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 piping in masonry block wall/chase to be wrapped in 6 mil poly-sleeve.

J. Under-building-slab/in slab, trap primer drainage piping shall be any of the following:
1. Soft copper tube, ASTM B 88, Type L; cast- or wrought- copper brazed-joint fittings; and brazed joints.
2. PEX Tubing: ASTM F877 and F876, NSF Standard 14 and 61; brass fittings; No joints in slab (other than fixture connections).
3. All underslab/in-slab piping to be wrapped in 6 mil poly-sleeve.

K. Acid Waste and Vent Piping: Reference Acid Waste and Vent Piping Specification.

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 2-inch 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 closing-in 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. Final Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and

watertight. Contractor shall introduce smoke into piping system continuously until the entire system has been approved by the engineer and the owner's representative.

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 13 17

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. Standard, Shielded, Stainless-Steel Couplings: CISPI 310, with stainless-steel corrugated 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) Fernco, Inc.
         3) Ideal Div.; Stant Corp.
         4) Mission Rubber Co.
         5) Tyler Pipe; Soil Pipe Div.
   2. 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 STEEL PIPE AND FITTINGS

A. Steel Pipe Nipples: ASTM A 53/A 53M, Type E or S, Grade A or B, Standard Weight or Schedule 40, galvanized. Include ends matching joining method.

2.6 COPPER TUBE AND FITTINGS

A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.
   1. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.

B. Hard Copper Tube: ASTM B 88, Types L, water tube, drawn temper.
   1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.

C. Soft Copper Tube: ASTM B 88, Types L, water tube, annealed temper.
   1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.

2.7 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.

2.8 PEX PIPING AND FITTINGS

A. PEX Tubing: ASTM F876 & F877 Grade A.
   1. Redbrass Male Threaded Adapter
      a. Manufacturers:
         1) Uponor Aqua Pex

2.9 SPECIAL PIPE FITTINGS

A. Flexible, Nonpressure Pipe Couplings: Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition pattern. Include shear ring, ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.
   1. Manufacturers:
      a. Dallas Specialty & Mfg. Co.

b. Fernco, Inc.
c. Logan Clay Products Company (The).
d. Mission Rubber Co.
e. NDS, Inc.
f. Plastic Oddities, Inc.

2. Sleeve Materials:
a. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
b. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
c. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

B. Shielded Nonpressure Pipe Couplings: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
1. Manufacturers:
a. Cascade Waterworks Mfg. Co.
b. Mission Rubber Co.

C. Flexible Ball Joints: Ductile-iron fitting with combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153. Include gasketed ball-joint section and ductile-iron gland, rubber gasket, and steel bolts.
1. Manufacturers:
a. EBAA Iron Sales, Inc.

D. Expansion Joints: Two or three-piece, ductile-iron assembly consisting of telescoping sleeve(s) with gaskets and restrained-type, ductile-iron, bell-and-spigot end sections complying with AWWA C110 or AWWA C153. Select and assemble components for expansion indicated. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.
1. Manufacturers:
a. EBAA Iron Sales, Inc.
b. Romac Industries, Inc.
c. Star Pipe Products; Star Fittings Div.

E. Wall-Penetration Fittings: Compound, ductile-iron coupling fitting with sleeve and flexing sections for up to 20-degree deflection, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.
1. Manufacturers:
a. SIGMA Corp.

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. Indirect drainage piping for equipment connections shall be any of the following:
   1. Copper DWV tube, copper drainage fittings, and soldered joints

C. Below-floor (crawl space), condensate drain and vent piping shall be any of the following:
   1. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and hubless-coupling joints.
   2. Solid-wall, Schedule 40, PVC pipe; PVC socket fittings; and solvent-cemented joints.
   3. Dissimilar Pipe-Material Couplings: Flexible, nonpressure pipe couplings for joining dissimilar pipe materials with small difference in OD.

D. Above-floor, condensate drain and vent piping shall be any of the following:
   1. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and hubless-coupling joints.
   2. Solid-wall, Schedule 40, PVC pipe; PVC socket fittings; and solvent-cemented joints.
   3. Copper DWV tube, copper drainage fittings, and soldered joints.
   4. Dissimilar Pipe-Material Couplings: Flexible, nonpressure pipe couplings for joining dissimilar pipe materials with small difference in OD.

E. Underground, condensate drain and vent piping shall be any of the following:
   1. Extra-Heavy class, cast-iron soil piping, hub and spigot; and gasketed joints.
   2. Solid-wall, Schedule 40, PVC pipe; PVC socket fittings; and solvent-cemented joints.
   3. Dissimilar Pipe-Material Couplings: Flexible, nonpressure pipe couplings for joining dissimilar pipe materials with small difference in OD.

F. Below-floor (crawl space), soil, waste and vent piping shall be any of the following:
   1. Hubless cast-iron soil pipe and fittings; heavy duty, shielded, stainless-steel couplings; and hubless-coupling joints. (Required for use in Boiler Room, Kitchen and for Greasewaste)
   2. Solid-wall, Schedule 40, PVC pipe; PVC socket fittings; and solvent-cemented joints. (not permitted in Boiler Room, Kitchen or for Greasewaste)
   3. Copper DWV tube, copper drainage fittings, and soldered joints.
   4. Dissimilar Pipe-Material Couplings: Flexible, nonpressure pipe couplings for joining dissimilar pipe materials with small difference in OD.

G. Above-floor, soil, waste and vent piping shall be any of the following:
   1. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and hubless-coupling joints.
   2. Galvanized steel nipples.
   3. Solid-wall, Schedule 40, PVC pipe; PVC socket fittings; and solvent-cemented joints. (All locations, however, in Kitchens, PVC permitted above drain connection only)
   4. Copper DWV tube, copper drainage fittings, and soldered joints.

5. Dissimilar Pipe-Material Couplings: Flexible, nonpressure pipe couplings for joining dissimilar pipe materials with small difference in OD.

H. 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)
2. Solid-wall, Schedule 40, PVC pipe; PVC socket fittings; and solvent-cemented joints. (Not permitted in Boiler Room, Kitchen or for Greasewaste)
3. Dissimilar Pipe-Material Couplings: Flexible, nonpressure pipe couplings for joining dissimilar pipe materials with small difference in OD.

I. Above and below floor (crawl space), 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. PEX Tubing: ASTM F877 and F876, NSF Standard 14 and 61; brass fittings; No joints in slab (other than fixture connections).
3. All underslab piping to be wrapped in 6 mil poly-sleeve.

J. Under-building-slab, trap primer drainage piping shall be any of the following:
1. Soft copper tube, ASTM B 88, Type L; cast- or wrought- copper brazed-joint fittings; and brazed joints.

K. Acid Waste and Vent Piping: Reference Acid Waste and Vent Piping Specification.

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 2-inch 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 closing-in 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 13 19

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.

C. Cast-Iron Wall 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. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: Hub-and-spigot, cast-iron soil pipe T-branch as required to match connected piping.
5. Closure: Countersunk, brass plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

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 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Hub Drains:

1. Description: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron, soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C 564, rubber gaskets.
2. Size: Same as connected waste piping with increaser fitting of size indicated.

B. 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.

C. Air-Gap Fittings:
1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
2. Body: Bronze or cast iron.
3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.
5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

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 roof flashing assemblies on roof drains, sanitary stack vents and vent stacks that extend through roof.

G. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.

H. Assemble open drain fittings and install with top of hub 2 inches above floor.

I. 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.

J. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

K. Install reinforcement for wall-mounting-type specialties.

L. 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 33 00

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:
   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: 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

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 (2.5 THROUGH 30 GALLON)

A. Commercial Storage Electric Water Heaters: Comply with UL 174 requirements for storage-tank-type water heaters.
   1. Manufacturers:
      a. Rheem Water Heater Div.; Rheem Manufacturing Company.
      b. Smith, A.O. Water Products Company.
   2. Storage-Tank Construction: steel vertical arrangement.
      a. Tappings: ½" NPT (2.5 Gallon tank) or ¾" NPT (6 through 30 Gallon) 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.
      b. Drain Valve: ¾", ¼ turn bronze ball valve, stainless steel ball and trim. ¾" hose thread adaptor and cap.
      c. Insulation: Comply with ASHRAE/IESNA 90.1; 2-½" rigid polyurethane foam insulation, non-CFC.
      d. Jacket: Steel with enameled finish.

e. Heating Elements: Electric, screw-in immersion type arranged in multiples of three; stainless steel.
   1) Staging: Input not exceeding 18 kW per step.
f. Temperature control: Adjustable thermostat, surface mounted.
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 on top of tank. 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 41 00

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. Service basins.

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, Automatic, Metering:
   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: Push button operated, metering; 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). 10 seconds (maximum) flow time.
      d. Mixing Valve: Internal temperature control mixer set to 110°F.
      e. Spout Outlet: Aerator, vandal resistant.
      f. Operation: Manual push button.

2.5 FLUSHOMETERS

A. Flushometers, Automatic:
   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. Sloan Valve Company.
2. Description: Flushometer for water-closet or urinal-type fixture. Include brass body with corrosion-resistant internal components, non-hold-open feature, control stop with check valve and vandal resistant stop cap, 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.

2.6 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.

2.7 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 cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

2.8 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. Water-Closet Supports:

1. Description: Combination carrier designed for mounting height of wall-mounting, water-closet-type fixture. Include single or double, vertical or horizontal, hub-and-spigot or hubless waste fitting as required for piping arrangement; faceplates; couplings with gaskets; feet; and fixture bolts and hardware matching fixture. Include additional extension coupling, faceplate, and feet for installation in wide pipe space. Factory painted.

C. 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.

D. 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.

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

2.9 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.
   c. Sloan (Water Closets/Flush Valve combo)
2. Description: Accessible, wall-mounting, back-outlet, vitreous-china fixture designed for flushometer valve operation.
   a. Style: One piece.
      1) Bowl Type: Elongated with siphon-jet design; include bolt caps matching fixture.
      2) Design Consumption: 1.28 gal./flush (unless noted otherwise on drawings or within Schedule).
      3) Color: White.
      4) Toilet Seat: Required; see other paragraph.
      5) Flushometer: Required; see other paragraph.
3. Description: Accessible, floor-mounting, floor-outlet, vitreous-china fixture designed for flushometer valve operation.
   a. Style: Flushometer valve.
      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.

2.10 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.
c. Sloan (Urinals/Flush Valve combo)
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.

2.11 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, drop-in, vitreous-china fixture.
a. Type: Drop-in
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.

2.12 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 heavy-duty, cast iron, deep seal trap.

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 (provided by Manufacturer).

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 valve, if supply stops are not specified with fixture. Valves are specified in Specification Section "Valves."

L. All appurtenances 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 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."

W. 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 23 00 05

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 01 00

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 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
   1. Submittals shall be in pdf format. The first page 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.

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 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
1. 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 re-submitted. 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.
3. 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 later 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 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 certification 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

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

2. 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. (UL)
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.
   l. 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 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.

2.3 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 roof-mounted 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" × 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 ¾ 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 specification 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 05 13

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, carbon-steel 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 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 B-line, 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, 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, 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 05 29

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 mechanical 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. 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.

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/ft^3 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 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.
   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 off-center 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 non-insulated 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.

18. 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 I-beams for heavy loads.

10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams 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 in concrete construction only in locations approved by the structural engineer.

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. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

G. Equipment Support Installation: Install suspended units on supports fabricated from welded-structural-steel shapes or from strut channels as applicable for the unit weight. Vertical support members must be appropriately sized threaded rods. Metal straps or cables are not allowed. Isolate units to prevent vibration or noise as specified in other sections.

H. 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.

I. Install lateral bracing with pipe hangers and supports to prevent swaying.

J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads for NPS 2-1/2 and larger, including valves, flanges, and strainers, and at changes in direction of piping (24" maximum distance from elbow). Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

K. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

L. 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.

M. 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 weight-distribution 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.

N. 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 floor-mounted equipment to make a smooth bearing surface.

C. Provide lateral bracing to prevent swaying for suspended 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 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, field cuts, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

SECTION 23 05 53

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 × 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, snap-on 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: 1½ 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 fasteners 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 05 93

TESTING, ADJUSTING AND BALANCING

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. The work included in this section consists of the furnishing of all labor, instruments, tools, and services required in connection with the testing, adjusting and balancing (TAB) of the heating, ventilating, and air conditioning systems as described in the mechanical specifications and/or shown on the mechanical plans, or reasonable implied therefrom.

B. TAB of the HVAC systems will be performed by an impartial technical firm that is a member of NEBB and whose operations are limited to the field of professional testing and balancing.

C. General Contractor to obtain bid from TAB Contractors listed below.
   1. EAB
   2. TSI
   3. PHI

D. Qualified TAB firms shall submit cost, scope of work, qualifications, time line, and references.

E. The TAB firm is responsible to and shall submit five (5) copies of all reports directly to the General Contractor. (TAB works for the GC)

F. TAB services shall result in the optimum temperature, airflow, and noise levels in the conditioned space of the project.

G. The following basic components of the HVAC systems shall be tested, adjusted, and balanced:
   1. Air distribution systems.
   2. Air moving equipment.
   3. HVAC pumps (chilled water, hot water, condenser water, etc.).
   4. Heating systems (HVAC).
   5. Control systems verification.

1.2 SUMMARY

A. This Section includes testing, adjusting, and balancing HVAC systems to produce design objectives, including the following:
   1. Balancing airflow and water flow within distribution systems, including submains, branches, and terminals, to indicated quantities according to specified tolerances.
   2. Adjusting total HVAC systems to provide indicated quantities.
   3. Measuring electrical performance of HVAC equipment.
   4. Setting quantitative performance of HVAC equipment.
   5. Verifying that automatic control devices are functioning properly.
   6. Measuring sound and vibration.

7. Reporting results of the activities and procedures specified in this Section.

B. Related sections include the following:
   1. Testing and adjusting requirements unique to particular systems and equipment are included in the Sections that specify those systems and equipment. See all related HVAC mechanical sections.
   2. Field quality-control testing to verify that workmanship quality for system and equipment installation is specified in system and equipment Sections.

1.3 DEFINITIONS

A. Adjust: To regulate fluid flow rate and air patterns at the terminal equipment, such as to reduce fan speed or adjust a damper.

B. Balance: To proportion flows within the distribution system, including submains, branches, and terminals, according to design quantities.

C. Draft: A current of air, when referring to localized effect caused by one or more factors of high air velocity, low ambient temperature, or direction of airflow, whereby more heat is withdrawn from a person's skin than is normally dissipated.

D. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.

E. Report Forms: Test data sheets for recording test data in logical order.

F. Static Head: The pressure due to the weight of the fluid above the point of measurement. In a closed system, static head is equal on both sides of the pump.

G. Suction Head: The height of fluid surface above the centerline of the pump on the suction side.

H. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

I. System Effect Factors: Allowances used to calculate a reduction of the performance ratings of a fan when installed under conditions different from those presented when the fan was performance tested.

J. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.

K. Test: A procedure to determine quantitative performance of a system or equipment.

L. Testing, Adjusting, and Balancing Agent: The entity responsible for performing and reporting the testing, adjusting, and balancing procedures.

M. NEBB: National Environmental Balancing Bureau.

N. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association.

1.4 SUBMITTALS

A. Quality-Assurance Submittals: Within 30 days from the Contractor's Notice to Proceed, submit 2 copies of evidence that the testing, adjusting, and balancing Agent and this Project's testing, adjusting, and balancing team members meet the qualifications specified in the "Quality Assurance" Article below.

B. Contract Documents Examination Report: Within 45 days from the Contractor's Notice to Proceed, submit 2 copies of the Contract Documents review report as specified in Part 3 of this Section.

C. Strategies and Procedures Plan: Within 60 days from the Contractor's Notice to Proceed, submit 2 copies of the testing, adjusting and balancing strategies and step-by-step procedures as specified in Part 3 "Preparation" Article below. Include a complete set of report forms intended for use on this Project.

D. Certified Testing, Adjusting and Balancing Reports: Submit 2 copies of reports prepared, as specified in this Section, on approved forms certified by the testing, adjusting and balancing Agent.

E. Sample Report Forms: Submit 2 sets of sample testing, adjusting and balancing report forms.

F. Warranty: Submit 2 copies of special warranty specified in the "Guarantee" Article below.

1.5 QUALITY ASSURANCE

A. Agent Qualifications: Engage a testing, adjusting, and balancing agent certified by NEBB.

B. Testing, Adjusting, and Balancing Conference: Meet with the Owner's and the Architect's representatives on approval of the testing, adjusting, and balancing strategies and procedures plan to develop a mutual understanding of the details. Ensure the participation of testing, adjusting, and balancing team members, equipment manufacturers' authorized service representatives, HVAC controls Installer, and other support personnel. Provide 7 days' advance notice of scheduled meeting time and location.
   1. Agenda Items: Include at least the following:
      a. Submittal distribution requirements.
      b. Contract Documents examination report.
      c. Testing, adjusting, and balancing plan.
      d. Work schedule and Project site access requirements.
      e. Coordination and cooperation of trades and subcontractors.
      f. Coordination of documentation and communication flow.

C. Certification of Testing, Adjusting, and Balancing Reports: Certify the testing, adjusting, and balancing field data reports. This certification includes the following:
   1. Review field data reports to validate accuracy of data and to prepare certified testing, adjusting, and balancing reports.
   2. Certify that the testing, adjusting, and balancing team complied with the approved testing, adjusting, and balancing plan and the procedures specified and referenced in this Specification.

D. Testing, Adjusting, and Balancing Reports: Use standard forms from NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems."

E. Instrumentation Type, Quantity, and Accuracy: As described in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems," Section II, "Required Instrumentation for NEBB Certification."

F. Instrumentation Calibration: Calibrate instruments at least every 12 months or more frequently if required by the instrument manufacturer.

1.6 PROJECT CONDITIONS

A. Partial Owner Occupancy: The Owner may occupy completed areas of the building before Substantial Completion. Cooperate with the Owner during testing, adjusting, and balancing operations to minimize conflicts with the Owner's operations.

1.7 COORDINATION

A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist testing, adjusting, and balancing activities.

B. Notice: Provide 7 days' advance notice for each test. Include scheduled test dates and times.

C. Perform testing, adjusting, and balancing after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

1.8 GUARANTEE

A. General: The national project performance guarantee specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine Contract Documents to become familiar with project requirements and to discover conditions in systems' designs that may preclude proper testing, adjusting, and balancing of systems and equipment.
   1. Contract Documents are defined in the General and Supplementary Conditions of the Contract.
   2. Verify that balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers,

are required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.

B. Examine approved submittal data of HVAC systems and equipment.

C. Examine Architect's and Engineer's design data, including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

D. Examine equipment performance data, including fan and pump curves. Relate performance data to project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system. Calculate system effect factors to reduce the performance ratings of HVAC equipment when installed under conditions different from those presented when the equipment was performance tested at the factory. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," Sections 7 through 10; or in SMACNA's "HVAC Systems--Duct Design," Sections 5 and 6. Compare this data with the design data and installed conditions.

E. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Specification Sections have been performed.

F. Examine system and equipment test reports.

G. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are properly installed, and their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.

H. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.

I. Examine air-handling equipment to ensure clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

J. Examine terminal units, such as variable-air-volume boxes and mixing boxes, to verify that they are accessible, and their controls are connected and functioning.

K. Examine plenum ceilings, utilized for supply air, to verify that they are airtight. Verify that pipe penetrations and other holes are sealed.

L. Examine strainers for clean screens and proper perforations.

M. Examine 3-way valves for proper installation for their intended function of diverting or mixing fluid flows.

N. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

O. Examine open-piping-system pumps to ensure absence of entrained air in the suction piping.

P. Examine equipment for installation and for properly operating safety interlocks and controls.

Q. Examine automatic temperature system components to verify the following:
1. Dampers, valves, and other controlled devices operate by the intended controller.
2. Dampers and valves are in the position indicated by the controller.
3. The Integrity of valves and dampers for free and full operation and for tightness of fully closed and fully open positions. This includes dampers in multizone units, mixing boxes, and variable-air-volume terminals.
4. Automatic modulating and shutoff valves, including 2-way valves and 3-way mixing and diverting valves, are properly connected.
5. Thermostats and humidistats are located to avoid adverse effects of sunlight, drafts, and cold walls.
6. Sensors are located to sense only the intended conditions.
7. Sequence of operation for control modes is according to the Contract Documents.
8. Controller set points are set at design values. Observe and record system reactions to changes in conditions. Record default set points if different from design values.
9. Interlocked systems are operating.
10. Changeover from heating to cooling mode occurs according to design values.

R. Report deficiencies discovered before and during performance of testing, adjusting, and balancing procedures.

3.2 PREPARATION

A. Prepare a testing, adjusting, and balancing plan that includes strategies and step-by-step procedures.

B. Complete system readiness checks and prepare system readiness reports. Verify the following:
1. Permanent electrical power wiring is complete.
2. Hydronic systems are filled, clean, and free of air.
3. Automatic temperature-control systems are operational.
4. Equipment and duct access doors are securely closed.
5. Balance, smoke, and fire dampers are open.
6. Isolating and balancing valves are open and control valves are operational.
7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
8. Windows and doors can be closed so design conditions for system operations can be met.
9. Motors are wired properly with appropriate overloads and correct rotation.

3.3 GENERAL TESTING AND BALANCING PROCEDURES

A. Perform testing and balancing procedures on each system according to the procedures contained in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to the insulation Specifications for this Project.

C. Mark equipment settings with paint or other suitable, permanent identification material, including damper-control positions, valve indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

3.4 FUNDAMENTAL AIR SYSTEMS' BALANCING PROCEDURES

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Determine the best locations in main and branch ducts for accurate duct airflow measurements.

E. Check the airflow patterns from the outside-air louvers and dampers and the return- and exhaust-air dampers, through the supply-fan discharge and mixing dampers.

F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

G. Verify that motor starters are equipped with properly sized thermal protection.

H. Check dampers for proper position to achieve desired airflow path.

I. Check for airflow blockages.

J. Check condensate drains for proper connections and functioning.

K. Check for proper sealing of air-handling unit components.

3.5 VARIABLE-AIR-VOLUME SYSTEMS' ADDITIONAL PROCEDURES

A. Pressure-Dependent, Variable-Air-Volume Systems without Diversity: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:
   1. Balance systems similar to constant-volume air systems.
   2. Set terminal units and supply fan at full-airflow condition.
   3. Adjust inlet dampers of each terminal unit to design airflow and verify operation of the static-pressure controller. When total airflow is correct, balance the air outlets downstream from terminal units as described for constant-volume air systems.
   4. Readjust fan airflow for final maximum readings.
   5. Measure operating static pressure at the sensor that controls the supply fan, if one is installed, and verify operation of the static-pressure controller.
   6. Set supply fan at minimum airflow if minimum airflow is indicated. Measure static pressure to verify that it is being maintained by the controller.

7. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow as described for constant-volume air systems.
   a. If air outlets are out of balance at minimum airflow, report the condition but leave the outlets balanced for maximum airflow.
8. Measure the return airflow to the fan while operating at maximum return airflow and minimum outside airflow. Adjust the fan and balance the return-air ducts and inlets as described for constant-volume air systems.

3.6 FUNDAMENTAL PROCEDURES FOR HYDRONIC SYSTEMS

A. Prepare test reports with pertinent design data and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against approved pump flow rate. Correct variations that exceed plus or minus 5 percent.

B. Prepare schematic diagrams of systems' "as-built" piping layouts.

C. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:
   1. Open all manual valves for maximum flow.
   2. Check expansion tank liquid level.
   3. Check makeup-water-station pressure gage for adequate pressure for highest vent.
   4. Check flow-control valves for specified sequence of operation and set at design flow.
   5. Set differential-pressure control valves at the specified differential pressure. Do not set at fully closed position when pump is positive-displacement type, unless several terminal valves are kept open.
   6. Set system controls so automatic valves are wide open to heat exchangers.
   7. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.
   8. Check air vents for a forceful liquid flow exiting from vents when manually operated.

3.7 HYDRONIC SYSTEMS' BALANCING PROCEDURES

A. Determine water flow at pumps. Use the following procedures, except for positive-displacement pumps:
   1. Verify impeller size by operating the pump with the discharge valve closed. Verify with the pump manufacturer that this will not damage pump. Read pressure differential across the pump. Convert pressure to head and correct for differences in gage heights. Note the point on the manufacturer's pump curve at zero flow and confirm that the pump has the intended impeller size.
   2. Check system resistance. With all valves open, read pressure differential across the pump and mark the pump manufacturer's head-capacity curve. Adjust pump discharge valve until design water flow is achieved.
   3. Verify pump-motor brake horsepower. Calculate the intended brake horsepower for the system based on the pump manufacturer's performance data. Compare calculated brake horsepower with nameplate data on the pump motor. Report conditions where actual amperage exceeds motor nameplate amperage.
   4. Report flow rates that are not within plus or minus 5 percent of design.

B. Set calibrated balancing valves, if installed, at calculated presettings.

C. Measure flow at all stations and adjust, where necessary, to obtain first balance.
   1. System components that have Cv rating or an accurately cataloged flow-pressure-drop relationship may be used as a flow-indicating device.

D. Measure flow at main balancing station and set main balancing device to achieve flow that is 5 percent greater than design flow.

E. Adjust balancing stations to within specified tolerances of design flow rate as follows:
   1. Determine the balancing station with the highest percentage over design flow.
   2. Adjust each station in turn, beginning with the station with the highest percentage over design flow and proceeding to the station with the lowest percentage over design flow.
   3. Record settings and mark balancing devices.

F. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures, including outdoor-air temperature.

G. Measure the differential-pressure control valve settings existing at the conclusions of balancing.

3.8 VARIABLE-FLOW HYDRONIC SYSTEMS' ADDITIONAL PROCEDURES

A. Balance systems with automatic 2- and 3-way control valves by setting systems at maximum flow through heat-exchange terminals and proceed as specified above for hydronic systems.

3.9 PRIMARY-SECONDARY-FLOW HYDRONIC SYSTEMS' ADDITIONAL PROCEDURES

A. Balance the primary system crossover flow first, then balance the secondary system.

3.10 MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
   1. Manufacturer, model, and serial numbers.
   2. Motor horsepower rating.
   3. Motor rpm.
   4. Efficiency rating if high-efficiency motor.
   5. Nameplate and measured voltage, each phase.
   6. Nameplate and measured amperage, each phase.
   7. Starter thermal-protection-element rating.

B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass for the controller to prove proper operation. Record observations, including controller manufacturer, model and serial numbers, and nameplate data.

3.11 BOILERS

A. Measure entering- and leaving-water temperatures and water flow.

3.12 HEAT-TRANSFER COILS

A. Water Coils: Measure the following data for each coil:
   1. Entering- and leaving-water temperatures.
   2. Water flow rate.
   3. Water pressure drop.
   4. Dry-bulb temperatures of entering and leaving air.
   5. Wet-bulb temperatures of entering and leaving air.
   6. Airflow.
   7. Air pressure drop.

B. Electric-Heating Coils: Measure the following data for each coil:
   1. Nameplate data.
   2. Airflow.
   3. Entering- and leaving-air temperatures at full load.
   4. Voltage and amperage input of each phase at full load and at each incremental stage.
   5. Calculated kW at full load.
   6. Fuse or circuit-breaker rating for overload protection.

3.13 TEMPERATURE TESTING

A. During testing, adjusting, and balancing, report need for adjustment in temperature regulation within the automatic temperature-control system.

B. Measure indoor wet- and dry-bulb temperatures every other hour for a period of 2 successive 8-hour days, in each separately controlled zone, to prove correctness of final temperature settings. Measure when the building or zone is occupied.

C. Measure outside-air, wet- and dry-bulb temperatures.

3.14 TEMPERATURE-CONTROL VERIFICATION

A. Verify that controllers are calibrated and commissioned.

B. Check transmitter and controller locations and note conditions that would adversely affect control functions.

C. Record controller settings and note variances between set points and actual measurements.

D. Verify operation of limiting controllers (i.e., high- and low-temperature controllers).

E. Verify free travel and proper operation of control devices such as damper and valve operators.

F. Verify sequence of operation of control devices. Note air pressures and device positions and correlate with airflow and water-flow measurements. Note the speed of response to input changes.

G. Confirm interaction of electrically operated switch transducers.

H. Confirm interaction of interlock and lockout systems.

I. Record voltages of power supply and controller output. Determine if the system operates on a grounded or nongrounded power supply.

J. Note operation of electric actuators using spring return for proper fail-safe operations.

3.15 TOLERANCES

A. Set HVAC system airflow and water flow rates within the following tolerances:
   1. Supply, Return, and Exhaust Fans: -5 to plus 10 percent.
   2. Air Outlets and Inlets: ± 10 percent.
   3. Heating-Water Flow Rate: ± 10 percent.
   4. Cooling-Water Flow Rate: ± 5 percent.

3.16 REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article above, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Status Reports: As Work progresses, prepare reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

C. Preliminary Report: Submit preliminary TAB reports to the design engineer for each floor, the central plant, and the chilled and hot water hydronic system.

3.17 FINAL REPORT

A. General: Typewritten, or computer printout in letter-quality font, on standard bond paper, in 3-ring binder, tabulated and divided into sections by tested and balanced systems.

B. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing engineer.
   1. Include a list of the instruments used for procedures, along with proof of calibration.

C. Final Report Final Report Contents: In addition to the certified field report data, include the following:
   1. Pump Curves.
   2. Fan curves.
   3. Manufacturers’ test data.
   4. Field test reports prepared by system and equipment installers.

5. Other information relative to equipment performance, but not include approved Shop Drawings and Product Data.

D. General Report Data: In addition to the form titles and entries, include the following data in the final report, as applicable:
   1. Title page.
   2. Name and address of testing, adjusting and balancing Agent.
   3. Project name.
   4. Project location.
   5. Architect's name and address.
   6. Engineer's name and address.
   7. Contractor's name and address.
   8. Report date.
   9. Signature of testing, adjusting and balancing Agent who certifies the report.
   10. Summary of contents, including the following:
      a. Design versus final performance.
      b. Notable characteristics of systems.
      c. Description of system operation sequence if it varies from the Contract Documents.
   11. Nomenclature sheets for each item of equipment.
   12. Data for terminal units, including manufacturer, type size and fittings.
   13. Notes to explain why certain final data in the body of reports vary from design values.
   14. Test conditions for fans and pump performance forms, including the following:
      a. Settings for outside-return-and exhaust-air dampers.
      b. Conditions of filters.
      c. Cooling coil, wet-and dry-bulb, conditions.
      d. Face and bypass damper settings at coils.
      e. Fan drive settings, including settings and percentage of maximum pitch diameter.
      f. Inlet vane settings for variable-air-volume, systems.
      g. Settings for supply-air, static-pressure, controller.
      h. Other system operating conditions that affect performance.

E. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present with single-line diagrams and include the following:
   1. Quantities of outside, supply, return and exhaust airflows.
   2. Water and steam flow rates.
   3. Duct, outlet and inlet sizes.
   4. Pipe and valve sizes and locations.
   5. Terminal units.
   6. Balancing stations.
   7. Locations of duct traverse(s) of duct layout.

F. Air-Handling Unit Test Reports: For air-handling units with coils, include the following:
   1. Unit Data: Include the following:
      a. Unit identification.
      b. Location.
      c. Make and type.
      d. Model number and unit size.
      e. Manufacturer's serial number.

f. Unit arrangement and class.
g. Discharge arrangement.
h. Sheave make, size in inches and bore.
i. Sheave dimension, center-to-center and amount of adjustments in inches (mm).
j. Number of belts, make and size.
k. Number of filters, type and size.

2. Motor Data: Include the following:
a. Make and frame type and size.
b. Horsepower and rpm.
c. Volts, phase and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches and bore.
f. Sheave dimensions, center-to-center and amount of adjustments in inches.

3. Test Data: Include design and actual values for the following:
a. Unit identification.
b. Location.
c. Make and type.
d. Model number and unit size.
e. Manufacturer's serial number.

G. Apparatus-Coil Test Reports: For apparatus coils, include the following:
1. Coil Data: Include the following:
a. System Identification.
b. Location.
c. Coil type.
d. Number of rows.
e. Fin spacing in fins per inch.
f. Make and model number.
g. Face area in sq.ft.
h. Tube size in NPS.
i. Tube and fin materials.
j. Circuiting arrangement.

2. Test Data: Include design and actual values for the following:
a. Airflow rate in cfm.
b. Average face velocity in fpm.
c. Air pressure drop in inches wg.
d. Outside-air, wet and dry-bulb temperatures in deg F.
e. Return-air, wet and dry-bulb temperatures in deg F.
f. Entering-air, wet and dry-bulb temperatures in deg F.
g. Leaving-air, wet and dry bulb temperatures in deg F.
h. Entering water temperature in deg F.
i. Leaving water temperature in deg F.
j. Water flow rate in gpm.
k. Water pressure differential in feet of head or psig.

H. Water Chiller Test Reports: For chillers (Air Cooled or Water Cooled)
1. Unit Data: Include the following:
a. Unit Identification.
b. Location.
c. Make and type.

d. Model number and unit size.
e. Manufacturer's serial number.
f. Unit arrangement and class.

2. Motor Data:
   a. Make and frame type and size.
   b. Volts, phase and hertz.
   c. Full-load amperage and service factor.
3. Test Data:
   a. Total chilled water flow rate in gpm.
   b. Total condenser water flow rate in gpm.
   c. WPD in ft across chilled water.
   d. WPD in ft across condenser water.
   e. Chilled water supply and return temperatures ˚F.
   f. Condenser water supply and return temperatures in ˚F.

I. Cooling Tower Test Reports: For condenser water cooling tower:
1. Unit Data: Include the following:
   a. Unit identification.
   b. Location.
   c. Make and type.
   d. Model number and unit size.
   e. Manufacturer's serial number.
   f. Unit arrangement and class.
   g. Discharge arrangement.
2. Motor Data (Fan or Pump): Include the following:
   a. Make and frame type and size.
   b. Horsepower and rpm.
   c. Volts, phase, and hertz.
   d. Full-load amperage and service factor.
3. Test Data: Include design and actual values for the following:
   a. Total condenser under flowrate in gpm.
   b. Total wpd in ft across condenser water.
   c. Condenser water supply and return temperatures in ˚F.
   d. Fan rpm.

J. Electric-Coil Test Reports: For electric furnaces, duct coils, and electric coils installed in central-station air-handling units, include the following:
1. Unit Data: Include the following:
   a. System identification.
   b. Location.
   c. Coil identification.
   d. Capacity in Btuh (kW).
   e. Number of stages.
   f. Connected volts, phase, and hertz.
   g. Rated amperage.
   h. Airflow rate in cfm.
   i. Face area in sq. ft.
   j. Minimum face velocity in fpm.
2. Test Data: Include design and actual values for the following:
   a. Heat output in Btuh.
   b. Airflow rate in cfm.

c. Air velocity in fpm.
d. Entering-air temperature in deg F.
e. Leaving-air temperature in deg F.
f. Voltage at each connection.
g. Amperage for each phase.

K. Fan Test Reports: For supply, return, and exhaust fans, include the following:
1. Fan Data: Include the following:
a. System identification.
b. Location.
c. Make and type.
d. Model number and size.
e. Manufacturer's serial number.
f. Arrangement and class.
g. Sheave make, size in inches, and bore.
h. Sheave dimensions, center-to-center and amount of adjustments in inches (mm).
2. Motor Data: Include the following:
a. Make and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Sheave dimensions, center-to-center and amount of adjustments in inches.
g. Number of belts, make, and size.
3. Test Data: Include design and actual values for the following:
a. Total airflow rate in cfm.
b. Total system static pressure in inches wg.
c. Fan rpm.
d. Discharge static pressure in inches wg.
e. Suction static pressure in inches wg.

L. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
1. Report Data: Include the following:
a. System and air-handling unit number.
b. Location and zone.
c. Locate traverse location on duct work layout.
d. Traverse air temperature in deg F.
e. Duct static pressure in inches wg.
f. Duct size in inches.
g. Duct area in sq. ft.
h. Design airflow rate in cfm.
i. Design velocity in fpm.
j. Actual airflow rate in cfm.
k. Actual average velocity in fpm.
l. Barometric pressure in psig.

M. Air-Terminal-Device Reports: For terminal units, include the following:
1. Unit Data: Include the following:
a. System and air-handling unit identification.

b. Location and zone.
c. Test apparatus used.
d. Area served.
e. Air-terminal-device make.
f. Air-terminal-device number from system diagram.
g. Air-terminal-device type and model number.
h. Air-terminal-device size.
i. Air-terminal-device effective area in sq. ft.

2. Test Data: Include design and actual values for the following:
a. Airflow rate in cfm.
b. Air velocity in fpm.
c. Preliminary airflow rate as needed in cfm.
d. Preliminary velocity as needed in fpm.
e. Final airflow rate in cfm.
f. Final velocity in fpm.
g. Space temperature in deg F.

N. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:
1. Unit Data: Include the following:
a. System and air-handling unit identification.
b. Location and zone.
c. Room or riser served.
d. Coil make and size.
e. Flowmeter type.

2. Test Data: Include design and actual values for the following:
a. Airflow rate in cfm.
b. Entering-water temperature in deg F.
c. Leaving-water temperature in deg F.
d. Water pressure drop in feet of head or psig.
e. Entering-air temperature in deg F.
f. Leaving-air temperature in deg F.

O. Instrument Calibration Reports: For instrument calibration, include the following:
1. Report Data: Include the following:
a. Instrument type and make.
b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

END OF SECTION

SECTION 23 07 19

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. 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:
   a. Johns Manville; Microlite.
   b. Knauf Insulation; Duct Wrap
   c. Owens-Corning; All-Service Duct Wrap.
2. Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, 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:
1. Manufacturers:
   a. Johns Manville; 800 Series Spin-Glas.
   b. Knauf Insulation; Insulation Board.
   c. Owens Corning; Fiberglas 700 Series.
2. Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied 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).

K. Mineral-Fiber, Preformed Pipe Insulation:
1. Manufacturers:
   a. Johns Manville; Micro-Lok.
   b. Knauf Insulation; 1000° Pipe Insulation.
   c. Owens Corning; Fiberglas Pipe Insulation.
2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. 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

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, One part, acetoxy cure, silicone adhesive, with a service temperature range of minus 50 to plus 400 deg F.
   1. Products:
      a. Foamglas: PC RTV 450 Sillicone Adhesive

C. Flexible Elastomeric: Comply with MIL-A-24179A, Type II, Class I.
   1. Products:
      a. K-Flex: 720 LVOC or equal

D. Phenolic: Water based adhesive with a service temp of minus 20°F to 700°F.
   1. Products:
      a. Foster 97-15

E. Mineral-Fiber 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 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 vapor-barrier 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 where 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.
10. 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 1.00-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

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:
   1. All Pipe Sizes: Insulation shall be any of the following:
      a. Flexible Elastomeric: 1 inch thick.

C. Chilled Water Supply and Return:
   1. 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/ Condensate	N/A	N/A	N/A	3”	N/A	N/A	N/A	N/A	3”	N/A
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:
   1. All pipe sizes: Insulation shall be the following:
      a. Flexible elastomeric: 1-½ inch thick.

3.15 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. 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 09 00

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, floor mounted unit ventilators. The drawing sequences of operation define specific requirements, but the scope of work is generally limited to enable/disable with status monitoring of equipment.

C. Related Sections include the following:
1. Section "Meters and Gauges" for measuring equipment that relates to this Section.

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.
    l. 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:
    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: 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 Electric

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 DDC EQUIPMENT

A. Operator Workstation: One PC-based microcomputer(s) with minimum configuration as follows:
   1. Motherboard: With 4 integrated USB 2.0 and 2 USB 3.0 ports, integrated Intel Pro 10/100/1000 (Ethernet), integrated audio, bios, and hardware monitoring.
   2. Processor: Intel Quad Core I7 Processor, 3.0 GHz.
   3. Random-Access Memory: 8 GB.
   4. Graphics: Video adapter, minimum 1600 x 1200 pixels, 128-MB video memory.
   5. Monitor: 24 inches, flat panel LCD, color.
   6. Keyboard: QWERTY, 105 keys in ergonomic shape.
   7. Hard-Disk Drive: 500 GB, SATA, 7200 RPM, 6 Gb/s.
   8. DVD Read/Write Drive: 48x24x48.
   9. Mouse: Three button, optical.
   10. Uninterruptible Power Supply: 2 kVa.
   11. Operating System: Microsoft Windows 7 Professional with high-speed Internet access.
      a. ASHRAE 135 Compliance: Workstation shall use ASHRAE 135 protocol and communicate using ISO 8802-3 (Ethernet) datalink/physical layer protocol.
   12. Application Software:
      a. Graphical User Interface (GUI): Thin client or browser based meeting the following criteria:
         1) Web Browser's for PC's: Only a 5.x browser (Internet Explorer or Netscape Navigator) will be required as the GUI, and a valid connection to the server network. No installation of any custom software shall be required on the operator's GUI workstation/client. Connection shall be over an intranet or the Internet. A firewall shall be installed (as necessary) to protect the owner’s Intranet.
         2) Secure Socket Layers: Communication between the Web Browser GUI and control system server shall be encrypted using 128 bit encryption technology within Secure Socket Layers (SSL). Communication protocol shall be Hyper Text Transfer Protocol (HTTP).
      b. Cross Platform Capability: The controls software (client and server) shall be operating system and hardware agnostic, compatible with Microsoft Windows, Sun Microsystems Solaris and Red Hat Linux.
      c. Database creation and support with the following:
         1) Database Open Connectivity: The BAS server database shall be Java DataBase Connectivity (JDBC) compatible, allowing real time access of data via the following standard mechanisms:
            a) Common Object Request Broker Architecture (CORBA).
            b) OLE/OPC (for Microsoft Client's/Server platform only).
            c) Import/Export of the database from or to XML (extensible Markup Language).
         2) Automatic and manual database save and restore.
      d. System security for each operator via software password and access levels.
      e. Automatic system diagnostics; monitor system and report failures.
      f. Tree navigation.

g. Dynamic color graphic displays with up to 10 screen displays at once.
h. Custom graphics generation and graphics library of HVAC equipment and symbols.
i. Alarm processing, messages, and reactions.
j. Trend logs retrievable in spreadsheets and database programs.
k. Alarm and event processing.
l. Object and property status and control.
m. Automatic restart of field equipment on restoration of power.
n. Data collection, reports, and logs. Include standard reports for the following:
    1) Current values of all objects.
    2) Current alarm summary.
    3) Disabled objects.
    4) Alarm lockout objects.
    5) Logs.
o. Custom report development.
p. Utility and weather reports.
q. ASHRAE Guideline 3 report.
r. Workstation application editors for controllers and schedules.
s. Maintenance management.

13. Custom Application Software:
    a. English language oriented.
    b. Full-screen character editor/programming environment.
    c. Allow development of independently executing program modules with debugging/simulation capability.
    d. Support conditional statements.
    e. Support floating-point arithmetic with mathematic functions.
    f. Contains predefined time variables.

B. 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, chilled-water reset, and equipment sequencing.
d. Programming Application Features: Include trend point; alarm processing and messaging; weekly, monthly, and annual scheduling; energy calculations; run-time 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.

C. 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.

D. 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.

E. 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.

F. Power Line Filtering: Internal or external transient voltage and surge suppression for workstations or controllers with the following:
   1. Minimum dielectric strength of 1000 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.

2.4 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.
   3. ASHRAE 135 Compliance: Communicate using read (execute and initiate) and write (execute and initiate) property services defined in ASHRAE 135. Reside on network using MS/TP datalink/physical layer protocol and have service communication port for connection to diagnostic terminal unit.
   4. Enclosure (interior): Dustproof rated for operation at 32 to 120 deg F (0 to 50 deg C).
   5. Enclosure (exterior): NEMA 3R.

2.5 ALARM AND OCCUPANT INTERFACE PANELS

A. Unitized cabinet with suitable brackets for wall or floor mounting. Fabricate of 0.06-inch- (1.5-mm-) thick, furniture-quality steel or extruded-aluminum alloy, totally enclosed, with hinged doors and keyed lock and with manufacturer's standard shop-painted finish. Provide common keying for all panels.

B. Alarm Panels: Indicating light for each alarm point, single horn, acknowledge switch, and test switch, mounted on hinged cover.
   1. Alarm Condition: Indicating light flashes and horn sounds.
   2. Acknowledge Switch: Horn is silent and indicating light is steady.
   3. Second Alarm: Horn sounds and indicating light is steady.
   4. Alarm Condition Cleared: System is reset and indicating light is extinguished.
   5. Contacts in alarm panel allow remote monitoring by independent alarm company.

2.6 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.

D. Fan-Speed Controllers: Solid-state model providing field-adjustable proportional control of motor speed from maximum to minimum of 55 percent and on-off action below minimum fan speed. Controller shall briefly apply full voltage, when motor is started, to rapidly bring motor up to minimum speed. Equip with filtered circuit to eliminate radio interference.

2.7 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. Alerton.
      b. BEC Controls Corporation.
      c. Ebtron, Inc.
      d. Heat-Timer Corporation.
      e. I.T.M. Instruments Inc.
      f. MAMAC Systems, Inc.
   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). Mount sensor in an electrical box through a hole in the duct, in an easily accessible location.
   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. Alerton
   b. Automation Components, Inc. (ACI)
   c. 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. Alerton.
   b. BEC Controls Corporation.
   c. MAMAC Systems, Inc.
   d. TCS/Basys Controls.
   e. Vaisala.
   f. Veris Industries.
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.

E. Pressure Transmitters/Transducers:
1. Available Manufacturers:
   a. BEC Controls Corporation.
   b. MAMAC Systems, Inc.
   c. ROTRONIC Instrument Corp.
   d. TCS/Basys Controls.
   e. Vaisala.
   f. Veris Industries.

2. Static-Pressure Transmitter: Nondirectional sensor with suitable range for expected input, and temperature compensated.
   a. Accuracy: 2 percent of full scale with repeatability of 0.5 percent.
   b. Output: 4 to 20 mA.
   c. Building Static-Pressure Range: 0- to 0.25-inch wg (0 to 62 Pa).
   d. Duct Static-Pressure Range: 0- to 5-inch wg (0 to 1240 Pa).
3. Water Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psig (1034-kPa) operating pressure; linear output 4 to 20 mA.
4. Water Differential-Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psig (1034-kPa) operating pressure and tested to 300-psig (2070-kPa); linear output 4 to 20 mA.
5. Differential-Pressure Switch (Air or Water): Snap acting, with pilot-duty rating and with suitable scale range and differential.
6. Pressure Transmitters: Direct acting for gas, liquid, or steam service; range suitable for system; linear output 4 to 20 mA.

2.8 STATUS SENSORS

A. Status Inputs for Fans: Differential-pressure switch with pilot-duty rating and with adjustable range of 0- to 5-inch wg (0 to 1240 Pa).

B. 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.

C. Status Inputs for Electric Motors: Comply with ISA 50.00.01, current-sensing fixed- or split-core transformers with self-powered transmitter, adjustable and suitable for 175 percent of rated motor current.

D. 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.

E. 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.

F. Current Switches: Self-powered, solid-state with adjustable trip current, selected to match current and system output requirements. Manufactured by Veris Industries or equivalent.

G. Electronic Valve/Damper Position Indicator: Visual scale indicating percent of travel and 2- to 10-V dc, feedback signal.

H. Water-Flow Switches: Bellows-actuated mercury or snap-acting type with pilot-duty rating, stainless-steel or bronze paddle, with appropriate range and differential adjustment, in NEMA 250, Type 1 enclosure.
   1. Available Manufacturers:
      a. BEC Controls Corporation.

b. I.T.M. Instruments Inc.
c. Kele & Associates

2.9 GAS DETECTION EQUIPMENT

A. Manufacturers:
1. General Monitors.
2. Veris Industries.

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.

C. Hydrocarbon Sensors: Model #S4000CH by General Monitors (no exceptions). Provide stainless steel (316) slip-stream sampling accessories (supply/return sampling tubes, sealed sensor housing, mounting plates, hardware, etc) as necessary for duct mounting in a readily accessible location. Provide with all accessories necessary for periodic testing and calibration. Coordinate with mechanical contractor.

D. Hydrogen Sulfide (H2S) Sensors: Model #S4000T by General Monitors (no exceptions). Provide stainless steel (316) slip-stream sampling accessories (supply/return sampling tubes, sealed sensor housing, mounting plates, hardware, etc) as necessary for duct mounting in a readily accessible location. Provide with all accessories necessary for periodic testing and calibration. Coordinate with mechanical contractor.

2.10 AIRFLOW MEASURING STATIONS (AFMS)

A. Duct Airflow Station: Combination of air straightener and multiport, self-averaging pitot tube station.
1. Manufacturers:
a. Air Monitor Corporation.
b. Ruskin.
2. Model: IAQ50 (Ruskin).
3. Frame: 6 inches × 1-3/8 inches × minimum 0.125-inch extruded aluminum.
a. Entire assembly frame shall be flanged.
4. Blades:
a. Modulating Air Control:
1) Style: Airfoil-shaped, single-piece.
2) Action: Parallel.
3) Orientation: Horizontal.
4) Material: Heavy gage 6063-T5 extruded aluminum.
5) Width: Maximum 5 inches (127 mm).

b. Stationary Sensing:
1) Style: Airfoil-shaped, single-piece.
2) Orientation: Horizontal.
3) Material: Heavy gage 6063-T5 extruded aluminum.
4) Width: Maximum 5-1/4 inches (133 mm).
5) Finish: Anodized.

5. Bearings: Self-lubricating molded synthetic sleeve, turning in extruded hole in frame.
6. Seals:
a. Blade: Extruded rubber type for ultra-low leakage. Mechanically attached to blade edge.
b. Jamb: Stainless steel, flexible metal compression type.
7. Linkage: Concealed in frame.
8. Axles: Minimum 1/2 inch (13 mm) diameter plated steel, hex-shaped, mechanically attached to blade.
9. Mounting: Vertical.
10. Electric Actuator: 24 V, 60 Hz, modulating, with position feedback.
11. Digital Controller: Application specific controller. Programming logic and calibration in nonvolatile EPROM. Controller uses generic 0 - 10 vdc inputs and outputs for interface to building automation system.
12. Flow Straightener: Aluminum honeycomb, 3/4-inch (20-mm) parallel cell, 3 inches (75 mm) deep, contained in a 5 inch deep sleeve attached to airflow frame.
13. Finish: Mill aluminum.
14. Assembly: Factory assembled damper/airflow monitor, actuator, and accessories, and furnish as a single factory-calibrated unit.
15. The maximum depth of the assembly shall be no greater than 11 inches. Refer to plans for overall duct dimensions and sizes.
16. Electrical: The airflow station shall run off of 24V power.
17. Performance Data:
a. Temperature Rating: Withstand -40 to 140 degrees F.
b. Capacity: Demonstrate capacity of damper/airflow monitor.
1) Monitor airflow within accuracy of 5 percent.
2) Perform sensing requirements in HVAC systems with velocities from 300 to 2,000 feet per minute.
c. Leakage: Maximum 2.0 cubic feet per minute per square foot at 1 inch w.g. for 48 inch × 48 inch closed damper.
Pressure Drop: Maximum 0.13 inch w.g. at 1,000 feet per minute across both damper/airflow monitor and air straightener.
18. Controls
a. The AFMS shall come complete with its own controls and, where indicated, a 24V actuator. A 0-10 V DC signal shall be provided by the AFMS to the building EMCS to monitor airflow. The AFMS shall be able to receive a 0-10 V DC signal from the EMCS to act as a setpoint adjustment when an actuator is provided.

2.11 THERMOSTATS

A. Available Manufacturers:
1. Danfoss Inc.; Air-Conditioning and Refrigeration Div.

2. Honeywell
3. Sauter Controls Corporation.
4. TAC Erie Controls.
5. tekmar Control Systems, Inc.
6. Theben AG - Lumilite Control Technology, Inc.

B. Combination Thermostat and Fan Switches: Line-voltage thermostat with push-button or lever-operated fan switch.
1. Label switches "FAN ON-OFF," "FAN HIGH-LOW-OFF" or "FAN HIGH-MED-LOW-OFF," as indicated.
2. Mount on single electric switch box.

C. Electric, solid-state, microcomputer-based room thermostat with remote sensor.
1. Automatic switching from heating to cooling.
2. Preferential rate control to minimize overshoot and deviation from set point.
3. Set up for four separate temperatures per day.
4. Instant override of set point for continuous or timed period from 1 hour to 31 days.
5. Short-cycle protection.
6. Programming based on weekday, Saturday, and Sunday.
7. Selection features include degree F or degree C display, 12- or 24-hour clock, keyboard disable, remote sensor, and fan on-auto.
8. Battery replacement without program loss.
9. Thermostat display features include the following:
   a. Time of day.
   b. Actual room temperature.
   c. Programmed temperature.
   d. Programmed time.
   e. Duration of timed override.
   f. Day of week.
   g. System mode indications include "heating," "off," "fan auto," and "fan on."

D. Low-Voltage, On-Off Thermostats: NEMA DC 3, 24-V, bimetal-operated, mercury-switch type, with adjustable or fixed anticipation heater, concealed set-point adjustment, 55 to 85 deg F (13 to 30 deg C) set-point range, and 2 deg F (1 deg C) maximum differential.

E. Line-Voltage, On-Off Thermostats: Bimetal-actuated, open contact or bellows-actuated, enclosed, snap-switch or equivalent solid-state type, with heat anticipator; listed for electrical rating; with concealed set-point adjustment, 55 to 85 deg F (13 to 30 deg C) set-point range, and 2 deg F (1 deg C) maximum differential.
1. Electric Heating Thermostats: Equip with off position on dial wired to break ungrounded conductors.
2. Selector Switch: Integral, manual on-off-auto.

F. Electric, Low-Limit Duct Thermostat: Snap-acting, single-pole, single-throw, automatic-reset switch that trips if temperature sensed across any 12 inches (300 mm) of bulb length is equal to or below set point.
1. Bulb Length: Minimum 20 feet (6 m).
2. Quantity: One thermostat for every 20 sq. ft. (2 sq. m) of coil surface.

G. Electric, High-Limit Duct Thermostat: Snap-acting, single-pole, single-throw, automatic-reset switch that trips if temperature sensed across any 12 inches (300 mm) of bulb length is equal to or above set point.
   1. Bulb Length: Minimum 20 feet (6 m).
   2. Quantity: One thermostat for every 20 sq. ft. (2 sq. m) of coil surface.

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 ACTUATORS

A. Electric Motors: Size to operate with sufficient reserve power to provide smooth modulating action or two-position action.
   1. Permanent Split-Capacitor or Shaded-Pole Type: Gear trains completely oil immersed and sealed. Equip spring-return motors with integral spiral-spring mechanism in housings designed for easy removal for service or adjustment of limit switches, auxiliary switches, or feedback potentiometer.
   2. Nonspring-Return Motors for Valves Larger Than NPS 2-1/2 (DN 65): Size for running torque of 150 in. x lbf (16.9 N x m) and breakaway torque of 300 in. x lbf (33.9 N x m).
   3. Spring-Return Motors for Dampers Larger Than 25 Sq. Ft. (2.3 sq. m): Size for running and breakaway torque of 150 in. x lbf (16.9 N x m).

B. Electronic Actuators: Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.
   1. Manufacturers:
      a. Belimo Aircontrols (USA), Inc.
   2. Valves: Size for torque required for valve close off at maximum pump differential pressure.
   3. Dampers: Size for running torque calculated as follows:
      a. Parallel-Blade Damper with Edge Seals: 7 inch-lb/sq. ft. (86.8 kg-cm/sq. m) of damper.
      b. Opposed-Blade Damper with Edge Seals: 5 inch-lb/sq. ft. (62 kg-cm/sq. m) of damper.
      c. Parallel-Blade Damper without Edge Seals: 4 inch-lb/sq. ft (49.6 kg-cm/sq. m) of damper.
      d. Opposed-Blade Damper without Edge Seals: 3 inch-lb/sq. ft. (37.2 kg-cm/sq. m) of damper.
      e. Dampers with 2- to 3-Inch wg (500 to 750 Pa) of Pressure Drop or Face Velocities of 1000 to 2500 fpm (5 to 13 m/s): Increase running torque by 1.5.

f. Dampers with 3- to 4-Inch wg (750 to 1000 Pa) of Pressure Drop or Face Velocities of 2500 to 3000 fpm (13 to 15 m/s): Increase running torque by 2.0.

4. Coupling: V-bolt and V-shaped, toothed cradle.
5. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
6. Fail-Safe Operation: Mechanical, spring-return mechanism. Provide external, manual gear release on nonspring-return actuators.
7. Power Requirements (Two-Position Spring Return): 24-V ac.
8. Power Requirements (Modulating): Maximum 10 VA at 24-V ac or 8 W at 24-V dc.
9. Proportional Signal: 2- to 10-V dc or 4 to 20 mA, and 2- to 10-V dc position feedback signal.
10. Temperature Rating: Minus 22 to plus 122 deg F (Minus 30 to plus 50 deg C).
11. Temperature Rating (Smoke Dampers): Minus 22 to plus 250 deg F (Minus 30 to plus 121 deg C).
12. Run Time: 12 seconds open, 5 seconds closed.

2.14 CONTROL VALVES

A. Manufacturers:
1. Belimo
2. Parker Hannifin Corporation; Skinner Valve Division.

B. Control Valves: Factory fabricated, of type, body material, and pressure class based on maximum pressure and temperature rating of piping system, unless otherwise indicated.

C. Hydronic system globe valves shall have the following characteristics:
1. NPS 2 (DN 50) and Smaller: Class 125 bronze body, bronze trim, rising stem, renewable composition disc, and screwed ends with backseating capacity repackable under pressure.
2. NPS 2-1/2 (DN 65) and Larger: Class 125 iron body, bronze trim, rising stem, plug-type disc, flanged ends, and renewable seat and disc.
3. Internal Construction: Replaceable plugs and stainless-steel or brass seats.
   a. Single-Seated Valves: Cage trim provides seating and guiding surfaces for plug on top and bottom.
   b. Double-Seated Valves: Balanced plug; cage trim provides seating and guiding surfaces for plugs on top and bottom.
4. Sizing: 5-psig (35-kPa) maximum pressure drop at design flow rate or the following:
   a. Two Position: Line size.
   b. Two-Way Modulating: Either the value specified above or twice the load pressure drop, whichever is more.
   c. Three-Way Modulating: Twice the load pressure drop, but not more than value specified above.
5. Flow Characteristics: Two-way valves shall have equal percentage characteristics; three-way valves shall have linear characteristics.
6. Close-Off (Differential) Pressure Rating: Combination of actuator and trim shall provide minimum close-off pressure rating of 150 percent of total system

(pump) head for two-way valves and 100 percent of pressure differential across valve or 100 percent of total system (pump) head.

D. Butterfly Valves: 200-psig (1380-kPa), 150-psig (1034-kPa) maximum pressure differential, ASTM A 126 cast-iron or ASTM A 536 ductile-iron body and bonnet, extended neck, stainless-steel stem, field-replaceable EPDM or Buna N sleeve and stem seals.
1. Body Style: Lug.
2. Disc Type: Nickel-plated ductile iron.
3. Sizing: 1-psig (7-kPa) maximum pressure drop at design flow rate.

E. Terminal Unit Control Valves: Bronze body, bronze trim, two or three ports as indicated, replaceable plugs and seats, and union and threaded ends.
1. Rating: Class 125 for service at 125 psig (860 kPa) and 250 deg F (121 deg C) operating conditions.
2. Sizing: 3-psig (21-kPa) maximum pressure drop at design flow rate, to close against pump shutoff head.
3. Flow Characteristics: Two-way valves shall have equal percentage characteristics; three-way valves shall have linear characteristics.

2.15 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. Entrances.
   2. Public areas.
   3. Where indicated.

E. Install automatic dampers according to Section "Duct Accessories."

F. Install damper motors on outside of duct in warm areas, not in locations exposed to outdoor temperatures.

G. Install hydronic instrument wells, valves, and other accessories according to Section "Hydronic Piping."

H. Install refrigerant instrument wells, valves, and other accessories according to Section "Refrigerant Piping."

I. Install duct volume-control dampers according to mechanical specification sections specifying air ducts.

J. Install electronic and fiber-optic cables according to Section "Control/Signal Transmission Media."

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 instrument installation for direction of flow, elevation, orientation, insertion depth, and other applicable considerations.
4. Check instrument tubing for proper fittings, slope, material, and support.
5. Check installation of air supply for each instrument.
6. Check flow instruments. Inspect tag number and line and bore size, and verify that inlet side is identified and that meters are installed correctly.
7. Check pressure instruments, piping slope, installation of valve manifold, and self-contained pressure regulators.
8. Check temperature instruments and material and length of sensing elements.
9. Check control valves. Verify that they are in correct direction.
10. Check air-operated dampers. Verify that pressure gages are provided and that proper blade alignment, either parallel or opposed, has been provided.
11. 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. Flow:
a. Set differential pressure flow transmitters for 0 and 100 percent values with 3-point calibration accomplished at 50, 90, and 100 percent of span.
b. Manually operate flow switches to verify that they make or break contact.
6. Pressure:
a. Calibrate pressure transmitters at 0, 50, and 100 percent of span.
b. Calibrate pressure switches to make or break contacts, with adjustable differential set at minimum.
7. Temperature:
a. Calibrate resistance temperature transmitters at 0, 50, and 100 percent of span using a precision-resistance source.
b. Calibrate temperature switches to make or break contacts.
8. Stroke and adjust control valves and dampers without positioners, following the manufacturer's recommended procedure, so that valve or damper is 100 percent open and closed.
9. Stroke and adjust control valves and dampers with positioners, following manufacturer's recommended procedure, so that valve and damper is 0, 50, and 100 percent closed.
10. Provide diagnostic and test instruments for calibration and adjustment of system.
11. Provide written description of procedures and equipment for calibrating each type of instrument. Submit procedures review and approval before initiating startup procedures.

B. Adjust initial temperature and humidity set points.

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 10 00

VALVES AND SPECIALTIES FOR HVAC 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 general duty valves common to several mechanical HVAC piping systems.

B. Related Sections: The following Sections contain requirements that relate to this Section:
   1. Special purpose valves are specified in Specification Section “Mechanical Piping System Sections.
   2. Valve tags and charts are specified in Specification Section "Mechanical Identification."

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 each valve type. Include body material, valve design, pressure and temperature classification, end connection details, seating materials, trim material and arrangement, dimensions and required clearances, and installation instructions. Include list indicating valve and its application.

C. Maintenance data for valves to include in the operation and maintenance manual specified in Division 1. Include detailed manufacturer's instructions on adjusting, servicing, disassembling, and repairing.

1.4 QUALITY ASSURANCE

A. ASME Compliance: Comply with ASME B31.9 for building services piping and ASME B31.1 for power piping.

B. MSS Compliance: Comply with the various MSS Standard Practice documents referenced.

1.5 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 and gate valves closed to prevent rattling.
4. Set ball 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 indoors and maintain valve temperature higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Ball Valves:
a. Hammond Valve Corporation.
b. Kitz.
c. Milwaukee Valve Company, Inc.
d. NIBCO Inc.
e. Stockham Valves & Fittings, Inc.
f. Victaulic Company of America.
2. Butterfly Valves:
a. Crane Company; Valves and Fitting Division.
b. General Signal; DeZurik Unit.
c. Grinnell Corp.
d. Hammond Valve Corporation.
e. Kitz.
f. Keystone Valve USA, Inc.
g. Milwaukee Valve Company, Inc.
h. NIBCO Inc.
i. Stockham Valves & Fittings, Inc.
j. Victaulic Company of America.
3. Globe Valves:
a. Kitz.
b. Milwaukee Valve Company, Inc.
c. Watts.
d. NIBCO, Inc.
4. Swing Check Valves:
a. Crane Company; Valves and Fitting Division.
b. Hammond Valve Corporation.
c. Kitz.
d. Milwaukee Valve Company, Inc.
e. NIBCO Inc.
f. Stockham Valves & Fittings, Inc.
g. Victaulic Company of America.
5. Lift Check Valves:

a. Crane Company; Valves and Fitting Division.
b. Kitz.
c. Milwaukee Valve Company, Inc.
d. NIBCO Inc.
e. Stockham Valves & Fittings, Inc.

6. Lever Weighted Check Valves
   a. Crane Company; Valves and Fitting Division
   b. Milwaukee Valve Co., Inc.
   c. Mueller and Co.
7. Bronze, Calibrated Orifice, Balancing Valves:
   a. Armstrong Pumps, Inc.
   b. Bell & Gossett Domestic Pump; a division of ITT Industry.
   c. Flow Design Inc.
   d. Griswold Controls.
   e. Taco.
   f. Pro Hydronic Specialties.
8. Cast-Iron or Steel, Calibrated-Orifice, Balancing Valves.
   a. Armstrong Pumps, Inc.
   b. Bell & Gossett Domestic Pump; a division of ITT Industry.
   c. Flow Design Inc.
   d. Griswold Controls.
   e. Taco.
   f. Tour & Anderson; a division of Victaulic Company of America.
   g. Pro Hydronic Specialties.
9. Diaphragm Operated, Pressure Reducing Valves.
   a. Amtrol, Inc.
   b. Armstrong Pumps, Inc.
   c. Bell & Gossett Domestic Pump; a division of ITT Industries.
   d. Conbraco Industries, Inc.
   e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
10. Diaphragm Operated, Safety Valves
    a. Amtrol, Inc.
    b. Armstrong Pumps, Inc.
    c. Bell & Gossett Domestic Pump; a division of ITT Industries.
    d. Conbraco Industries, Inc.
    e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
11. Automatic Flow Control Valves (2” and smaller):
    a. Flow Control Design.
    b. Griswold Controls.
    c. Nexus Valves.
    d. Pro Hydronic Specialties.
12. Automatic Flow Control Valves (2-1/2” and larger):
    a. Flow Control Design.
    b. Griswold Controls.
    c. Nexus Valves.
    d. Pro Hydronic Specialties.
13. Pressure and Temperature Ports/Plugs

2.2 BASIC, COMMON FEATURES

A. Design: Rising stem or rising outside screw and yoke stems, except as specified below.
   1. Non-rising stem valves may be used only where headroom prevents full extension of rising stems.

B. Pressure and Temperature Ratings: As indicated in the "Application Schedule" of Part 3 of this Section and as required to suit system pressures and temperatures.

C. Sizes: Same size as upstream pipe, unless otherwise indicated.

D. Operators: Use specified operators and handwheels, except provide the following special operator features:
   1. Handwheels: For valves other than quarter turn.
   2. Lever Handles: For quarter-turn valves 6 inches and smaller.
   3. Gear-Drive Operators: For quarter-turn valves 8 inches and larger.

E. Extended Stems: Where insulation is indicated or specified, provide extended stems arranged to receive insulation. (Stem to be insulated type).

F. Threads: ASME B1.20.1.

G. Flanges: ASME B16.1 for cast iron, ASME B16.5 for steel, and ASME B16.24 for bronze valves.

H. Chain Wheel Operators: Provide chain wheel operators for all valves 7 ft (Chain to be accessible 5' AFF). AFF and above.

2.3 BALL VALVES

A. Ball Valves, 2 Inches and Smaller: MSS SP-110, Class 150, 600-psi CWP, ASTM B 584 bronze body and bonnet, 2-piece construction; stainless steel trim and ball; Full port, vented ball, blowout proof; bronze stem; PTFE seats and seals; threaded end connections:
   1. Operator: Vinyl-covered steel lever handle.
   2. Stem Extension: For valves installed in insulated piping - Extend stem past insulation jacket. Stem to be insulated type.
   3. Memory Stop: For operator handles.

2.4 BUTTERFLY VALVES

A. Butterfly Valves: MSS SP-67, 200-psi WOG, Class ISO, ASTM A 126 ductile-iron body and bonnet, extended neck, stainless-steel stem, field-replaceable EPDM sleeve and stem seals, lug style flanges:
   1. Disc Type: Aluminum bronze.
   2. Operator for Sizes 2 Inches to 6 Inches: Standard lever handle with memory stop.
   3. Operator for Sizes 8 Inches to 24 Inches: Gear operator with position indicator. Chain operator required on valves installed 7' AF or higher. Bottom of chain loop to extend down to be 5' AFF.

2.5 GLOBE VALVES

A. Globe Valves, 2 inches and smaller. MSS SP-80, Class 150 SWP, bronze body and bonnet, stainless steel seat ring and disc; threaded end connections. Union bonnet, Gland Packed.
   1. Operator: Malleable Iron hand wheel.

B. Globe Valves, 2½ inches and larger. Class 150 SWP, steel body (A216), Seat Ring/Facing A105 steel/Co-CR-W. Steel Disc (A182); Flanged ends.
   1. Operator: Steel (A47).

2.6 CHECK VALVES

A. Swing Check Valves, 2-1/2 Inches and Smaller: Class 150, 300-psi WOG; horizontal swing, Y-pattern, ASTM B 62 cast-bronze body and cap, rotating bronze disc with composition seat, threaded end connections.

B. Swing Check Valves, 3 Inches and Larger: MSS SP-71, Class 125, 200-psi WOG, ASTM A 126 cast-iron body and bolted cap, horizontal-swing bronze disc with bronze seat ring, flanged or grooved end connections.

C. Lift Check Valves: Class 125, ASTM B 62 bronze body and cap (main components), horizontal or vertical pattern, lift-type, bronze disc or Buna N rubber disc with stainless-steel holder threaded or soldered end connections.

D. Lever weighted check valves, 2-1/2” and larger, Class 125, ASTM 126 CL.B cast iron body, horizontal or vertical pattern, brass bearings, stainless steel hinge pin, heavy ductile iron clapper arm, cast iron disc with bronze seat ring.

2.7 AIR CONTROL DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Amtrol, Inc.
   2. Armstrong Pumps, Inc.
   3. Bell & Gossett Domestic Pump; a division of ITT Industries.
   4. Taco.

B. Manual Air Vents:
   1. Body: Bronze.
   2. Internal Parts: Nonferrous.
   3. Operator: Screwdriver or thumbscrew.
   4. Inlet Connection: NPS 1/2.
   5. Discharge Connection: NPS 1/8.
   6. CWP Rating: 150 psig.
   7. Maximum Operating Temperature: 225 deg F.

C. Automatic Air Vents:
   1. Body: Bronze or cast iron.
   2. Internal Parts: Nonferrous.
   3. Operator: Noncorrosive metal float.
   4. Inlet Connection: NPS 1/2.
   5. Discharge Connection: NPS 1/4.

6. CWP Rating: 150 psig.
7. Maximum Operating Temperature: 240 deg F.

D. Diaphragm-Type Expansion Tanks:
1. Tank: Welded steel, rated for 125-psig working pressure and 375 deg F maximum operating temperature. Factory test with taps fabricated and supports installed and labeled according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
2. Diaphragm: Securely sealed into tank to separate air charge from system water to maintain required expansion capacity.
3. Bottom of tank water connection.
4. Air-Charge Fittings: Schrader valve, stainless steel with EPDM seats.

E. Air and Dirt Separators, Coalescing-Type:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. ITT Bell & Gossett
b. Spirotherm, Inc.
c. Taco
d. Thrush Co. Inc.
2. Tank: Welded steel with air valve at top of tank for skimming floating dirt and bleeding large volumes of air at system fill; ASME constructed and labeled for 125-psig minimum working pressure and 375 deg F maximum operating temperature;
3. Air and Dirt Collector Tube: Coalescing type; copper or stainless steel medium, constructed to direct released air into an automatic vent, and to drop out dirt into a collection chamber for blow down.
4. Inline Inlet and Outlet Connections: Threaded for NPS 2 and smaller; flanged connections for NPS 2-1/2 and larger.
5. Blowdown Connection: Threaded with inline ball valve.
6. Size: Match system flow capacity; 4-fps maximum entering velocity for specified system gpm.

2.8 HYDRONIC PIPING SPECIALTIES

A. Y-Pattern Strainers:
1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: 20-mesh startup strainer screen, 60-mesh permanent strainer screen and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

B. Basket Strainers:
1. Body: ASTM A 126, Class B, high-tensile cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: 20-mesh startup strainer screen, 60-mesh permanent strainer

screen and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

C. T-Pattern Strainers:
1. Body: Ductile or malleable iron with removable access coupling and end cap for strainer maintenance.
2. End Connections: Grooved ends.
3. Strainer Screen: 20-mesh startup strainer screen, 60-mesh permanent strainer screen and perforated stainless-steel basket with 57 percent free area.
4. CWP Rating: 750 psig.

D. Stainless-Steel Bellow, Flexible Connectors:
1. Body: Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket.
2. End Connections: Threaded or flanged to match equipment connected.
3. Performance: Capable of 3/4-inch misalignment.
4. CWP Rating: 150 psig.
5. Maximum Operating Temperature: 250 deg F.

E. Spherical, Rubber, Flexible Connectors:
1. Body: Fiber-reinforced rubber body.
2. End Connections: Steel flanges drilled to align with Classes 150 and 300 steel flanges.
3. Performance: Capable of misalignment.
4. CWP Rating: 150 psig.
5. Maximum Operating Temperature: 250 deg F.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance of valves. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. 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.

C. Operate valves from fully open to fully closed positions. Examine guides and seats made accessible by such operation.

D. Examine threads on valve and mating pipe for form and cleanliness.

E. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Check gasket material for proper size, material composition suitable for service, and freedom from defects and damage.

F. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE APPLICATIONS

A. Install shutoff-duty valves at each branch connection to supply mains, and at supply connection to each piece of equipment.

B. Install automatic flow-control valves in the return pipe of each heating or cooling coil; refer to drawing details for additional requirements.

C. Install check valves at each pump discharge and elsewhere as required to control flow direction.

D. Install Y strainers at the inlet side of all control valves, chillers, heat transfer coils and suction side of all pumps.

E. Install safety valves at hot-water generators and elsewhere as required by ASME Boiler and Pressure Vessel Code. Install drip-pan elbow on safety-valve outlet and pipe without valves to the outdoors; and pipe drain to nearest floor drain or as indicated on Drawings. Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 01, for installation requirements.

F. Install pressure-reducing valves with reduced-pressure backflow valves at makeup-water connection to regulate system fill pressure. Coordinate with plumbing drawings.

G. Install modulating control valves where indicated on the drawings. Install control valves in the upright position for top-mounting of the actuator unless specifically approved or indicated otherwise.

3.3 INSTALLATION

A. Install valves as indicated, according to manufacturer's written instructions.

B. Piping installation requirements are specified in other Mechanical Sections. Drawings indicate the general arrangement of piping, fittings, and specialties.

C. Install valves with unions or flanges at each piece of equipment arranged to allow servicing, maintenance, and equipment removal without system shutdown.

D. Locate valves for easy access and provide separate support where necessary.

E. Install valves in horizontal piping with stem at or above the center of the pipe.

F. Install valves in a position to allow full stem movement.

G. Installation of Check Valves: Install for proper direction of flow as follows:
   1. Swing Check Valves: Horizontal position with hinge pin level.
   2. Lift Check Valve: With stem upright and plumb.
   3. Lever Weighted Check Valve: Vertical position at pump discharge. Lever arm must move freely.

H. All valves shall be installed with threaded, grooved or bolted flanged connections such that the valve can be replaced without the use of heat. No soldered or welded in place valves shall be used.

I. Install strainers on inlet side of each control valve, pressure-reducing valve, solenoid valve, pump, and elsewhere as indicated. Install NPS 3/4 nipple and ball valve in

blowdown connection of strainers NPS 2 and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2.

3.4 TERMINAL EQUIPMENT CONNECTIONS

A. Sizes for supply and return piping connections shall be the same as or larger than equipment connections.

B. Install control valves in accessible locations close to connected equipment.

C. Install bypass piping with globe valve around control valve. If parallel control valves are installed, only one bypass is required.

D. Install ports for pressure gages and thermometers at coil inlet and outlet connections according to Specification Section "Meters and Gages."

E. Install PT plugs for verification of all DDC mounted pressure and temperature sensors. PT plugs to be adjacent to all DDC pipe mounted sensors. PT plugs shall have minimum 6-inch clear access and the mounting angle shall be vertical.

3.5 THREADED CONNECTIONS

A. Note the internal length of threads in valve ends and proximity of valve internal seat or wall to determine how far pipe should be threaded into valve.

B. Align threads at point of assembly.

C. Apply appropriate tape or thread compound to the external pipe threads, except where dry seal threading is specified.

D. Assemble joint, wrench tight. Wrench on valve shall be on the valve end into which the pipe is being threaded.

3.6 FLANGED CONNECTIONS

A. Align flange surfaces parallel.

B. 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 with a torque wrench.

C. For dead-end service, butterfly valves require flanges both upstream and downstream for proper shutoff and retention.

D. Valves to be installed in fully accessible locations, handles to have full range of motion without obstruction.

3.7 VALVE END SELECTION

A. Select valves with the following ends or types of pipe/tube connections:
   1. Steel Pipe Sizes, 2-1/2 Inches and Smaller: Threaded or grooved end.
   2. Steel Pipe Sizes, 3 Inches and Larger: Grooved end or flanged.

3.8 APPLICATION SCHEDULE

A. General Application: Use gate, ball, and butterfly valves for shutoff duty; globe, ball, and butterfly for throttling duty. Refer to piping system Specification Sections for specific valve applications and arrangements.

B. Valve Chart

TYPE	SIZE	SYSTEMS	CLASS
Ball Valves (Shut off)	2" and smaller	Chilled Water Hot Water Condenser Water Misc. Drains	150 WSP/600 WOG
Globe Valves (Balancing)	2" and Smaller	Chilled Water Hot Water	150 SWP
Butterfly (shut off)	2-½" to 4"	Chilled Water Hot Water Condenser Water Misc. Drains	200 WOG
Globe (balancing)	2-½" to 4"	Chilled Water Hot Water Condenser Water Misc. Drains	150 WOG
Butterfly (shut off & balancing)	6" and larger	Chilled Water Hot Water Condenser Water Misc. Drains	200 WOG
Check Valve (Swing)	2 ½" and smaller	All Water Systems Condensate Drains	150 WSP/300 WOG
Check Valve (Swing)	3" and larger	All water systems	125 WSP/200 WOG

3.9 ADJUSTING

A. Adjust or replace packing after piping systems have been tested and put into service, but before final adjusting and balancing. Replace valves if leak persists.

END OF SECTION

SECTION 23 21 13

HYDRONIC 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. This Section includes pipe and fitting materials, joining methods, special-duty valves, and specialties for the following:
   1. Hot-water heating piping.
   2. Chilled-water piping.
   3. Condenser-water piping.
   4. Makeup-water piping.
   5. Condensate-drain piping.
   6. Blowdown-drain piping.
   7. Air-vent piping.
   8. Safety-valve-inlet and -outlet piping.

B. Related Sections include the following:
   1. Mechanical specification section "Hydronic Pumps" for pumps, motors, and accessories for hydronic piping, if applicable.
   2. Mechanical specification section "Special Conditions for all Mechanical Work".
   3. Mechanical specification section "Basic Mechanical Material and Methods".

1.3 DEFINITIONS

A. PTFE: Polytetrafluoroethylene.
B. PVC: Polyvinyl chloride plastic
C. HDPE: High-density polyethylene plastic

1.4 PERFORMANCE REQUIREMENTS

A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature:
   1. Hot-Water Heating Piping: 150 psig at 200 deg F.
   2. Chilled-Water Piping: 150 psig at 200 deg F.
   3. Condenser-Water Piping: 150 psig at 150 deg F.
   4. Makeup-Water Piping: 125 psig at 150 deg F.
   5. Condensate-Drain Piping: 150 deg F.
   6. Blowdown-Drain Piping: 200 deg F.
   7. Air-Vent Piping: 200 deg F.

8. Safety-Valve-Inlet and -Outlet Piping: Equal to the pressure of the piping system to which it is attached.

1.5 SUBMITTALS

A. Product Data: For each type of the following:
   1. Hydronic specialties.

B. Shop Drawings: Detail, at 1/4 (1:50) scale, the piping layout, fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to the building structure. Detail location of anchors, alignment guides, and expansion joints and loops.

C. Welding certificates.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For air control devices, hydronic specialties, and special-duty valves to include in emergency, operation, and maintenance manuals.

F. Water Analysis: Submit a copy of the water analysis to illustrate water quality available at Project site.

1.6 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.
   1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
   2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 01.

1.7 STORAGE OF MATERIALS

A. Store all hydronic piping on site in a clean, dry, clear area on the jobsite – covered and protected from the elements. Pipe is not to be directly on the ground, support pipe off of ground by wood blocking or other material. All pipe ends are to be capped and protected from the elements until piping is ready for installation. Any piping not covered or protected will be required to be removed from the jobsite and replaced at no cost to the owner.

1.8 EXTRA MATERIALS

A. Differential Pressure Meter: For each type of balancing valve and automatic flow control valve, include flowmeter, probes, hoses, flow charts, and carrying case.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Drawn-Temper Copper Tubing: ASTM B 88, Type L (ASTM B 88M, Type B).

B. Annealed-Temper Copper Tubing: ASTM B 88, Type K (ASTM B 88M, Type A).

C. DWV Copper Tubing: ASTM B 306, Type DWV.

D. Wrought-Copper Fittings: ASME B16.22.

E. Wrought-Copper Unions: ASME B16.22.

2.2 STEEL PIPE AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, Grade B, black steel with plain ends; type, grade, and wall thickness as indicated in Part 3 "Piping Applications" Article.

B. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125 and 250 as indicated in Part 3 "Piping Applications" Article.

C. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300 as indicated in Part 3 "Piping Applications" Article.

D. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300 as indicated in Part 3 "Piping Applications" Article.

E. Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.1, Classes 25, 125, and 250; raised ground face, and bolt holes spot faced as indicated in Part 3 "Piping Applications" Article.

F. Wrought-Steel Fittings: ASTM A 234/A 234M, wall thickness to match adjoining pipe.

G. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
   1. Material Group: 1.1.
   2. End Connections: Butt welding.
   3. Facings: Raised face.

H. Grooved Mechanical-Joint Fittings and Couplings:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Anvil International, Inc.
      b. Central Sprinkler Company; a division of Tyco Fire & Building Products.

c. National Fittings, Inc.
d. S. P. Fittings; a division of Star Pipe Products.
e. Victaulic Company of America.

2. Joint Fittings: ASTM A 536, Grade 65-45-12 ductile iron; ASTM A 47/A 47M, Grade 32510 malleable iron; ASTM A 53/A 53M, Type F, E, or S, Grade B fabricated steel; or ASTM A 106, Grade B steel fittings with grooves or shoulders constructed to accept grooved-end couplings; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.
3. Couplings: Ductile- or malleable-iron housing and synthetic rubber gasket of central cavity pressure-responsive design; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.

I. Steel Pipe Nipples: ASTM A 733, made of same materials and wall thicknesses as pipe in which they are installed.

2.3 PRE-INSULATED PIPE

A. Steel or Copper Pipe, Pre-insulated:
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. Insul-Pipe Systems, Inc.
b. Insul-tek
c. Perma-pipe, Inc.
d. Thermal Pipe Systems, Inc.
e. Thermacor Process, L.P.
2. Description: Factory pre-insulated double-wall pipe system.
3. Carrier Pipe:
a. ASTM A 53/A 53M, Grade B, black steel with plain ends; type, grade, and wall thickness as indicated in Part 3 "Piping Applications" Article.
b. Drawn-Temper Copper Tubing: ASTM B 88, Type L (ASTM B 88M, Type B).
c. Provide 6” of exposed pipe at each end for field joint fabrication.
4. Fittings:
a. Wrought-Steel, ASTM A 234/A 234M, wall thickness to match adjoining pipe.
b. Wrought-Copper: ASME B16.22
5. Pipe Insulation: Foamed-in-place polyurethane, 90% closed cell, poured in place, "K" = 0.16 per inch @ 75 degrees F, with a density of not less than 2.5 lbs. per cubic foot. Insulation shall be completely encased within a seamless jacket.
a. Insulation at each end of each length of pipe shall be protected with an end seal bonded both to the carrier pipe and the outer jacket. Piping cuts made in the field must be provided with end-seals equal to factory type.
b. Steel Pipe insulation thickness, minimum: 1.0-inches for NPS 2 and smaller; 1.55-inches for NPS 2-1/2; 1.25-inches for NPS 3; 1.75-inches for NPS 4; 1.68-inches for NPS 6; 1.69-inches for NPS 8; 1.65-inches for NPS 10; and 1.47-inches for NPS 12.
c. Copper Pipe insulation thickness, minimum: 1.12-inches for NPS 2 and smaller; 1.67-inches for NPS 2-1/2; 1.42-inches for NPS 3; 1.93-inches for NPS 4; and 1.93-inches for NPS 6.

d. Roof-mounted piping shall have a minimum insulation thickness of 1-1/2”.

6. Jacket:
   a. PVC; ASTM D-1784, Class 12454-B, of not less than .060 inches thick and able to withstand H-20 highway loading. (Not allowed in return air plenums.)
   b. HDPE; wall of not less than .10 inches thick and able to withstand H-20 highway loading.
   c. Metal spiral (outdoor applications only); internal lock seal, 22 gauge, spiral wound, galvanized steel with a rubber “o” ring formed in the seam, formed into steel tubes.
7. Fitting insulation: Coupling joints on straight runs shall be field wrapped with a sleeve, sealed with heat shrink tape or metal bands and filled with field mixed pour polyurethane foam. Fittings shall be field insulated using a field mixed polyurethane poured between the fitting and fitting cover supplied by the manufacturer that is sealed with self seal or heat shrink tape. Vapor barrier jacketing material for fittings and joints shall be of the same material as the pipe jacketing. Installation shall be as per manufacturer's instructions.

2.4 JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
   1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
      a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
      b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

D. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.

E. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

F. Gasket Material: Thickness, material, and type suitable for fluid to be handled and working temperatures and pressures.

2.5 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper-alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Capitol Manufacturing Company.
   b. Central Plastics Company.
   c. Hart Industries International, Inc.
   d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
   e. Zurn Plumbing Products Group; AquaSpec Commercial Products Division.
2. Factory-fabricated union assembly, for 250-psig minimum working pressure at 180 deg F.

D. 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. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Factory-fabricated companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.

E. Dielectric-Flange Kits:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Advance Products & Systems, Inc.
   b. Calpico, Inc.
   c. Central Plastics Company.
   d. Pipeline Seal and Insulator, Inc.
2. Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
3. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.

F. Dielectric Couplings:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Calpico, Inc.
   b. Lochinvar Corporation.
2. Galvanized-steel coupling with inert and noncorrosive thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

G. 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. Sioux Chief Manufacturing Company, Inc.
   d. Victaulic Company of America.
2. Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

2.6 VALVES

A. Gate, Globe, Check, Ball, and Butterfly Valves: Comply with requirements specified in Mechanical Specification Section "General-Duty Valves for HVAC Piping."

B. Automatic Temperature-Control Valves, Actuators, and Sensors: Comply with requirements specified in Specification Section "Instrumentation and Control for HVAC."

C. Bronze, Calibrated-Orifice, Balancing Valves:
1. Body: Bronze, ball or plug type with calibrated orifice or venturi.
2. Ball: Brass or stainless steel.
3. Plug: Resin.
4. Seat: PTFE.
5. End Connections: Threaded or socket.
6. Pressure Gage Connections: Integral seals for portable differential pressure meter.
7. Handle Style: Lever, with memory stop to retain set position.
8. CWP Rating: Minimum 125 psig.
9. Maximum Operating Temperature: 250 deg F.

D. Cast-Iron or Steel, Calibrated-Orifice, Balancing Valves:
1. Body: Cast-iron or steel body, ball, plug, or globe pattern with calibrated orifice or venturi.
2. Ball: Brass or stainless steel.
3. Stem Seals: EPDM O-rings.
4. Disc: Glass and carbon-filled PTFE.
5. Seat: PTFE.
6. End Connections: Flanged or grooved.
7. Pressure Gage Connections: Integral seals for portable differential pressure meter.
8. Handle Style: Lever, with memory stop to retain set position.
9. CWP Rating: Minimum 125 psig.
10. Maximum Operating Temperature: 250 deg F.

E. Diaphragm-Operated, Pressure-Reducing Valves:
1. Body: Bronze or brass.
2. Disc: Glass and carbon-filled PTFE.
3. Seat: Brass.
4. Stem Seals: EPDM O-rings.
5. Diaphragm: EPT.
6. Low inlet-pressure check valve.
7. Inlet Strainer: stainless steel, removable without system shutdown.
8. Valve Seat and Stem: Noncorrosive.
9. Valve Size, Capacity, and Operating Pressure: Selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.

F. Diaphragm-Operated Safety Valves:
1. Body: Bronze or brass.
2. Disc: Glass and carbon-filled PTFE.
3. Seat: Brass.

4. Stem Seals: EPDM O-rings.
5. Diaphragm: EPT.
6. Wetted, Internal Work Parts: Brass and rubber.
7. Inlet Strainer: stainless steel, removable without system shutdown.
8. Valve Seat and Stem: Noncorrosive.
9. Valve Size, Capacity, and Operating Pressure: Comply with ASME Boiler and Pressure Vessel Code: Section IV, and selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.

G. Automatic Flow-Control Valves (2" and smaller):
1. Body: Brass.
2. Piston and Spring Assembly: Stainless steel, tamper proof, self cleaning, and removable.
3. Combination Assemblies: Include chrome plated brass ball valve.
4. PT plugs: Two PT plugs for flow verification. Plug extensions to be provided on chilled water applications.
5. Identification Tag: Marked with zone identification, valve number, and flow rate.
6. Size: Same as pipe in which installed.
7. Performance: Maintain constant flow, plus or minus 5 percent over system pressure fluctuations.
8. Minimum CWP Rating: 400 psig.
9. Maximum Operating Temperature: 250 deg F.
10. Testing: Valve to be factory leak tested to 100 psi.

H. Automatic Flow-Control Valves (2-1/2" and larger):
1. Body: Ductile-Iron - flanged.
2. Piston and Spring Assembly: Stainless steel, tamper proof, self cleaning, and removable.
3. PT plugs: Two PT plugs for flow verification. Plug extensions to be provided on chilled water applications.
4. Identification Tag: Marked with zone identification, valve number, and flow rate.
5. Size: Same as pipe in which installed.
6. Performance: Maintain constant flow, plus or minus 5 percent over system pressure fluctuations.
7. Minimum CWP Rating: 600 psig.
8. Maximum Operating Temperature: 250 deg F.
9. Testing: Valve to be factory leak tested to 100 psi.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Hot-water heating piping, aboveground (indoor), NPS 2 and smaller, shall be any of the following:
1. Schedule 40 steel pipe; Class 150, malleable-iron fittings; cast-iron flanges and flange fittings; and threaded joints.

2. Type L, drawn-temper copper tubing, wrought-copper fittings, and brazed joints.

B. Hot-water heating piping, aboveground (indoor), NPS 2-1/2 and larger, shall be any of the following:
1. Schedule 40 steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.
2. Type L, drawn-temper copper tubing, wrought-copper fittings, and brazed joints.

C. Chilled-water piping, aboveground (indoor), NPS 2 and smaller, shall be any of the following:
1. Schedule 40 steel pipe; Class 150, malleable-iron fittings; cast-iron flanges and flange fittings; and threaded joints.
2. Type L, drawn-temper copper tubing, wrought-copper fittings, and brazed joints.

D. Chilled-water piping, aboveground (indoor), NPS 2-1/2 and larger, shall be any of the following:
1. Schedule 40 steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.
2. Schedule 40, steel, pre-insulated pipe, wrought-steel fittings, and welded joints.
3. Type L, drawn-temper copper tubing, wrought-copper fittings, and brazed joints.

E. Chilled and hot-water piping, outdoor, all sizes, shall be any of the following:
1. Schedule 40 steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.
2. Schedule 40, steel, pre-insulated pipe, wrought-steel fittings, and welded joints.
3. Type L, copper, pre-insulated pipe, wrought-copper fittings, and brazed joints.

F. Chilled-water piping, below ground, NPS 2-1/2 and larger, shall be any of the following:
1. Schedule 40, steel, pre-insulated pipe, wrought-steel fittings, and welded joints.

G. Hot-water piping, below ground, NPS 2-1/2 and larger, shall be any of the following:
1. Schedule 40, steel, pre-insulated pipe, wrought-steel fittings, and welded joints.

H. Chilled- and hot-water piping, in crawl space, all sizes, shall be any of the following:
1. Schedule 40, steel, pre-insulated pipe, wrought-steel fittings, and welded joints.
2. Type L, copper, pre-insulated pipe, wrought-copper fittings, and brazed joints.

I. Makeup-water piping installed aboveground shall be the following:
1. Type L (B), drawn-temper copper tubing, wrought-copper fittings, and soldered joints.

J. Condensate-Drain Piping: Type DWV, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.

K. Blowdown-Drain Piping: Same materials and joining methods as for piping specified for the service in which blowdown drain is installed.

L. Air-Vent Piping:

1. Inlet: Full size of vent inlet, same pipe material as service.
2. Outlet: Type L (Hard) drawn-temper copper tubing with soldered joints (full size of outlet).

M. Safety-Valve-Inlet and -Outlet Piping for Hot-Water Piping: Same materials and joining methods as for piping specified for the service in which safety valve is installed.

N. Grooved, mechanical joint coupling and fittings shall only be used for equipment connections to facilitate equipment removal and/or service.

3.2 PIPING INSTALLATIONS

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicate piping locations and arrangements if such 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.

B. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Select system components with pressure rating equal to or greater than system operating pressure.

K. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

L. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.

M. Install piping at a uniform grade of 0.2 percent upward in direction of flow.

N. Reduce pipe sizes using eccentric reducer fitting installed with level side up.

O. Install branch connections to mains using mechanically formed tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.

P. Install valves according to Mechanical Specification Section "Valves and Specialties for HVAC Piping."

Q. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.

R. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.

S. Identify piping as specified in Specification Section "Mechanical Identification" If applicable.

T. Provide dielectric flange at 12” above grade at pipe transition from buried to above ground condition.

3.3 HANGERS AND SUPPORTS

A. Hanger, support, and anchor devices are specified in Specification Section "Hangers and Supports." Comply with the following requirements for maximum spacing of supports.

B. Install the following pipe attachments:
1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
4. Spring hangers to support vertical runs. Provide riser clamps at all through floor penetrations.
5. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

C. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:
1. NPS 3/4: Maximum span, 7 feet; minimum rod size, 3/8 inch.
2. NPS 1: Maximum span, 7 feet; minimum rod size, 3/8 inch.
3. NPS 1-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
4. NPS 2: Maximum span, 10 feet; minimum rod size, 3/8 inch.
5. NPS 2-1/2: Maximum span, 11 feet; minimum rod size, 1/2 inch.
6. NPS 3: Maximum span, 12 feet; minimum rod size, 1/2 inch.
7. NPS 4: Maximum span, 12 feet; minimum rod size, 5/8 inch.
8. NPS 6: Maximum span, 5 feet; minimum rod size, 3/4 inch.
9. NPS 8: Maximum span, 5 feet; minimum rod size, 3/4 inch.
10. NPS 10: Maximum span, 5 feet; minimum rod size, 7/8 inch.
11. NPS 12: Maximum span, 5 feet; minimum rod size, 7/8 inch.

D. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:
   1. NPS 3/4: Maximum span, 5 feet; minimum rod size, 3/8 inch.
   2. NPS 1: Maximum span, 6 feet; minimum rod size, 3/8 inch.
   3. NPS 1-1/2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
   4. NPS 2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
   5. NPS 2-1/2: Maximum span, 9 feet; minimum rod size, 1/2 inch.
   6. NPS 3: Maximum span, 10 feet; minimum rod size, 1/2 inch.

E. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.

3.4 PIPE JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Mechanical Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
   1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
   2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

I. Grooved Joints: Assemble joints with coupling and gasket, lubricant, and bolts. Cut or roll grooves in ends of pipe based on pipe and coupling manufacturer's written instructions for pipe wall thickness. Use grooved-end fittings and rigid, grooved-end-pipe couplings.

3.5 HYDRONIC SPECIALTIES INSTALLATION

A. Install pressure/temperature (PT) plugs at locations identified on the drawing schematics, diagrams, details and floor plans. At minimum, provide PT plugs at all pump, chiller, boiler, fan coil and air handler inlet and outlet connections. PT plugs shall have minimum 6-inch clear access and the mounting angle shall be vertical.

B. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.

C. Install automatic air vents at high points of system piping in mechanical equipment rooms only. Manual vents at heat-transfer coils and elsewhere as required for air venting.

D. Install Y strainer, drain valve with hose connection, PT plugs, manual air vent and union on inlet of all coils. Install union with manual air vent and PT plugs on return piping between coil and control valve.

E. Install coalescing air/dirt separator in pump suction. Install blowdown piping with gate or full-port ball valve; extend full size to nearest floor drain.

F. Install expansion tanks on the floor with 5-1/2-inch housekeeping pad. Vent and purge air from hydronic system, and ensure tank is properly charged with air to suit system Project requirements.

G. Install PT plugs for verification of all DDC mounted pressure and temperature sensors. PT plugs to be adjacent to all DDC pipe mounted sensors. PT plugs shall have minimum 6-inch clear access and the mounting angle shall be vertical.

H. Provide brass nipples at all pipe gages, (temperature & pressure) and any connection for DDC sensors. Nipples no shorter than 2”.

3.6 PAINTING

A. Paint all welded joints for piping, valves, and piping specialties. Paint shall be applied prior to insulation, where insulation is required in other Sections.
   1. Alkyd System: MPI EXT 5.1D.
      a. Prime Coat: Alkyd anticorrosive metal primer.
      b. Color: Gray or red.

3.7 FIELD QUALITY CONTROL

A. Prepare hydronic piping according to ASME B31.9 and as follows:
   1. Leave joints, including welds, non-insulated and exposed for examination during test.
   2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
   3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.

4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

B. Perform the following tests on hydronic piping:
1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
3. Isolate expansion tanks and determine that hydronic system is full of water.
4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A in ASME B31.9, "Building Services Piping."
5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components and repeat hydrostatic test until there are no leaks.
6. Prepare written report of testing.

C. Perform the following before operating the system:
1. Open manual valves fully.
2. Inspect pumps for proper rotation.
3. Set makeup pressure-reducing valves for required system pressure.
4. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
5. Set temperature controls so all coils are calling for full flow.
6. Inspect and set operating temperatures of hydronic equipment, such as boilers, chillers, cooling towers, to specified values.
7. Verify lubrication of motors and bearings.

3.8 X-RAY FIELD VERIFICATION

A. If desired by engineer, contractor to provide on-site field X-Ray verification of 2-welds. Testing to be executed with engineer present.

3.9 CLEANING AND FLUSHING

A. Chilled, hot and condenser water systems, including coils, heat exchangers, boilers, and other system components shall be thoroughly flushed and cleaned before placing in operation to rid systems of rust, dirt, piping compound mill scale, oil, grease, and any and all other material foreign to the media being circulated.
1. New piping in renovation projects shall be flushed before connecting to existing systems.

B. The Contractor shall contact the Owner's approved chemical provider and water treatment consultant for recommendations and a review of the proposed plan for flushing and cleaning procedures prior to installation of any system piping or equipment components. The plan must be submitted and reviewed by the Owner's Representative prior to the installation of any piping system components. Failure to submit this plan shall be considered sufficient cause for rejection and replacement of any system components installed.

C. The procedure for cleaning and flushing these water systems shall be as follows:
   1. Initial flushing and cleaning of the main piping (prior to connections at piping run-outs to unit ventilators and fan coil units from main lines) system shall be accomplished by installing temporary by-passes at air handling unit coils, pumps, chillers, boilers or other major equipment and the main piping runs to allow the system to be "back-flushed" (water circulated in the system in the opposite direction from its normal flow). This flushing shall be accomplished by circulating water through the system at a rate equal to that of the system pumps and bleeding-making up water to the system until at least ten (10) times the system volume has been made-up and discharged.
   2. Following this initial flushing, drain system and refill the system, add cleaning chemicals, and circulate the system for a period as recommended by the firm responsible for cleaning the system. Drain and make-up the system while circulating until the system tests clean. Following satisfactory tests, drain and refill the system with fresh water and corrosion treatment as recommended by the chemical firm.
   3. Final connections to air handling unit coils, chillers, boilers, etc. and piping run-outs from mains to unit ventilators and fan-coil units may now be accomplished. All piping, fittings, etc. used for these run-out connections shall be visually examined and the interior cleaned prior to installation.
   4. Following completion of final system connections, the flushing and cleaning processes hereinbefore described as initial cleaning and flushing shall be repeated with system water being circulated in its normal direction and thru all coils and equipment.
   5. After each flushing or cleaning process hereinbefore indicated remove and thoroughly clean all start-up and permanent strainers.
   6. After the final system cleaning and flushing is completed, all strainers shall be cleaned, start-up strainers removed, permanent strainers installed, and inhibitor compounds or the type and concentrations acceptable to the Owner's Representative shall be introduced into the system by the firm selected to perform the cleaning and flushing services. System water pumps shall not be operated for any sustained period of time (over 48 hours total) for any reason other than cleaning and flushing until the Contractor has filed with the Owner's Representative, a report stating that the systems are clean, the inhibitor compounds have been introduced into the system, all strainers are cleaned, and new filters have been installed in the system filter-feeders.
   7. Chemicals and inhibitor compounds used for cleaning and flushing processes shall be provided by the company performing the cleaning and flushing services. Chemicals shall be approved by a listed water treatment provider specified in Specification Section "HVAC Water Treatment."

END OF SECTION

SECTION 23 81 25

DUCTLESS SPLIT SYSTEM AIR CONDITIONERS

PART 1 - GENERAL

1.1 SYSTEM DESCRIPTION

A. Single, indoor, direct expansion, wall mounted fan coil matched with an outdoor condensing unit.

B. Outdoor-mounted, air-cooled split system outdoor section suitable for on-the-ground, rooftop, or wall hung installation. Unit shall consist of a hermetic or rotary compressor, an air-cooled coil, propeller-type blow-thru outdoor fans, accumulator, full refrigerant charge, and control box. Unit shall discharge air horizontally. Units shall function as the outdoor component of an air-to-air cooling system. Unit shall be used in a refrigeration circuit matched to a duct-free cooling fan coil unit.

1.2 QUALITY ASSURANCE

A. Systems shall be rated and certified in accordance with ARI Standards 210/240. Units shall be listed in the ARI directory as a matched set.

B. Systems shall be listed with UL (Underwriters' Laboratories), UL Canada, or ETL (Electrical Testing Laboratories).

C. Condensing unit cabinet shall be capable of withstanding Federal Test Standard No. 141 (method 6061) 500-hour salt spray test.

D. Air-cooled condenser coils shall be leak tested at 350-psig-air pressure with the coil submerged in water.

E. All wiring shall be in accordance with the NEC (National Electrical Code).

1.3 SUBMITTALS

A. Shop drawings.

B. Product data.

C. 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.

D. Contract closeout information:
1. Operating and maintenance data.
2. Owner instruction report.
3. Test report.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Units shall be shipped in one piece and shall be stored and handled per unit manufacturer’s recommendations.

1.5 WARRANTY

A. One-year parts, 5-year compressor limited warranty.

PART 2 - PRODUCTS

2.1 DUCTLESS SPLIT AIR CONDITIONING UNIT

A. Acceptable manufacturers:
1. Ductless split air heat pump conditioners:
a. Mitsubishi
b. Daikin
c. LG
d. Liebert
e. Other as approved by engineer.

2.2 INDOOR UNIT

A. General:

1. Indoor, direct-expansion, wall mounted fan coil. Fan coil shall be factory assembled and shipped complete with cooling coil, fan, fan motor, insulated piping connectors, controls, and mounting plate.

B. Unit Cabinet:
   1. Unit cabinet shall be high strength molded plastic.
   2. Casing shall have an integral sensor for reading the infrared signal from a wireless remote controller.
   3. Matching mounting brackets shall be provided.
   4. Color shall be white.

C. Fans:
   1. Indoor fans shall be 3-speed (minimum) direct drive type.
   2. Automatic, motor-driven horizontal air sweep shall be provided.
   3. Fans shall be statically and dynamically balanced, with permanently lubricated bearings.

D. Coils:
   1. Indoor coils shall be copper tube with aluminum fins and galvanized steel tube sheets. Braze all tube joints.
   2. Fins shall be bonded to the tubes by mechanical expansion.
   3. A drip pan under the coil shall have a drain connection for the hose attachment to remove condensate.
   4. Coil and piping shall have a dry nitrogen gas charge from the factory.
   5. Coils shall be factory pressure tested.
   6. Provide multiple options for refrigerant piping and condensate piping field connections.

E. Filters:
   1. Unit shall have a filter rack with a factory supplied cleanable filter, accessible from the front.

F. Controls:
   1. Controls shall consist of a unit installed microprocessor, which shall control space temperature and determine optimum fan speed. The temperature control range shall be from 64F to 84F. The unit shall have the following functions as a minimum:
      a. Automatic restart after power failure at the same operating conditions as at failure.
      b. Wall mounted controller or wireless remote control to enter set points and operating conditions.
      c. Cooling mode to provide modulating fan speed based on the difference between temperature setpoint and space temperature.
      d. Fan-only operation to provide room air circulation when no cooling is required.
      e. Fan speed control shall be user-selectable during all operating modes.
      f. Automatic airsweep control to provide on or off activation of airsweep louvers.
      g. A time delay shall prevent compressor restart in less than 2 to 4 minutes.
      h. An indoor to outdoor control connection cable of suitable length shall be provided with the fan coil unit.

i. Self-diagnostic capability with diagnostic/fault codes displayed at the controller.
j. Total hours of compressor run time shall be logged.
k. Ability to receive and process commands from the controller or wireless remote.

G. Electrical Requirements:
1. Unit shall operate on single-phase, 60 cycle power at 208/230V as specified on the equipment schedule.
2. Each units electrical power shall be a single point connection, unless indoor unit is powered from the outdoor unit.
3. Unit control voltage shall be 24V. All power and control wiring shall be installed per NEC and all local building codes.
4. Unit shall have low-voltage terminal block connections.

2.3 CONDENSING UNIT

A. General:
1. Factory assembled, single piece, air-cooled outdoor unit. Contained within the unit enclosure shall be all factory wiring, piping, controls, compressor, and a full charge of R-410a refrigerant.

B. Unit Cabinet:
1. Unit cabinet shall be constructed of galvanized steel, bonderized and coated with a baked-enamel finish.
2. Unit access panels shall be removable with minimal screws and shall provide full access to the compressor, fan, and control components.
3. Outdoor compartment shall be isolated and have an acoustic lining to assure quiet operation.

C. Fans:
1. Outdoor fans shall be direct-drive propeller type and shall discharge air horizontally. Fans shall blow air through the outdoor coil.
2. Outdoor fan motors shall be totally enclosed; single-phase motors with class B insulation and permanently lubricated sleeve bearings. Motor shall be protected by internal thermal overload protection.
3. Shaft shall have inherent corrosion resistance.
4. Fan blades shall be corrosion resistant and shall be statically and dynamically balanced.
5. Outdoor fan openings shall be equipped with protection grille over fan.

D. Compressor:
1. Compressor shall be a variable speed, inverter driven type.
2. Compressor shall be equipped with oil system, operating oil charge, and motor. Internal overloads shall protect the compressor from overtemperature and overcurrent.
3. Motor shall be NEMA rated class F, suitable for operation in a refrigerant atmosphere.
4. Compressors shall be equipped with crankcase heaters to minimize liquid refrigerant accumulation in compressor during shutdown and to prevent refrigerant dilution of oil.

5. Compressor assembly shall be mounted to avoid the transmission of vibration.
6. Compressors shall have a 208 volt single-phase power requirement.

E. Outdoor Coil:
1. Coil shall be constructed of aluminum fins mechanically bonded to internally enhanced, seamless copper tubes, which are cleaned, dehydrated, and sealed.
2. Coil shall be provided with a metal hail guard of either louvered construction or ½" x ½" wire mesh.
3. Coils shall be factory pressure tested.

F. Refrigeration Components:
1. Refrigerant circuit components shall include brass external liquid line service valve with service gage port connections, suction line service valve with service gage connection port, service gage port connections on compressor suction and discharge lines with Schrader type fittings with brass caps, accumulator, liquid line filter, pressure relief, and a full charge of refrigerant.
2. Refrigerant flow shall be controlled by either an expansion valve or a metering orifice.

G. Controls and Safeties:
1. Operating controls and safeties shall be factory selected, assembled, and tested. The minimum control functions shall include the following:
   a. Controls:
      1) Time delay restart to prevent compressor reverse rotation.
      2) Automatic restart on power failure.
      3) Safety lockout if any outdoor unit safety is open.
      4) A time delay control sequence provided through the fan coil board, thermostat, or controller.
      5) Liquid line low-pressure switches.
      6) Automatic outdoor-fan motor protection.
      7) Start capacitor and relay.
   b. Safeties:
      1) System diagnostics.
      2) Compressor motor current and temperature overload protection.
      3) High-pressure relief.
      4) Outdoor fan failure protection.
2. Electrical Requirements:
   a. Unit electrical power shall be a single point connection.
   b. All power and control wiring must be installed per NEC and all local building codes.
   c. High and low voltage terminal block connections.

H. Operating Range:
1. The outdoor unit shall be capable of operating in cooling mode between 15°F and 115°F.

2.4 REFRIGERANT PIPING AND ELECTRICAL WORK

A. Refrigerant Piping:
1. Maximum piping length and/or maximum height difference shall not be exceeded.

B. Control wiring: Provide wiring between components for control functions.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The system must be installed by a licensed contractor or dealer that has been trained by the equipment manufacturer or a factory certified manufacturer's agent.

B. Install in accordance with manufacturer's instructions and recommendations.

C. Connect piping, wiring and control wiring.
   1. Install either a wall mounted, wired controller or a wall bracket for the wireless remote controller.

D. Refer to drawing sheets for condensate pump routing or location of condensate pump.

E. Install condensing unit on a concrete pad if mounted on grade. Refer to Section "Special Conditions for All Mechanical Work," paragraph 2.10 for pad requirements. Install condensing unit on one or more equipment rails if roof mounted. Refer to Section "Special Conditions for All Mechanical Work," paragraph 3.9 for requirements. Secure unit to pad or equipment rails.

F. Where traps are not required by the equipment manufacturer, all offsets shall use 45 degree fittings and have a minimum 3:1 length to offset ratio.

END OF SECTION

SECTION 23 82 19

FAN-COIL 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 fan-coil units and accessories.

1.3 DEFINITIONS

A. BAS: Building automation system.

1.4 SUBMITTALS

A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories.

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.

C. Coordination Drawings: Floor plans, reflected ceiling plans, and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
   1. Ceiling suspension components.
   2. Structural members to which fan-coil units will be attached.
   3. Method of attaching hangers to building structure.
   4. Size and location of initial access modules for acoustical tile.
   5. Items penetrating finished ceiling, including the following:
      a. Lighting fixtures.
      b. Air outlets and inlets.
      c. Speakers.
      d. Sprinklers.
      e. Access panels.
   6. Perimeter moldings for exposed or partially exposed cabinets.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For fan-coil units to include in emergency, operation, and maintenance manuals. In addition to items specified in Section "Operation and Maintenance Data," include the following:

1. Maintenance schedules and repair part lists for motors, coils, integral controls, and filters.

F. Warranty: Special warranty specified in this Section.

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.

1.6 COORDINATION

A. Coordinate layout and installation of fan-coil units and suspension system components with other construction that penetrates or is supported by ceilings, including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.

B. Coordinate size and location of wall sleeves for outdoor-air intake.

1.7 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 (Compressor Only): Five years from date of Substantial Completion.

1.8 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. Fan-Coil-Unit Filters: Furnish one (1) spare filter for each filter installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

B. In the Fan-Coil-Unit Schedule where titles below are column or row headings that introduce lists, the following requirements apply to product selection:
1. Basis-of-Design Product: The design for each fan-coil unit is based on the product named on the drawing schedule. Subject to compliance with

requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

2.2 FAN-COIL UNITS

A. Manufacturers: Subject to compliance with requirements; provide products by one of the following:
   1. Carrier Corporation.
   2. Lennox Industries, Inc.
   3. McQuay International.
   4. Trane.
   5. YORK International Corporation.

B. Unit Construction
   1. The cabinets shall be constructed of heavy-gauge zinc-coated steel. All steel surfaces are cleaned, phosphatized, rinsed, and dried before application of final finish paint. The paint shall be applied by an electrostatic powder spray system. The minimum thickness of paint shall be 1.5 mil that results in an appliance-grade finish.
   2. Cabinet end pockets shall be a minimum of 12 inches wide to facilitate piping and service. If less than 12 inches, unit manufacturer shall provide an extended cabinet or piping enclosure.

C. Floor-Mounted Unit Ventilators
   1. Floor-mounted units shall have an integral pipe tunnel for convenient crossover of piping or electrical wiring. The front surface shall consist of three removable panels for quick access.
   2. The unit discharge grille shall be of a double deflection type to throw air in two directions (optional).
   3. To prevent entry of small objects into the fan, draw-through units shall be provided with a discharge grille screen.
   4. Units shall have four adjustable leg levelers.
   5. End panels shall be factory-installed on the unit.

D. Fan Assembly and Motor
   1. Electronically commutated motors (ECM): All motors are brushless DC (BLDC) electronically commutated motors (ECM) factory programmed and run tested in assembled units. The motor controller is mounted in a control box with a built in integrated user interface and LED tachometer. If adjustments are needed, motor parameters can be adjusted through momentary contact switches accessible without factory service personnel on the motor control board. Motors will soft ramp between speeds to lessen the acoustics due to sudden speed changes. Motors can be operated at three speeds or at variable speed with factory supplied or field supplied controllers. The motors have integral overload protection with a maximum ambient operating temperature of 104.0 F and use permanently sealed ball bearings. Motors can operate at plus or minus 10 percent of rated voltage on all speed settings.
   2. A factory-mounted High-Medium-Low-Off switch shall control motor speed. Provide actual airflow data per specific coil option.
   3. For quick maintenance, the fan board assembly shall be a single, rigid assembly including fans, fan housing, bearing, and fan shaft. Fan assembly shall be

easily removable through the front panel with two screws.

4. Fan/coil arrangement shall be blow-through design to eliminate debris from falling into the spinning fan. This safety consideration helps prevent personal injury, noise, or equipment damage. The blow-through design shall protect the coil from freezing by placing the coil farther away from the inlet and mixing the room air and fresh air before it blows across the coil. The coil shall be placed near the discharge opening in order to attenuate fan noise.
5. Provide quick connects for the fan motors for easy maintenance and removal.

E. Fresh Air and Room Air Dampers
1. The unit shall be equipped with a single-blade, mixing damper capable of varying the proportion of mixed air from 100 percent room air to 100 percent fresh air.
2. Provide an ultra-low leak damper seal with stainless steel jamb seals. Leakage shall be less than 1 percent against 0.5 inches of external static pressure.
3. Damper shall contain a continuous divider placed between the damper blades to separate the fresh air and room air compartments to prevent blow-through.

F. Unit Capacity, Airflow and Ventilation Performance

1. Unit manufacturer shall provide airflow performance data by specific option and size per ARI 840-98.
2. Manufacturers providing units not ARI 840 certified must provide, at their expense, certified, independent, balancing reports verifying compliance to scheduled performance and minimum ventilation effectiveness per ARI 840. These reports shall be submitted to the mechanical engineer for approval.

G. Drain Pan
1. Unit drain pans are to be dual-sloped internal to the unit.
2. Drain pan location shall facilitate visual inspection and cleaning. The drain pan shall be easily removable without the use of tools.
3. The drain outlet shall be field configurable to either end pocket.
4. The drain pan shall be constructed of smooth, corrosion resistant material. Stainless steel drain pans shall be provided as an equal to polymer resin drain pans.
5. An auxiliary drain pan shall be provided which fully covers the factory-provided piping packages (optional).
6. The condensate drain shall be internally or externally trapped via accepted ASHRAE guidelines.

H. Coils
1. Coils shall be selected in accordance with ARI 440.
2. Hydronic Coils
   a. Hydronic coils shall be constructed with copper tubes and mechanically bonded aluminum corrugated plate fins. All coils shall have aluminum individual unshared fin surfaces.
   b. A threaded drain plug shall be furnished at the lowest point of the coil.
   c. A manual air vent shall be provided at the highest point of the coil.
3. Piping Packages
   a. Piping packages shall be provided by the unit manufacturer for hydronic coils and shipped in the unit end pocket.
   b. Packages shall consist of coil unions for easy removal, 2 or 3-way control

or isolation valves, ball-type shutoff valves, PT ports and flow balancing device.

I. Filters: Each unit shall be equipped with a single 1-inch thick, pleated filter accessible through the removal of a single unit front panel.

J. Underwriters Laboratory: Unit Ventilators shall be listed by Underwriters Laboratory, Inc. for the United States and Canada.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive fan-coil units for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in for piping and electrical connections to verify actual locations before fan-coil-unit installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install fan-coil units level and plumb.

B. Install fan-coil units to comply with NFPA 90A.

C. Suspend fan-coil units from structure with elastomeric hangers. Vibration isolators are specified in Specification Section "Mechanical Vibration and Seismic Controls."

D. Verify locations of thermostats, humidistats, and other exposed control sensors with Drawings and room details before installation. Install devices 48 inches (1220 mm) above finished floor.

E. Install new filters in each fan-coil unit within two weeks after Substantial Completion.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Mechanical Sections. Drawings indicate general arrangement of piping, fittings, and specialties. Specific connection requirements are as follows:
   1. Install piping adjacent to machine to allow service and maintenance.
   2. Connect piping to fan-coil-unit factory hydronic piping package. Install piping package if shipped loose. All connections shall be hard-piped; hose connections are not permitted.
   3. Connect condensate drain to indirect waste.
      a. Install condensate trap of adequate depth to seal against the pressure of fan. Install cleanouts in piping at changes of direction.
      b. Provide and install a condensate detection system that shuts down the unit fan upon an overflow condition, as required by the local code authority.

B. Connect supply and return ducts to fan-coil units with flexible duct connectors specified in Specification Section "Duct Accessories." Comply with safety requirements in UL 1995 for duct connections.

C. Ground equipment according to Specification Section "Grounding and Bonding."

D. 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. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
   2. Operate electric heating elements through each stage to verify proper operation and electrical connections.
   3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

B. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION

SECTION 26 00 05

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 below-grade 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.

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 00 15

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 life 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 word “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 contractor's 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 of approval (if not published in an addenda) for purposes of future verification.
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 contractor's 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 in pdf format. 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.
   2. A table of contents will follow the first page and shall list all of the sections contained in the specification 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 specification 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 arrive, he will assume all costs for furnishing 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:
         1) 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 ⅛-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 certification 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 manufacturer's and is properly installed and operating in accordance with the recommendations and are asbestos free."

_____

Name and Company

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 owner's representative elects to keep the equipment it shall be contractor's 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 owner’s representative or shall be awaiting parts or supplies that are “on order”. The contractor at the owner’s 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.
      l. 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 above-mentioned 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 contractor's 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" $\times$ 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 ¼ inch, except that the minimum clearance shall be ½ inch where piping contacts the ground. Sleeves through floors shall extend ¾ 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 ¾ 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 roof-mounted 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:
   1. 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 specification 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 00 50

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 circuit-breaker 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.
   5. 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. Where exterior electrical equipment is mounted on unistrut racks and the top of the mounted equipment is taller than 60” above the mounting surface, provide rear triangular support for unistrut rack angled 30 degrees connected 2/3 way up the rack and mounted to the same structure as the unistrut rack. If mounting on a roof assembly support for the rear support shall go through the roof at 90 degrees.

M. Install sleeves for cable and raceway penetrations of concrete slabs and walls. 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.
   1. Exception: Sleeves are not required for core-drilled penetrations where the hole is the same size as the outer conduit dimension. Tape or wrap conduit in contact with the concrete and firecaulk as required to maintain fire rating.

N. Provide x-ray scans for all penetrations through concrete floors that are post tension.

O. 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 05 19

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-70.
   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-70.
   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 Size 6-14 AWG:
   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.

C. Pre-Insulated Multi-Conductor Connectors Dry Location for conductors larger than #6.
   1. UL Listed rated for 90 degree C, insulated with high dialectric plastisol or equal, UV resistance, Polaris, NSI, or equal.
   2. Dual rating for copper and/or aluminum.
   3. Provide correct type based upon wire stranding (fine or coarse).
   4. Supplied with removable plugs.

D. Pre-Insulated Multi-Conductor Connectors Wet or submersible Dry Location for conductors larger than #6.
   1. UL Listed rated for 90 degree C, insulated with 125 mils rubber or equal, UV resistance, Polaris, NSI, or equal.
   2. Dual rating for copper and/or aluminum.

3. Provide correct type based upon wire stranding (fine or coarse).
4. Supplied with removable plugs.

E. Pre-insulated single conductor in-line connector for conductors larger than #6 Dry Location.
1. UL Listed rated for 90 degree C, insulated with high dialectric plastisol or equal, UV resistance, Polaris, NSI or equal.
2. Dual rating for copper and/or aluminum.
3. Provide correct type based upon wire stranding (fine or coarse).
4. Supplied with removable plugs.

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. Install exposed cables parallel and perpendicular to surfaces of exposed structural members and follow surface contours where possible.

F. Install without damaging conductors/cable, shield, or jacket.
1. Do not bend conductors/cable, in handling or installation, to smaller radii than minimum recommended by manufacturer.
2. All new installation cabling shall be one piece without breaks or splices except at device connections.

G. Conductor/Cable extensions if indicated: Provide splices and connectors suitable for the environment and conductors. Each conductor to be individually extended using either pre-insulated in-line connectors or hydraulically crimped butt connectors with 3m Scotchcast™ resin kits to complete the insulation. Connector and insulation shall be suitable for environment. All splice and tap connectors shall be compatible with cable material. Make no splices except at indicated splice points.

H. Conductor/Cable splits: Provide multi-conductor pre-insulated connectors suitable for environment with specific number of connectors to split. Provide with wireway or pull box for access. Torque to manufacturers specific requirements. Provide configuration per connections. For service wireways, provide with in-tap-out for future use.

I. Pull conductors/cables without exceeding manufacturer's recommended pulling tensions.
1. Pull simultaneously if more than one is being installed in same raceway.
2. Use pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation.
3. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage media or raceway.

J. Provide pull boxes as per NEC.

K. Provide junction or pull boxes at all splice points.

L. Support cables according to Section “Basic Electrical Materials and Methods.”

M. Seal around cables penetrating fire-rated elements according to Section “Firestopping.”

N. 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 05 33

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. Non UL listed FMC is not allowed for any line voltage (greater than 70V) system.

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. Penetrations though exterior walls: RMC or IMC
   12. Embedded in Concrete: Only in Approved locations – wrapped RMC or IMC.
   13. 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 1.5x (times) 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 or any signal below 50V 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 of compacted earth 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 opening fire rating 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 (½ 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 (½ 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 semi-recessed 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.

PP. Wireways or gutters above panelboards, switchboards, distribution boards, or any other circuit distributing panel shall not be wider than 1.5x (times) the width of the panel or panels if adjoining.

QQ. Under no circumstances shall wireways, pull boxes, or gutters wrap the room and be used as a channel for circuits, unless specifically called out by the engineer or per manufacturers shop drawings.

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 13 10

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, ¾-inch flanges, screw covers, etc.

B. For exterior work, provide galvanized sheet metal boxes of code thickness with lapped and welded joints, ¾-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 2⅛ 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. Pull boxes, wireways or gutters above panelboards, switchboards, distribution boards, or any other circuit distributing panel shall not be wider than 1.5x (times) the width of the panel or panels if adjoining.

G. Under no circumstances shall wireways, pull boxes, or gutters wrap the room and be used as a channel for circuits, unless specifically called out by the engineer or per manufacturers shop drawings.

H. Observe maximum conductor fill as required by the National Electrical Code.

END OF SECTION

SECTION 26 28 16

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.
      c. Eaton
   2. Combination Circuit Breaker and Ground Fault Trip:
      a. Siemens Energy & Automation, Inc.
      b. Square D Co.
      c. Eaton
   3. Molded-Case, Current-Limiting Circuit Breakers:
      a. Siemens Energy & Automation, Inc.
      b. Square D Co.
      c. Eaton
   4. Integrally Fused, Molded-Case Circuit Breakers:
      a. Siemens Energy & Automation, Inc.
      b. Square D Co.
      c. Eaton

2.2 DISCONNECT SWITCHES

A. General: Heavy Duty safety switch, service entrance rated if indicated, with grounding lug kit, rated for equipment amperage, capable to be locked in the open position, with number of poles matching equipment connections.

B. Enclosed, 600V Nonfusible Switch: NEMA KS 1, Type HD, with lockable handle. Switch shall be rated for equipment amperage.

C. 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 amperage.

D. 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, 304 stainless steel.
3. Kitchen Locations: Type 4X 304 stainless steel.
4. Pools and Coastal Locations: Type 4X 316 stainless steel.
5. Hazardous Areas Indicated on Drawings: Type 7 stainless steel.

E. Lugs: Mechanical lugs and power-distribution connectors for number, size, and material of conductors indicated.

F. Shunt Trip: Where indicated.

G. Accessories: As indicated.

2.3 ENCLOSED CIRCUIT BREAKERS

A. Enclosed, Molded-Case Circuit Breaker: UL 489, with lockable handle. Bolt on mounting.

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 circuit 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, 304 stainless steel.
3. Hazardous Areas Indicated on Drawings: Type 7 stainless steel.
4. Kitchen Locations: Type 4X 304 stainless steel.

5. Pools and Coastal Locations: Type 4X 316 stainless steel.

M. Surge Protective Device: 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.

2.4 MOTOR CONTROL CENTER ADDED BREAKERS

A. Motor circuit breakers shall be thermal magnetic breakers.

B. Match AIC ratings.

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. Height of handle centerline shall not exceed 68 inches. Provide required clearance in front of disconnect switches voltage requirements by NEC.

C. Install disconnecting means (safety switch, enclosed circuit breaker, motor rated switch) for equipment independent of the equipment unless directly by engineer. In interior installations, mount on unistrut racks or suspend from structure. Exterior installations shall be mounted on galvanized unistrut racks. Provide working clearance in front of disconnecting means. Interior above ceiling disconnecting means shall be clearly visible from the equipment point of connection. Coordinate location with equipment.

D. Install wiring between disconnect switches, circuit breakers, control, and indication devices.

E. Provide power to all shunt trip circuit breakers/switches from panel the breakers are mounted in or fed from unless indicated otherwise on drawings. Provide 20A 1P CB and label shunt trip power.

F. Grounding: Ground case and metallic conduit of disconnects.

G. Provide working clearance in front of disconnect switch per NEC, minimum 36 inches.

H. 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.

I. Label and identify each disconnect switch and enclosed circuit breaker according to requirements specified in Section "Electrical Identification." Labels shall be 1" for 100A and smaller, 2" for 200 – 400A switches, and 3 inch for larger switches.

J. Label and identify each switch and breaker in MCC, distribution panels, and switchboards with 1" permanent engraved label indicating name and rating.

K. Engage factory tech to set all adjustable breaker settings per actual equipment installed. Coordinate with manufacturer for required settings and engage qualified agency (testing company/manufacturer) to obtain breaker settings.

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 51 00

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. 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: 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.

D. 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.

E. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

F. 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.

1. Warranties for LED Drivers; Written warranty, executed by manufacturer agreeing to replace LED drivers that fail in materials or workmanship within five years from date of manufacture, but not less than four years from date of Substantial Completion.
2. Warranties for Electronic Ballasts; Written warranty, executed by manufacturer agreeing to replace Electronic Ballasts that fail in materials or workmanship within 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. LED Fixtures: Provide 10 extra 2x4 fixtures in boxes. Deliver to owner.
   2. 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. Post-bid 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:
   1. Steel, unless otherwise indicated.
   2. Form and support to prevent warping and sagging.
   3. Housing painted after fabrication.
   4. Smooth hemmed sides and smooth inward formed end flanges.

C. Doors, Frames, and Other Internal Access:
   1. 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.

2. Standard extruded aluminum door frame has superior structural integrity with premium appearance and mitered corners. Door frame is painted after fabrication, standard. Powder-painted rotary cam latches provide easy, secure door closure. Integral T-bar clips are standard. Acrylic shielding materials is 100% UV stabilized.

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.

G. Housings: Manufacturers standard with integral heat sink.

H. Fixture Type Components:
1. Cylinder: With integral mounting provisions.
2. Downlight:
   a. Universal mounting bracket.
   b. Integral junction box with conduit fittings.
   c. Battery backup test button and integral to fixture.
3. Strip Light
   a. Pendant mounted with secondary support provision.
   b. Universal mounting bracket.
   c. Integral junction box with conduit fittings.
   d. Wire guard or lens.
4. Surface Mount, Linear
   a. Universal mounting bracket.
   b. Integral junction box with conduit fittings.
5. Surface Mount, Nonlinear
   a. Universal mounting bracket.
   b. Integral junction box with conduit fittings.
6. Suspended, Linear
   a. Pendant mounted with secondary support provision.
   b. Universal mounting bracket.
   c. Provide with aircraft cable.
   d. Fixtures shall join with factory fittings of length on drawings with factory ends.
   e. Coordinate cord drop.
   f. Power feed thru factory quick connect.
   g. White cord drop to end of fixture.
   h. Minimum two supports per run. Minimum one every 8 feet.

7. Suspended, Nonlinear
    a. Pendant mounted with secondary support provision.
    b. Universal mounting bracket.

2.3 LED LIGHTING

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 90,000 hours at 25 degrees C. or
6. L95 at 60,000 hours at 25 degrees C. *
7. Exterior Surf Mtd: L90 at 100,000 hours at 40 degrees C or
   L80 at 100,000 hours at 25 degrees C *
8. 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 and wet location listed products must clearly state the IP rating carried on the fixture based on independent test lab data.

G. 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.

H. 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.

I. Minimum CRI 80.

J. All outdoor lighting color rendering should be within a 7 step McAdams Ellipse. All outdoor lighting should be 4100 Kelvin unless specifically noted.

K. All indoor lighting color rendering should be within a 3 step McAdams ellipse. All indoor lighting should be 4000 Kelvin unless specifically noted.

L. 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”.

M. Driver manufacturers must have a 5-year history producing dimmable electronic LED drivers for the North American market.

N. Ambient driver temperatures must be within -20 degrees to 50 degrees C (-4 degrees to 122 degrees F).

O. 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
   2. 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

P. Any exceptions are at the engineer's 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: ½-inch steel tubing with swivel ball fitting and ceiling canopy. Finish same as fixture.

C. Twin-Stem Hangers: Two, ½-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, General: 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. Mount at 84 inches or above, unless otherwise indicated. All wall mounted fixtures shall be ADA compatible if below 84 inches.
   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.
   6. Provide supports without causing deflection of ceiling or wall.
   7. Secure to outlet box.

B. 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.
   3. 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.

C. 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) ¾-inch metal channels spanning and secured to ceiling tees.

D. 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. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
   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.
   7. Sized and rated for fixture weight.
   8. Do not use ceiling grid as support for pendant luminaires. Connect support wired or rods to building structure.

E. Flush-Mounted Luminaire Support:
   1. Secured to outlet box.
   2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
   3. Trim ring flush with finished surface.

F. Wall-Mounted Luminaire Support:
   1. Attached to structural members in walls.
   2. Do not attach luminaires directly to gypsum board.
   3. Provide blocking to support.

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 to switch mechanisms (wall switch, contactors, relays) room controllers.

C. Provide dual switching for room mounted dual ballast fixtures. Wire each switch leg to each ballast. 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.

D. Fixture 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.

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 (Except LED Fixtures): Replace or repair, then retest. Repeat procedure until units operate properly.

F. Malfunctioning LED Fixtures: Replace fixture then retest. LED fixtures shall not be repaired.

G. 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 00 00

GENERAL TECHNOLOGY REQUIREMENTS

PART 1 - GENERAL

1.1 PROJECT SUMMARY

A. Scope: Successful bidder shall provide, install, configure, and provide warranty service for technology systems described herein.

1.2 RELATED DOCUMENTS

A. Documents: Provisions of General Conditions, Supplementary Conditions, and the sections included under Procurement & Contract Requirements are included as part of this section as though bound herein.

1.3 RELATED WORK

A. Section 27 10 00 – Communications Cabling General Requirements

B. Section 27 10 05 – Grounding and Bonding for Technology Systems

C. Section 27 11 00 – Communications Equipment Rooms

D. Section 27 13 00 – Communications Backbone Cabling

E. Section 27 15 00 – Communications Horizontal Cabling

F. Section 27 16 00 – Communications Connecting Cords

G. Section 27 18 00 – Communications Labeling and Identification

H. Section 27 60 00 – Physical Security Requirements

I. Section 27 62 00 – Video Surveillance System

J. Section 27 64 00 – Electronic Access Control System

1.4 OWNER DESIGN SESSION:

A. The Contractor shall pro-actively schedule a pre-installation coordination meeting with the Technology Department to review ground system design prior to completing design documents.

B. Design review meetings shall cover the following systems:

1. MDF/IDF layout and equipment schedules.

2. Backbone and up-link requirements.

3. Horizontal cable pathways, termination hardware, colors and labeling.

4. Patch cords (qty, colors and lengths)

1.5 DEFINITIONS

A. Approved or Approval: Where approval is called for, only persons with the authorized authority may grant approval. Owner reserves all rights to govern over and grant approval and will appoint authority of agents acting on their behalf.

B. As Required: Contractor shall provide the quantity of said item that is necessary. Owner and Consultant reserve the right to make the final determination of necessary quantities to provide for a complete system.

C. Basis of Design: The documentation of the concepts, calculations, decisions, and product selections used to meet the Owner's project requirements. These Consultant produced documents are not shop drawings. Product selections depict minimum functionality and overall quality and are open to substitution requests.

D. Consultant: True North Consulting Group.

E. Contractor: The qualified party responsible to provide all items and perform services as described within these documents. The Contractor referred to within a specific specification section shall be the successful qualified party contracted to perform and complete that work.

F. Documents: The complete package of Bid and Contract Requirements, General Technology Requirements, related Division 27 sections, drawings, schedules, and addenda that make up this Request for Bid.

G. End-User: Individual(s) who will ultimately operate the completed system.

H. ETR: Existing to Remain. Item is to remain in current location and maintain current functionality.

I. Furnish: To supply and deliver to project site, ready for installation.

J. Install: To place in a position of service or use.

K. NIC: Not in Contract. Item will be the responsibility of others.

L. Notice to Proceed: Formal communication from Owner to Contractor stating the date the Contractor can begin work subject to the conditions of the contract. The performance time of the contract starts from the Notice to Proceed date.

M. OFCI: Owner Furnished Contractor Installed. Item will be provided by Owner and shall be installed by Contractor.

N. OFE: Owner Furnished Equipment. Item will be provided and integrated by Owner.

O. OFOI: Owner Furnished Owner Installed. Item will be provided and installed by Owner.

P. Owner: The party named in the Procurement and Contract Requirements as the advertising party.

Q. Provide: To furnish and install, complete and ready for intended use.

R. Turnkey: Of or involving the provision of a complete product or service that is ready for immediate use.

S. Work: The provision of products and/or services to meet the requirements specified in these documents.

1.6 REFERENCE STANDARDS AND CODES

A. Standards and other procedures referenced by this bid package are as follows:

1. ADA – Americans with Disabilities Act of 2010
www.ada.gov/2010ADAstandards_index.htm

2. AIA – American Institute of Architects
www.aia.org

3. ANSI – American National Standards Institute
www.ansi.org

4. ASHE – American Society of Healthcare Engineering
www.ashe.org

5. ASTM – American Society of Testing and Materials
www.astm.org

6. BICSI – Building Industry Consulting Service International, Inc.
(RCDD Standards)
www.bicsi.org

7. CFR – Code of Federal Regulations
www.gpo.gov/fdsys/browse/collectionCfr.action?collectionCode=CFR
(Available from the Government Printing Office)
(Material is usually first published in the Federal Register)
U.S. Copyright Law, December 2011
www.copyright.gov/title17

8. ECIA – Electronic Components Industry Association
ESC – EIA Standards Council
www.eciaonline.org

9. IACS – International Annealed Copper Standard
www.ndt-ed.org/GeneralResources/IACS/IACS.htm

10. IEC – International Electrotechnical Commission
www.iec.ch

11. IEEE – Institute of Electrical and Electronics Engineers
standards.ieee.org

12. ISO – International Organization for Standardization
www.iso.org

13. ITU-T – International Telecommunication Union – Telecommunication
www.itu.int

14. NEC – National Electrical Code (NFPA 70)
maintained by NFPA – National Fire Protection Association
www.nfpa.org

15. NECA – National Electrical Contractors Association
www.necanet.org

16. NEMA – National Electrical Manufactures' Association
www.nema.org

17. OSHA – Occupational Safety and Health Administration
(U.S. Department of Labor, OSHA)
www.osha.gov

18. TIA – Telecommunications Industry Association
www.tiaonline.org/standards

19. UL – Underwriters' Laboratories
www.ul.com

B. Standards: Referenced standards and/or procedures shall be binding on the Contractor and work shall be judged against such standards and procedures unless otherwise stated in writing.

C. Local/State Codes: Contractor shall comply with all local and state code requirements as determined by the authority having jurisdiction (AHJ).

D. Owner Standards: Contractor shall obtain and abide by all published Owner standards as they pertain to the work described herein.

E. Contractor shall use the latest versions of all standards and codes unless otherwise directed by the authority having jurisdiction (AHJ) or expressly noted herein.

1.7 DRAWINGS AND BASIS OF DESIGN

A. General: Work, equipment, or material delineated on any drawing in this package is expected to be provided by Contractor unless noted otherwise.

B. Interpretation: Work shall be installed in accordance with the basis of design diagrammatically expressed on the drawings and described in the written specifications and equipment schedule(s). Contractor shall not make limiting interpretation that provides for incomplete work or a non-functioning system.

1.8 PRODUCT SUBSTITUTION PROCEDURES

A. Requests for Substitutions: Should the Contractor request a change in the material that is to be supplied, from that which was specified in the contract, the Contractor shall provide the Owner and the Consultant with a written request for said change.

B. Substitutions for Non-specified Products: Where no product specification is provided, Contractor may use manufacturer's specification for the identified product as a guide for suggesting appropriate substitutions.

C. Requirements: The Request for Substitution shall include:

1. Reason for substitution.

2. Material data sheets for both the proposed item(s) and the item(s) to be replaced.

3. Any cost impact to the Owner.

D. Changes: Proposed changes to Contract Documents shall be clearly identified in the pre-construction submittals.

E. Approval: The Owner may approve or deny any Requests for Substitution. The Owner reserves the right to govern over and proclaim whether proposed products are equal to the specifications. The Contractor shall not procure any substitute materials until the Owner has approved and signed the Request for Substitution and passed copies to the Contractor and the Consultant. Any procurement or work performed prior to this approval is at the Contractor's own risk.

F. Deviation: Products provided or installed that deviate from the products specified in make, model, color, or other significant characteristic (i.e., non-approved substitutions) shall be removed and replaced with specified products at no additional expense to Owner.

1.9 UNIT PRICES

A. The Proposer shall provide unit pricing breakdown for all equipment as a line item materials list submitted with their proposal. In the event the Proposal form does not specifically provide a worksheet for requested unit pricing, the Contractor shall provide the unit price list by separate attachment along with their Proposal.

1. The unit price may be used to add or deduct, by change order, quantities of units as represented by the unit price.

2. Failure to provide requested unit prices may result in the rejection of the proposal.

3. Example Unit Pricing:

Part#	Manufacturer	Description	Quantity	Unit Price	Extended Price	Installation	Line Item Total
			-	$ -	$ -	$ -	$ -
			-	$ -	$ -	$ -	$ -
			-	$ -	$ -	$ -	$ -
			-	$ -	$ -	$ -	$ -
			-	$ -	$ -	$ -	$ -

1.10 SOFTWARE

A. Versions: Consultant used the following software versions for this project:

1. Microsoft Office 2016

2. Autodesk Revit MEP 2014 (floor plans)

3. Autodesk AutoCAD MEP 2014 (detail sheets)

1.11 SUBMITTAL CONDITIONS

A. The Contractor shall not consider the Consultant or Owner's review of submittals to be exhaustive or complete in every detail. Approval of shop drawings or submittals including substitutions indicates only the acceptance of the Contractor's apparent intent to comply with general design or method of construction and quality as specified. The finished product shall meet functional requirements, operations, arrangements, and quantities and comply with the contract documents unless specifically approved otherwise.

B. The Contractor shall be held responsible for delivery of systems as specified. Any errors or omissions in the submittals shall not relieve Contractor of responsibility to deliver complete systems as specified.

1.12 PRE-CONSTRUCTION PROCEDURES

A. Pre-Construction Submittal Meeting: Contractor shall schedule web conference (WebEx or similar) with Owner and Consultant to review basis of design and submittal expectations.

B. Prior to Work: Pre-construction submittals shall be provided to Consultant with appropriate promptness as to cause no delay to the work.

C. Project Timeline: Project timeline will not be altered due to lateness of submittals. Contractor is bound to deliver a timely, complete, and finished project as stipulated in their contract and specified herein.

D. Format and Distribution: Contractor shall provide one (1) electronic copy in PDF format to Consultant of all pre-construction submittals. The Contractor shall provide hard copies sets as required up to five (5) sets.

E. Provision: Contractor shall submit pre-construction submittals including any corrections or additions to Consultant prior to the procurement of equipment or commencement of work.

F. Review: Pre-construction submittals shall be received and formally approved by Consultant prior to the procurement of material or the commencement of work. Any procurement or work performed prior to this approval is at Contractor's own risk.

G. Failure to Provide: The failure of Contractor to provide pre-construction submittals as required herein may result in the withholding of payment for work and/or the cancellation of the contract.

1.13 PRE-CONSTRUCTION SUBMITTALS

A. Pre-construction submittals are intended to document the details of installation. Exact copies of original drawings and specifications are not acceptable as pre-construction submittal drawings. Consultant schematic diagrams describe the basis of design as defined herein.

B. Contractor shall provide to Consultant the following pre-construction submittals for approval in addition to specific requirements identified in subsequent sections.

1. Qualifications: Shall include documentation of all required qualifications.

2. Shop Drawings:

a. Title: Each drawing shall have a descriptive title and all subparts of each drawing shall have unique identifiers.

b. Floor Plans: Shall include device locations, Contractor provided furniture and installation notes.

c. System Drawings: Shall include functional diagrams for each system detailing system flow including all equipment, routing, inputs/outputs, wiring signal type, cable identification detail, connectors, adapters, intra/inter-rack power distribution, installation notes and any other information required to convey the complete turnkey system design.

d. Equipment Rack and Cabinet Elevations: Shall include placement of all mounted equipment.

e. Structurally Mounted Elements: Shall include both plan view of placement as well as a detail of structural mounting techniques to be used.

f. Furniture: Shall include all Contractor provided furniture showing dimensional drawings, cable management and finishes with samples for Owner approval.

3. Product Data:

a. Equipment Schedules: Shall include manufacturers, part numbers, quantities and unit pricing.

b. Product Cut Sheets: Shall identify (highlight, arrow, etc.) actual part numbers to be utilized including but not limited to equipment, mounting hardware, cabling, connectors, software and power distribution equipment.

4. Manufacturer's Recommendations:

a. Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, copies of these recommendations shall be provided prior to installation. Installation of the items will not be allowed to proceed until the recommendations are received and approved.

1.14 CONSTRUCTION PROGRESS PROCEDURES

A. Meeting Attendance: Contractor is required to attend job progress meetings in accordance with requirements set by Owner or Consultant.

B. Additional Coordination: Contractor shall request additional job construction coordination meetings it deems to be necessary to ensure coordination of their responsibilities with other parties.

C. Progress Inspection: Consultant may perform periodic progress inspections. At Consultant's request, Contractor shall make Project Manager and/or Lead Technician available.

D. Test Plan: Ten (10) business days prior to the proposed Contractor test date, Contractor shall provide a test plan defining the tests required.

1. The test plan shall be approved by Consultant prior to any testing.

1.15 CONSTRUCTION PROGRESS SUBMITTALS

A. Completion: Contractor shall complete and submit via email all construction progress documentation in PDF format as requested by Owner and Consultant.

B. Contractor shall provide to Consultant the following construction progress submittals in addition to specific requirements identified in subsequent sections.

1. Weekly Report: Weekly written report to be submitted to Consultant through appropriate project channels in PDF format outlining progress from previous week, plans for progress in the current week, and any coordination issues that may require Consultant or Owner attention.

2. Test Plan: Shall ensure the system meets Owner operational and performance specifications and include the following:

a. Identification of the capabilities and functions to be tested.

b. Detailed instructions for the setup and execution of each test.

c. Procedures for evaluation and documentation of the results.

C. Failure to Complete: Failure to complete requested construction progress documentation may result in the withholding of payment by Owner.

1.16 CLOSEOUT PROCEDURES

A. Notification: Contractor shall provide written notification to Consultant and Owner when Contractor is satisfied that the work has reached Substantial Completion and is ready for inspection.

B. Pre-Inspection Submittals: Contractor shall submit an electronic copy of all closeout submittals to Consultant in accordance with the requirements found in these documents no less than ten (10) business days prior to the scheduled Final Inspection.

1. Test Results

2. As-built drawings (full-size sheets)

3. Operation and Maintenance Manuals

4. End User Software

C. Punch List: Work or materials found to be incomplete, of unsatisfactory quality, failing to meet the specifications in these documents, and/or unacceptable to Consultant or Owner shall be documented by Consultant and provided to Contractor to rectify at no additional cost. Contractor shall provide written notification to Consultant and Owner when all punch list items have been completed.

D. Final Inspection: Contractor shall coordinate, schedule and participate in final project inspection and walk thru. Owner shall be notified and included in final walk thru inspections.

E. Re-Inspection: If more than one (1) re-inspection is necessary, the costs of the additional travel, time, and expenses of Owner and Consultant may be deducted by Owner from the contract amount due to the Contractor.

F. Punch List Approval: Once all punch list items are complete, the Contractor shall return an initialed punch list to the Consultant and Owner for verification. Punch list shall be considered complete only after having been signed by Owner and Consultant.

G. Closeout Submittals: Upon approval of closeout submittals and prior to final acceptance, Contractor shall provide three (3) electronic copies to Owner and Consultant in format(s) noted below.

1. Record Drawings – AutoCAD 2010 editable .dwg format AND PDF.

2. Operation and Maintenance Manuals – USB Flash Drive, CD, OR DVD.

3. End User Software – USB Flash Drive, CD, OR DVD.

4. Documentation of testing and system certification.

H. Closeout Submittal Format and Distribution: Upon approval of closeout submittals and prior to final acceptance, Contractor shall provide a total of three (3) bound hard copies with labeled dividers of all record drawings (full-size sheets) and operation and maintenance manuals, two (2) copies to Owner and one (1) copy to Consultant. Title on front and spine of binder shall be "Operation and Maintenance Manual – [PROJECT NAME]". The following additional items shall be identified on the binder cover:

1. Client Name

2. Contractor Name and Contact Information

3. Consultant Name and Contact Information

4. Date

I. All documentation prepared by the Contractor, including hard copy and electronic forms, shall become the property of the Owner.

J. Payment Authorization: Final payment will be authorized only after all closeout procedures and requirements have been followed and fulfilled by Contractor and approved in writing by Owner and Consultant, including punch list(s) and/or re-inspection(s) and delivery of closeout deliverables.

1.17 CLOSEOUT SUBMITTALS

A. Closeout submittals are intended to document the details of the final installation that substantially conforms to the construction documents and functions as intended to meet the Owner's needs.

B. Contractor shall provide to Consultant the following closeout submittals for approval in addition to specific requirements identified in subsequent sections.

1. As-built drawings: As-built drawings are prepared by the Contractor. They show, in red ink, on-site changes to the Consultant-approved pre-construction submittal documents. As-built drawings shall be submitted to Consultant for approval prior to submitting record drawings and include:

a. Changes made by Addenda, Change Orders, Requests for Information (RFIs), Architect's Supplemental Instruction (ASIs), or Requests for Proposal (RFPs) in addition to any other changes to the original documents.

b. Actual device locations, conduit routing, wiring and relationships as they were constructed.

c. Nomenclature showing as-built wire designations and colors.

d. Room numbers coinciding with Owner space planning numbering.

2. Record drawings: Record drawings are the final drawings prepared by the Contractor and incorporate all as-built drawing changes previously approved by Consultant. Record drawings should be electronically produced without any handwritten, red ink, or clouded changes.

3. Operation and Maintenance Manuals: Notwithstanding requirements specified elsewhere, submit one (1) copy of each of the following per binder:

a. A final Bill of Materials for each system.

b. Usernames and passwords by device for all applicable products.

c. Manufacturers Instruction Manuals: Specification sheets, operation manuals and service sheets published by the manufacturers of the components, devices and equipment provided.

d. Replacement parts list with current prices. Include list of recommended spare parts, tools, and instruments for testing and maintenance purpose.

e. Performance, Test and Adjustment Data: Comprehensive documentation of performance verification according to parameters specified herein.

f. Warranties: Provide an executed copy of the Warranty Agreement and copies of all manufacturers' Warranty Registration papers as described herein.

g. Sufficient information, (detailed schematics of subsystems, assemblies and subassemblies to component level) clearly presented, shall be included to determine compliance with drawings and specifications.

h. Any other items defined herein.

1.18 PROJECT MANAGEMENT

A. Project Manager: Contractor shall appoint a Project Manager who will be the main point of contact for Owner and Consultant regarding the project.

B. Responsibility: Project Manager is responsible for the following:

1. Successfully completing the contract in a timely manner.

2. Overseeing work and performance of all employees and Subcontractors who have been hired by Contractor and ensuring compliance with specification.

3. Completing and submitting required documentation.

4. Attending project coordination meetings as required by Owner, Consultant, and Contractor. Contractor is responsible for taking minutes of these meetings and distributing copies to all participants.

5. Coordinating with Owner, Consultant, Architect, General Contractor, and other Contractors involved in the project to ensure smooth flow of work and on-time project completion.

6. Providing a written weekly progress update to the Owner and Consultant in a PDF format emailed to the project team.

7. Reporting all unexpected conditions and problems that may result in delay or expense to Owner and Consultant immediately upon discovery.

C. Change of Project Manager: If Contractor seeks to change Project Manager during the course of the Project, such change is subject to prior written approval from Owner.

D. The Owner reserves the right to request a change of project manager at any time for any reason.

1.19 EXAMINATION OF EXISTING CONDITIONS

A. Examination: Contractor shall examine the facility and construction documents to the extent necessary to plan for efficient installation strategies prior to the delivery of materials to the site or the commencement of work. Other documents (Architectural Drawings, hardware schedules…) may be made available upon request. Failure to adequately complete the examination shall not result in change order requests.

B. Acceptance of Conditions: Commencement of work by Contractor shall indicate acceptance of existing conditions, unless a written notice of exceptions has been provided to Owner prior to commencement.

C. Observation: If Contractor observes—during preliminary examinations or subsequent work—existing violations of fire stopping, electrical wiring, grounding, or other safety- or code-related issues, Contractor shall report these to Owner in a timely manner.

D. Pre-Existing Damage: If Contractor observes damage to finished surfaces before they begin installation in any area, Contractor shall document by taking digital photos of the damaged area(s) and immediately notifying Construction Manager and Consultant via email, with attached photos.

E. Damage during Installation: Any damage caused by, or reasonably believed by the Construction Manager to be caused by the Contractor shall result in back-charges for said damages. Repairs shall match preexisting color and finish of walls, floors, and ceilings. Any Contractor damaged ceiling tiles, floor, and carpet shall be replaced to match color, size, style, and texture.

1.20 PRODUCT STORAGE AND HANDLING REQUIREMENTS

A. Storage: Storage of materials shall remain the full responsibility of Contractor until Acceptance.

B. Protection: Contractor shall take all necessary precautions to protect materials from the following:

1. Theft
2. Vandalism/Tampering
3. Dents
4. Scratches
5. Dust
6. Temperature
7. Weather
8. Cutting
9. Paint
10. Other hazardous conditions

C. Replacement: Contractor shall replace any damaged or lost material as required by Owner or Consultant.

D. Installed Materials: Installed materials remain the responsibility of the Contractor until Acceptance. Contractor shall take necessary precautions to ensure the safety and security of installed materials.

1.21 ON-SITE CONDUCT

A. Tobacco Free: Alamo Colleges are 100% smoke free campuses and also prohibit e-cigarette use, hookah use, and prohibit smoking/vaping.

B. Conduct: Any demonstration of rudeness, use of profanity, or lack of respect by Contractor Personnel to a building tenant will be cause for immediate removal from the premises, and such Personnel will not be allowed to return. Contractor and Contractor’s Personnel are to remain in project area.

C. Vandalism: Graffiti or vandalism will not be tolerated. Any Contractor/Personnel caught in the act shall be immediately removed from the premises and will not be allowed to return.

D. Hazardous Conditions: No one shall be allowed to endanger the building, its premises, and its occupants in any manner whatsoever. In the event that a situation occurs which threatens the building or its occupants in any manner, Contractor, Contractor Personnel, Subcontractor, etc. shall take steps to correct hazardous condition. In the event that Contractor's Personnel fail to correct hazardous condition, Owner reserves the right to immediately take steps to correct the situation at Contractor's expense.

1.22 SAFEGUARDS AND PROTECTION

A. Barriers: Provide and maintain suitable barriers, guards, fences and signs where necessary to accommodate the safety of others relative to and/or for the protection of this work.

B. Regulations: Comply with OSHA, Federal, State, Local, and Owner regulations and standards pursuant to this work.

C. Protection: Protect all materials and equipment to prevent the entry or adhesion of any and all foreign material. If necessary, cover equipment with temporary protective material suitable for this purpose.

D. Finishing: Check, clean and remove defects, scratches, fingerprints and smudges if necessary from all equipment and devices immediately prior to Acceptance of the Installation.

E. Damage: Replace all damaged or defective material or work at no additional cost prior to Final Acceptance.

F. Documentation: Provide written description of accidents by workers, staff, and general public of any incident occurring on the project. Report incident in writing to Owner's representative immediately and to the Project Manager for follow up.

1.23 OWNER-FURNISHED PRODUCTS

A. Delivery: Owner is responsible for delivery of Owner-furnished products to the project site, unless otherwise specified in this document.

B. Placement: Contractor is responsible for locating, inspecting, and moving Owner-furnished products to their final installation position.

C. Inspection: Contractor shall report any damage, discrepancies in quantity, type, or function to Owner and Consultant immediately upon discovery.

D. Warranty: Contractor assumes no responsibility for any material warranty for Owner-furnished products. Contractor shall be responsible for integrating, cabling, and installing Owner-furnished products under the same warranty conditions as other products furnished by Contractor.

1.24 QUALITY ASSURANCE

A. Assurance: It is the intent of these specifications to describe and provide for a complete, professional, and reliable installation.

B. Qualifications: Contractor employees who are engaged in installation shall be properly trained in the tasks they are expected to perform.

C. Acceptability: Owner shall determine the acceptability of work.

D. Regulatory Requirements: Contractor shall comply with code requirements that apply to the work being performed.

E. Certifications: Where manufacturer certifications are required for warranty or for authorized resale, installation personnel shall have received such certification prior to the start of installation of those manufacturers' materials.

1.25 QUALITY CONTROL

A. Installation: During installation period, when connections are made to the Owner's existing infrastructure, Contractor shall use care to ensure that no negative results occur that could reduce or hamper existing systems.

1.26 OWNER'S RIGHT TO USE EQUIPMENT

A. The Owner reserves the right to use equipment, material and services provided as part of this work prior to Acceptance of the Work, without incurring additional charges and without commencement of the Warranty period.

PART 2 - PRODUCTS

2.1 BASIC EQUIPMENT AND MATERIALS REQUIREMENTS

A. Standards: Equipment and materials used to accomplish the goals of this project shall meet standards for good engineering practice as defined within this document.

B. Quality: Products specified in these documents are intended to establish a baseline or operational, functional, and performance-based standards that all proposed products shall meet or exceed by functionality and quality.

2.2 ANCILLARY HARDWARE

A. General: Contractor shall provide ancillary and required accessory items necessary to provide a complete and fully functional system to Owner.

B. Interpretation: Exclusion of or limitation in the language used in the drawings or specifications shall not be interpreted as meaning that ancillary or accessory items of work or equipment necessary to complete or make the installed system fully functional can be omitted.

2.3 GROUNDING HARDWARE

A. Refer to Section 27 10 05 for specific Grounding and Bonding requirements.

B. Provide data/telecommunication grounding systems indicated in the project drawings and specifications. Products shall include, but are not limited to, cables/wires, connectors, terminals, compression lugs, grounding rods/electrodes and plate electrodes, bonding jumper braid, surge arresters, and additional accessories needed for a complete installation. Where materials or components are not indicated, provide products complying with NEC, UL, IEEE, ANSI/TIA and established industry standards for applications indicated.

2.4 FIRE STOPPING MATERIALS

A. All penetrations of walls shall be approved by the General Contractor before any penetrations are made. Should the Contractor find it necessary to penetrate any walls extending to the slab, it will be the responsibility of that Contractor to provide satisfactory sleeving and fire caulking both inside and outside of that sleeving. If existing sleeving is to be utilized, it will be the responsibility of the Contractor to fire caulk inside the sleeving.

B. The Contractor is responsible for adhering to the following standards:

1. Fire-Rated Cable Pathways: STI EZ-PATH® Fire-Rated Pathway device modules comprised of steel pathway with self-adjusting intumescent foam pads allowing 0 to 100 percent cable fill shall be used for all wall penetrations at an IDF or MDF room or any penetrations with greater than 20 horizontal cables

2. Small Conduit penetrations through fire-rated or smoke walls (less than 20 horizontal cables: Completely seal around the conduit penetration with Hilti fire-rated sealant Tremco, EZ PATH, 3M or approved equal.

3. Completely seal inner opening of the conduit sleeve with fire wool packing and Hilti intumescent firestop sealant.

C. A submitted response to this specification assumes that all firestopping will be provided as specified. The firestop manufacturer’s specifications and instructions shall be submitted with the final documentation.

D. Firestop Sealants: STI SpecSeal® Brand single component latex formulations that upon cure do not re-emulsify during exposure to moisture, the following products are acceptable:

2.5 COMPATIBILITY OF RELATED EQUIPMENT

A. Existing Equipment: Equipment and systems specified in these documents shall be assumed to be compatible with the systems already installed at Owner site(s) and as identified in this document as related to this project.

B. Installed Equipment: Specified equipment and systems shall be compatible with all other equipment and systems as offered by Contractor, thus placing the responsibility on Contractor to ensure proper interaction.

2.6 SPARE PARTS

A. Suggested List: Contractor is requested to submit a list of suggested spare parts with an offered price, allowing Owner to select appropriate parts.

B. Means of Obtainment: Contractor shall state where spare parts can be obtained after the installation.

2.7 MAINTENANCE MANUALS

A. Contractor shall produce a maintenance manual showing interconnection of equipment and any special procedures necessary for proper operation and maintenance of the systems.

PART 3 - EXECUTION

3.1 GENERAL

A. Contractor shall provide, furnish, deliver, transport, erect, install, connect and configure all of the material and equipment described herein or depicted on any bid package document or drawing, as required for a turnkey solution.

3.2 COORDINATION

A. General: Contractor shall cooperate with other Contractors for proper provisioning, anchorage, placement, and execution of all work. Interference between the work of various Contractors shall be resolved before installation. In the event of conflict on space requirements or location of devices, refer the matter to Owner and Consultant for decision.

B. Related Work: References to the following related work do not limit or release Contractor from the responsibility of coordination with other trades or from having the necessary knowledge of other non-referenced work.

1. Work by General Contractor.

2. Work by other Technology Contractors.

3. Work by Electrical Contractor, including electrical rough-ins and surface-mounted raceway.

4. Delays: Contractor shall coordinate with all other trades to avoid causing delays in the installation schedule.

5. AC Power: Contractor shall coordinate with General Contractor its requirements for proper AC power to service all equipment installed by Contractor.

6. Low Voltage Sleeving: Contractor shall provide openings through walls as necessary, with sleeving and fire-stopping materials installed in a professional manner to meet local and national codes.

7. Grounding and Bonding: Contractor shall coordinate with General Contractor its requirements for proper grounding and bonding to their equipment.

8. Surface-Mounted Raceway Coordination

9. General and Electrical Contractors: Contractor shall coordinate with General Contractor and Electrical Contractor the installation of surface-mounted-raceway where not provided but made necessary by non-penetrable wall.

10. Verification: Contractor shall field verify and coordinate the proposed use of surface-mounted raceway at any location with Architect, GC, and Owner.

3.3 BASIC EXECUTION REQUIREMENTS

A. General: Contractor is responsible for following industry standards of good practice for telecommunications and networking equipment.

B. Aesthetic Factors: With the installation of equipment and cables, consideration shall be given not only to operation efficiency but also to overall aesthetic factors. Contractor shall redo, at no cost to Owner, any work deemed by Owner to appear sloppy, hastily done, or unprofessional. Owner shall make final decision over whether work shall be redone.

C. Manufacturers' Recommendations: Manufactured items, materials, and equipment shall be applied, installed, connected, erected, used, and adjusted as recommended by the manufacturers or as indicated in their published literature unless otherwise noted herein.

D. Protection of Work Area: Work shall be properly protected during construction, including the shielding of soft or fragile materials, protecting against dust and dirt, protecting and supporting cable ends off of the floor and from other traffic, protecting floor box lids, and temporarily plugging open conduits during construction. Upon completion, installation shall be thoroughly cleaned and all tools, equipment, obstructions, or debris present as a result of work shall be removed from the premises.

E. Protection of Cable and Equipment: Contractor shall make appropriate preparations to protect all cabling and equipment from foreign material. Foreign material is defined as any substance or material that would void the manufacturer's performance warranty, impact ratings (UL, Plenum, etc.), or cover up markings needed for inspection. Foreign material includes, but is not limited to, paint overspray (intentional or not), fire-stopping material, drywall compound, or any other chemical, liquid, or compound that could come in contact with cables, cable jackets, cable termination points, or other equipment.

1. Cleaning of cables or equipment with harsh chemicals from a failure to comply with Protection of Cable and Equipment clause is unacceptable. Contractor shall replace any affected cable, cable components, or equipment in their entirety at no additional cost to the project.

F. Waste Materials: Contractor shall keep work area neat, orderly, and free from accumulation of waste materials. Remove trash and debris from the building and job site as required to maintain a clean work environment at all times. Rubbish shall be moved to a common trash point or receptacle on the job site as determined and directed by General Contractor or Owner.

G. Dumpsters: No construction debris shall be placed in building's dumpsters. Contractor shall provide a dumpster for construction waste and debris at own expense. Said dumpster shall be emptied on a regular schedule. Location of dumpster shall be arranged through Building Management.

H. Ceiling Grid: Contractor shall not hang cable supports from ceiling grid wire.

I. Roof Deck: Contractor shall not shoot into the roof deck for mounting cable hangers.

J. Mounting: Equipment and enclosures shall be mounted plumb and square in relation to the structure.

K. Raised Floor: All cabling installed below the raised floor shall be placed in the provided cable trays with appropriate means to hold cable in place. If no cable tray exists, Contractor shall provide J-hooks to hold cables in place. Sleeves shall be utilized for cable egress.

3.4 PREPARATION

A. Existing Equipment: Prior to any installation, the Contractor shall prepare the site by removing any remaining debris, leveling equipment racks (where appropriate), and verifying information and systems stated to be in-place are ready for use.

B. Equipment for Installation: Prior to installation, Contractor shall ensure that required major equipment has been secured and is ready for installation.

3.5 CLEANING

A. Daily: At the end of each work period or day, Contractor shall remove excess packing, drilling remnants, and other non-equipment related parts, materials, or debris to ensure a clean, safe, and professional working environment.

B. Carpet: Contractor shall ensure that no damage to carpeting occurs as a result of their work. Contractor shall cover carpets in areas of work to prevent wire debris from entering the carpet.

3.6 FIRE STOPPING

A. Contractor is responsible for applying fire-stopping material in and around all openings that it creates or are created for it, whether or not specifically indicated in specifications or project drawings, where code requires the use of fire stopping material.

B. Contractor shall ensure that all fire-stopping materials meet appropriate codes and are installed in a neat and workman like manner.

C. If Contractor removes anything from an opening in a fire-rated wall, Contractor shall restore the fire-rating condition of the wall to the same condition as before Contractor started its work. Depending on the size of the opening, this may involve sheetrock patching, in addition to use of other appropriate fire-stopping materials.

D. Where non-mechanical pathways must be utilized, such as sealing (caulking) around single or grouped conduits, provide products that upon curing do no re-emulsify, dissolve, leach, breakdown or otherwise deteriorate over time from exposure to atmospheric moisture, sweating pipes, ponding water or other forms of moisture characteristic during or after construction. Provide letter from manufacturer certifying compliance with this section.

E. Cable pathway shall replace conduit sleeves in walls and floors, and;

F. When installed individually in floors, devices shall pass through core-drilled opening utilizing tested floor plates.

G. When multiple units are ganged in floors, devices shall be anchored by means of a tested grid.

H. When installed individually in walls, devices shall pass through core drilled opening utilizing tested wall plates or integrated flanges.

I. When multiple units are ganged in walls, devices shall be anchored by means of a tested grid.

J. Cable tray shall terminate at each barrier and resume on the other side such that cables pass independently through devices. Cable tray shall be properly supported on each side of the barrier

3.7 WATERPROOFING

A. Contractor is responsible for creating a waterproof seal in and around any openings to the outside environment that are created by Contractor or for systems being installed.

B. Contractor shall ensure that all waterproof materials meet appropriate codes and are applied according to good engineering practice.

3.8 INSTALLATION REQUIREMENTS

A. All cable shall be pulled by hand unless installation conditions require mechanical assistance. Where mechanical assistance is used, care shall be taken to ensure that the maximum tensile load for the cable as defined by the manufacturer is not exceeded. This may be in the form of continuous monitoring of pulling tension, use of a “break-away”, or other approved method.

B. Qualified personnel utilizing state-of-the-art equipment and techniques shall complete all installation work. During pulling operation, an adequate number of workers shall be present to allow cable observation at all points of pathway entry and exit.

C. Cable pulling shall be done in accordance with cable manufacturer’s recommendations and ANSI/IEEE C2 standards. Recommended pulling tensions and pulling bending radius shall not be exceeded. Any cable bent or kinked to radius less than recommended dimension shall not be installed.

D. All cable shall be free of tension at both ends.

E. PLENUM rated cable shall be used in areas used for air handling.

F. Contractor shall replace any cables that have been damaged or abraded during installation.

G. Pulling lubricant may be used to ease pulling tensions. Lubricant shall be of a type that is non-injurious to the cable jacket and other materials used. Lubricant shall not harden or become adhesive with age.

H. A pull cord (nylon; 1/8” minimum) shall be co-installed with all cable installed in any conduit or surface mount raceway.

3.9 EQUIPMENT INSTALLATION

A. General: Contractor shall make system properly operational and physically secure by mounting equipment and related accessories into furniture, consoles, and racks as required. Manufacturer’s guidelines for installation shall be followed. Discrepancies in installation procedure or inability to complete a given task due to a shortage of materials or malfunctioning equipment shall be reported to Consultant immediately upon discovery.

B. Equipment Placement: Contractor shall locate equipment as indicated on drawings and as specified herein. Where such information is not provided, follow industry best practices and locate operable devices at convenient positions; heat generating devices at the top and seldom-accessed equipment below.

C. Unless otherwise specified, end user-operable devices shall be positioned within the range of front wheelchair access per ADA standards.

D. Equipment Installation: Equipment shall be installed as directed by the manufacturer using equipment manufacturer's desktop mounting frames, equipment tubs, installation hardware, and techniques. Contractor shall be responsible for moving equipment from storage and for providing necessary personnel or devices to carry and lift equipment around obstacles and into operating position.

3.10 ROUGH-IN

A. Scheduling: Contractor shall make every effort to install systems per this specification in a timely manner including rough-in of cabling and other apparatus where appropriate to stay on schedule.

B. Protection of Environment: Where cabling and/or equipment is installed prior to other trades completing their work in an area, Contractor shall take necessary precautions to cover, wrap, or otherwise protect to reduce possible damage due to plastering, painting, cleaning, or other such work.

3.11 CUTTING, DRILLING, PATCHING, AND PAINTING

A. Coordination: Contractor is responsible for coordinating the work when any cutting or drilling is required in the performance of installing the specified systems.

B. Restoration: Contractor is responsible for returning all surfaces (including walls, floors, and ceilings) to their previous condition after any cutting.

3.12 LABELING

A. General: Rack-mounted equipment and hardware shall be labeled as required herein. Connectors, jacks, receptacles, outlets, cables, cable terminations, terminal blocks, rack mounted equipment, active slots of card frame systems, etc. shall be clearly, logically, and permanently labeled in a manner acceptable to Consultant.

B. Approval: Proposed wording and/or numbering schemes for labeling shall be provided to Consultant for review and written approval prior to procurement or installation.

C. Labels used shall be permanent and secure. Provide labeling as follows unless otherwise noted in a specific section:

1. Like Size: Labels shall be sized to match other labels used for same purpose. Similarly, provide engraved labels of like size in other locations.

2. Equipment Racks: For enclosed racks containing equipment, provide labels on each equipment rack rear door or console rear panel reading “No user serviceable parts. Refer service to qualified technician.”

3. Installer and Consultant Identification: Position at the front top center section of each equipment rack a label that states the names of system Installer and Consultant.

4. Custom Panels: Custom panel nomenclature shall be engraved, etched, or screened. Markings are to be designed to ensure consistency and clarity within and without of system. Verify markings and placements by submitting label sample layouts to Consultant for approval prior to procurement.

5. Documentation: Labeling information shall appear on the as-built drawings.

3.13 DEMOLITION

A. General: Where demolition is indicated in Project Documents, Contractor shall be responsible for removal, collection, transportation, and recycling of all indicated cabling and components, including the delivery of cable to the recycling center. If material is to remain on site for more than seven days after removal, Contractor shall coordinate with Owner for acceptable storage location.

B. Verification: Contractor shall field-verify existing conditions prior to beginning demolition work. Any discrepancies between existing conditions and Owner’s written instructions shall be reported to Owner prior to the start of work in order to prevent disturbance of existing installation(s). Beginning work shall indicate acceptance of existing conditions. Contractor is responsible for immediately restoring any outages caused as a result of removing or damaging adjacent cabling, systems, or services.

C. Cable Removal: Where it is not possible to remove cables without damaging other cables that are to remain, such as in a shared conduit, Contractor shall cut cables at entry and exit point of constriction, leaving a minimum of 24” of cable at each end.

D. Cover Plates: Contractor shall provide and install blank cover plates for any outlets that are to be left in place and from which all cables have been removed. Cover plates shall match the Project standard color and finish.

3.14 ADDITIONAL ENGINEERING SERVICES

A. General: Contractor is responsible for securing necessary engineering services where needed to meet the needs of the installation.

B. Change Orders: Only when Contractor can show that additional engineering services are needed as a result of changes to the scope of the services being requested will Owner entertain a Change Order for these services.

3.15 GROUNDING

A. All systems and equipment shall be grounded per manufacturer recommendations and TIA/EIA/BICSI 607 standards.

3.16 WARRANTY AND MAINTENANCE PROGRAM

A. Contractor shall provide the following warranty in addition to specific requirements identified in subsequent sections.

B. As part of the base proposal cost, the Proposer shall include a 15-year, system channel assurance warranty period with full support costs.

C. The Warranty period shall begin once the system is complete and all punch list items are confirmed as being complete per the construction documents. The Contractor shall receive a letter of completion from the Consultant and Owner once the project is complete starting the warranty period.

D. The warranty and support work included in this contract shall cover Labor, travel, equipment, materials and transportation cost.

E. Response Time: Response time for service calls.

1. The Owner reserves the right to make the final determination of emergency or normal service calls and the right to coordinate the best times for service of any system failure

2. Emergency service calls are defined as failures that prohibit the use of a typical system function(s) that pose a life safety concern or such failures that create a major impact to the Owner’s daily operations.

a. The Contractor shall provide remote service diagnosing the impact within two (2) hours after notification by the Owner.

b. If remote service does not correct the reported issue, the Contractor shall provide on-site service correcting the impact within four (4) hours after notification by the Owner.

3. Normal service calls are defined as failures that prohibit the use of typical system function(s) that do not inhibit critical system usage, do not pose life safety concerns and do not create a major impact to Owner’s daily operations.

a. The Contractor shall provide remote service correcting the impact within twenty-four (24) hours after notification by the Owner.

4. The Contractor shall supply Service Request forms and or proper contact procedure to the Owner with instructions for proper notification of the Contractor for warranty service. By following said instructions, the Owner shall constitute proper notification for any need warranty service

F. Repair Time: Contractor shall locally stock critical parts in sufficient quantities such that emergency repair or replacement shall be guaranteed within 12-hours. Temporary replacements within this time period shall be acceptable, provided temporary replacements do not compromise system functionality, and provided permanent replacement is achieved within 96 hours. Contractor may contact the Owner for use of Owner supplied spare parts where delay of system repair will have negative impact on system performance.

G. Transmittal: A copy of this Warranty shall be delivered to, and signed for by the Owner's representative whose primary responsibility is the operation and care of these systems. A copy of the signed Warranty document shall be delivered for review as part of the Final Submittals.

H. Registration: Register Warranty papers for all equipment and software in the name of the Owner. Furnish reproductions of all equipment Warranty papers to the Owner with the Final Submittals.

I. Subcontracting: Warranty service work may not be subcontracted except with specific permission and approval by the Owner.

J. Resolution of Conflicts

1. The Owner retains the right to resolve unsatisfactory warranty service performance at any time by declaring the work unsatisfactory, stating specific areas of dissatisfaction in writing.

K. If the Contractor or his approved Subcontractor does not resolve such stated areas of dissatisfaction within ninety-six (96) hours, the Owner may appoint an alternative service agency or person to fulfill the terms of the Warranty at the expense of the Contractor. This action may be taken repeatedly until the Owner is satisfied that Warranty service performance is satisfactory. Satisfactory resolution of a malfunction shall be considered adequate when the device, equipment, system or component which is chronically malfunctioning is brought into compliance with the standards of performance as contained herein and published by the manufacturers of the equipment installed.

END OF SECTION

SECTION 27 10 00

COMMUNICATIONS CABLING GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 SCOPE

A. Each campus shall contain one MDF, typically within the Administration Building.

B. Connectivity to the MDF and between buildings shall be provided via underground duct bank. IDF rooms shall be allocated on each floor of each building. Contractor shall provide cable tray, conduit, or sleeves as detailed on the drawings.

C. IDF rooms are identified with the prefixes "IDF-1" and "IDF-2", followed by the architectural room number. An IDF-1 serves as the entrance facility for a building. Only one IDF-1 exists per building. Subsequent distribution in the building is routed through the IDF-2's. One or more IDF-2's are typically present on each floor. The Cabling Contractor shall build-out MDF and IDF-1 and IDF-2 space(s) as described within the Contract Drawings.

D. The Cabling Contractor shall provide and install equipment racks, enclosures and cabinets, cable runway, patch panels, wire managers, and miscellaneous hardware as shown on the drawings as part of the complete and working telecommunications cabling system.

E. Intra-building cable required to support network connectivity shall be installed within the plenum space, in conduit, duct and cable support accessories such as cable tray, cable ladder, surface mounted raceway, and/or power pole type assemblies

F. This section describes the products and execution requirements related to furnishing and installing Category 5e/6 Cabling and Termination Components and related subsystems as part of a Structured Cabling System.

G. Backbone system comprising copper and fiber optic cabling and horizontal (station) cabling is covered under this document.

H. Others will provide the network electronics for the LAN within the Telecom Rooms (TRs) and will be responsible for connecting the new cabling infrastructure to the LAN. This Contractor, however, shall supply the Category 6 patch cords. The Contractor shall be available on site during the crossover to assist with any cabling issues that may occur during the connection.

I. The Electrical Contractor shall install conduits and surface raceway for new technology outlet locations unless otherwise noted.

J. The Cabling Contractor shall provide and install all sleeves through the wall penetrations as required whether or not specifically marked on Project Drawings, unless otherwise noted.

K. All cables and related terminations support, and grounding hardware shall be furnished, installed, wired, tested, labeled, and documented by the Contractor, as detailed in the following section(s).

L. All work and materials shall conform in every detail to the rules and requirements of the National Fire Protection Association, the TX Electrical Code, and present manufacturing standards.

M. All materials shall be listed by UL and shall bear the UL label. If UL has no published standards for a particular item, then other national independent testing standards shall apply and such items shall bear those labels. Where UL has an applicable system listing and label, the entire system shall be so labeled.

N. A limited amount of broadband analog video distribution (CATV) cabling will be required as part of the SOW if identified on the drawings. In these instances, inter-building video signals are to be distributed via single-mode optical fiber cables and broadband coaxial cable using traditional CATV techniques within the buildings as defined on the project drawings. Plenum rated RG-6 coaxial cables shall be homerun from the serving area MDF, IDF-1, or IDF-2 to video outlet locations and installed within cable tray and/or conduit. All broadband distribution passive devices, labeling, testing and balancing, etc. shall be included as part of the Cabling Contractors SOW

1.2 RELATED WORK

A. Section 27 00 00 – General Technology Requirements

B. Section 27 10 00 – Communications Cabling General Requirements

C. Section 27 10 05 – Grounding and Bonding for Technology Systems

D. Section 27 11 00 – Communications Equipment Rooms

E. Section 27 13 00 – Communications Backbone Cabling

F. Section 27 15 00 – Communications Horizontal Cabling

G. Section 27 16 00 – Communications Connecting Cords

H. Section 27 18 00 – Communications Labeling and Identification

1.3 REFERENCE STANDARDS AND CODES

A. All references relate to the current version adopted by the city/county according to the authority having jurisdiction (AHJ). If the city/county has not adopted a version the latest version shall be utilized.

B. ASTM B633: Specification for Electrodeposited Coatings of Zinc on Iron and Steel

C. ASTM A653: Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot Dip Process

D. ASTM A123: Specification for Zinc (Hot Galvanized) Coatings on Iron and Steel

E. ASTM A510: Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel

F. ANSI/TIA 569-C: Telecommunications Pathways and Spaces

G. ANSI/TIA 568-C.0, 1, 2, 3, 4: Commercial Building Telecommunications Standard

H. ANSI/TIA-598-C-2005 – Optical Fiber Cable Color Coding

I. ANSI/TIA 606-B: Administration Standard for Telecommunications Infrastructure

J. ANSI/TIA 942-A: Telecommunications Infrastructure Standard for Data Centers

K. ANSI/TIA 607-B: Generic Telecommunications Grounding (Earthing) and Bonding for Customer Premises

L. IEEE: National Electrical Safety Code® (NESC®)

M. standards.ieee.org/about/nesc

1.4 QUALIFICATIONS

A. Premises Distribution System: Written certification that the premises distribution system complies with the EIA ANSI/TIA/EIA-568-C.0,1, 2, 3, EIA ANSI/TIA/EIA-569-B, and ANSI/TIA/EIA-606-A.

B. Materials and Equipment: Where materials or equipment are specified to conform, be constructed, or be tested to meet specific requirements, certification that the items provided conforms to such requirements. Certification by a nationally recognized testing laboratory that a representative sample has been tested to meet the requirements, or a published catalog specification statement to the effect that the item meets the referenced standard, will be acceptable as evidence that the item conforms. Compliance with these requirements does not relieve the Contractor from compliance with other requirements of the specifications.

C. Installers

1. All installing personnel shall have completed and be certified in manufacturer training or BICSI (Building Industry Consulting Service International) installation training for UTP infrastructure systems, or the Contractor shall contract with manufacturer for installation of all proposed components. Company Certifications shall accompany the proposal response.

2. The Contractor’s technicians shall be certified and trained in the connectivity hardware that is being installed.

3. The Contractor shall submit certification that installers are factory certified to install and test the provided products. No less than half of the crew to be used for the telecommunications installation shall be trained by that manufacturer for the work.

1.5 PRE-CONSTRUCTION SUBMITTALS

A. Shop Drawings in addition to requirements in Section 27 00 00:

1. Equipment rack elevation details

2. Elevations of telecommunication room walls mounted equipment

3. Outlet faceplate details for all outlet configurations, sizes, and cable types

4. Overhead telecommunication room enlargements, provide dimensions of room and clearance for maintenance and operation

1.6 CLOSEOUT SUBMITTALS

A. Refer to Section 27 00 00 for requirements. In addition provide three (3) sets of the following:

1. Data cable test results

2. USB Drive containing:

a. As-built drawings (autoCAD format)

b. As-built drawings (PDF format)

c. Detailed test results in original tester format (Fluke Linkware)

d. Detailed cable test results in PDF format

e. Summary test results in PDF format

3. Warranty certification from connectivity manufacturer

1.7 DELIVERY, STORAGE, AND HANDLING

A. Vendor shall be responsible for all materials until completion of Project.

B. Cable shall be stored according to manufacturer’s recommendations at minimum. In addition, cable shall be stored in a location protected from vandalism and weather.

C. If cable is stored outside, it shall be covered with opaque plastic or canvas with provision for ventilation to prevent condensation and for protection from weather. If air temperature at cable storage location will be below 40 degrees Fahrenheit, the cable shall be moved to a heated (minimum 50 degrees Fahrenheit) location. If necessary, cable shall be stored off site at the Contractor's expense.

D. If the Contractor wishes to have a trailer on site for storage of materials, arrangements shall be made with the Owner.

E. Commercial off-the-shelf manuals shall be furnished for operation, installation, configuration, and maintenance for all products provided as a part of the premises distribution system. Specification sheets for all cable, connectors, and other equipment shall be provided.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Unless noted otherwise, products in this section are intended as a basis of design and are open to substitutions per the product substitution procedures defined in Section 27 00 00.

PART 3 - EXECUTION

3.1 WARRANTY

A. Refer to Section 27 00 00 for additional requirements.

B. The Contractor shall provide to the Owner a manufacturer's 15 year minimum warranty certificate for all materials, equipment, etc. Upon successful completion of the installation and subsequent inspection, the Owner shall receive a numbered certificate, from the manufacturing connectivity hardware (patch panels, jacks, parch cords 110 blocks, etc.) company, registering the installation. This warranty shall include all labor, materials, and travel time.

C. The warranty shall ensure against product defects and guarantee that all approved cabling components exceed the specifications of TIA/EIA-568-C, and ISO/IEC IS 11801 for cabling links/channels, and that the installation will exceed the loss and bandwidth requirements of TIA/EIA 568-C ISO/IEC IS 11801 for fiber links/channels, for a fifteen (15) year period. The warranty shall apply to all passive structure cabling system components.

D. The warranty shall cover the failure of the wiring system to support the application that it was designed to support, as well as additional application(s) introduced in the future by recognized standards or user forums that use the TIA/EIA 568-C or ISO/IEC IS 11801 component and link/channel specifications for cabling, for a minimum of a fifteen (15) year period.

E. The warranty shall cover the replacement or repair of defective product(s) and labor for the replacement or repair of such defective products(s), labeling of the new components, and testing of the circuit(s) at no cost to the Owner.

3.2 EXAMINATION

A. Verification of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper and timely completion.

B. Verify cable lengths comply with published standards.

C. Notify Owner of installation that would exceed maximum lengths prior to installation of cable.

D. Contactor shall consult with Owner regarding alternative routing or location of cable.

E. Do not proceed until unsatisfactory conditions have been corrected.

3.3 INSTALLATION REQUIREMENTS

A. Contractor shall furnish all required installation tools to facilitate cable pulling without damage to the cable jacket. Such equipment shall include, but not be limited to, sheaves, winches, cable reels, cable reel jacks, duct entrance tunnels, pulling tension gauge, and similar devices. All equipment shall be of substantial construction to allow steady progress once pulling has begun. Makeshift devices that may move or wear in a manner to pose a hazard to the cable shall not be used.

B. Service Loops: A surplus of cable, typically located at or near the point of termination to facilitate potential future changes. Cables shall have a minimum cable slack of 10ft (3m) at the telecommunication room(s) and 3.28ft (1m) at each telecommunications outlet in the suspended ceiling unless noted otherwise. Service loops shall be stored in an extended loop or in a figure-eight configuration, not in bundled loops.

C. Cable Support (TIA 569-C.9.7):

1. Non-continuous supports shall be located at intervals not to exceed 1.5 m (5 ft). Non-continuous supports shall be selected to accommodate the immediate and anticipated quantity, weight, and performance requirements of cables.

2. It is recommended not to make long runs exactly 5 ft apart due to “harmonics” issues per cable manufacturers

3. Non-continuous pathways do not need to be bonded together or grounded (see 2011 NEC 250.92.A.1

D. Maximum pulling tension (TIA 568-C.5.3.1):

1. The pulling tension for a 4-pair balanced twisted pair cable shall not exceed 110 N (25 lbf) during installation. For multipair cable (12-pair and above), manufacturer's pulling tension guidelines shall be followed.

2. Sags between supports shall be a maximum of 300 mm (12 inches).

3.4 COOPERATION

A. The Contractor shall cooperate with other trades and General Contractor's personnel in locating work in a proper manner.

B. Should it be necessary to raise, lower, or move longitudinally any part of the work to better fit the general installation, such work shall be done at no extra cost to the Owner, provided such decision is reached prior to actual installation. The Contractor shall check location of electrical outlets with respect to other installations before installing.

3.5 TESTING AND ACCEPTANCE

A. The Contractor shall perform acceptance tests as indicated below for each subsystem (backbone, station, etc.) as it is completed.

B. The Contractor shall supply all equipment and personnel necessary to conduct the acceptance tests. Prior to testing, the Contractor shall provide a summary of the proposed test plan for each cable type, including equipment to use, setup, test frequencies or wavelengths, results format, etc. The Consultant will approve the method of testing.

C. The Contractor shall visually inspect all cabling and termination points to ensure that they are complete and conform to the wiring pattern defined herein. The Contractor shall provide the Consultant with a written certification that this inspection has been made.

D. The Contractor shall conduct acceptance testing according to a schedule coordinated with the Consultant. Representatives of the Owner may be in attendance to witness the test procedures. The Contractor shall provide a minimum of one (1) week advance notice to the Consultant and Owner to allow for such participation. The notification shall include a written description of the proposed conduct of the tests, including copies of blank test result sheets to be used.

E. Tests related to connected equipment of others shall be done only with the permission and presence of Contractor involved. The Contractor shall ascertain that testing only as required to prove the wiring connections are correct.

F. The Contractor shall provide test results and describe the conduct of the tests, including the date of the tests, the equipment used, and the procedures followed. At the request of the Consultant, the Contractor shall provide copies of the original test results.

G. All cabling shall be 100% fault free unless noted otherwise. If any cable is found to be outside the specification defined herein, that cable and the associated termination(s) shall be replaced at the Contractor's expense. The applicable tests shall then be repeated.

H. Backbone voice cables shall be free of shorts within the pairs and be verified for continuity, pair validity and polarity, and conductor position on the termination blocks (e.g., 110). Any mispositioned pairs shall be identified and corrected. The percentage of "bad" pairs shall not exceed 1% in any backbone (riser or tie) cable based on total pair count. All bad pairs shall be identified and documented.

I. The Consultant or Owner may request that a 10% random field re-test be conducted on the cable system to verify documented findings.

1. If requested, the Contractor shall test up to 10% of cable links at no cost to the Owner.

2. Tests shall be a repeat of those defined above and under Testing and Acceptance. If findings contradict the documentation submitted by the Contractor, additional testing shall be performed to the extent determined necessary by the Consultant, including a 100% re-test. This re-test shall be at no additional cost to the Owner.

3.6 FIRE STOPPING

A. Contractor shall seal any openings created for cable pass-through between floors or through fire rated walls. Sealing material and application of this material shall be accomplished in such a manner that is acceptable to the local fire and building authorities having jurisdiction over this work.

B. Creation of such openings as are necessary for cable passage between locations as shown on the Drawings shall be the responsibility of the Contractor. Any openings created by or for the Contractor and left unused shall also be sealed as part of this work.

C. Firestopping materials shall be asbestos free and capable of maintaining an effective barrier against flame, smoke, and gasses in compliance with requirements of ASTM E 814, and UL 1479. Only listed firestopping material acceptable to the City of San Antonio Fire Marshal shall be used within each of the following conditions:

1. Duct, cables, conduit, piping, and cable tray penetrations through floor slab and through time-rated partitions or fire walls.

2. Openings between floor slab and curtain walls, including inside hollow curtain walls at the floor slab.

3. Penetrations of vertical service shafts.

4. Openings and penetrations in time-rated partitions of fire walls containing fire doors.

5. Locations where specifically shown on the drawings or where specified in other sections of the project manual.

6. The rating of the installed firestop system shall in no case less than the rating of the time-rated floor or wall assembly.

3.7 ACCEPTABLE PRODUCTS

A. Manufacturers acceptable contingent upon products' compliance with the specifications and City of San Antonio requirements:

1. STI EZ-Path assemblies shall be used for all wall penetrations coming into an MDF or IDF rooms. Assemblies shall be sized to accommodate 50% growth over initial installation.

2. 3M Brand Caulk CP-25, Putty 303, Wrap/Strip FS-195, Composite Strip CS-195, or Penetrating Sealing Systems 7900 Series.

3. Dow Corning Fire Stop Foam, liquid component Part A (black) and liquid component Part B (off-white).

4. Dow Corning Fire Stop Sealant.

5. Fibrex Safing Insulation.

B. Damming Materials permitted are those products compatible with the above materials as certified by the manufacturer in their respective published data.

END OF SECTION

SECTION 27 10 05

GROUNDING AND BONDING FOR TECHNOLOGY SYSTEMS

PART 1 - GENERAL

1.1 SCOPE

A. Refer to Section 27 00 00 for additional project scope information.

1.2 RELATED WORK

A. Section 27 00 00 – General Technology Requirements

B. Section 27 10 00 – Communications Cabling General Requirements

C. Section 27 11 00 – Communications Equipment Rooms

D. Section 27 13 00 – Communications Backbone Cabling

E. Section 27 15 00 – Communications Horizontal Cabling

F. Section 27 16 00 – Communications Connecting Cords

G. Section 27 18 00 – Communications Labeling and Identification

1.3 REFERENCE STANDARDS AND CODES

A. IEEE C2-2007 - National Electrical Safely Code

B. IEEE Std. 837-2002, or latest version – Standard for Qualifying Permanent Connections Used in Substation Grounding

C. ANSI/TIA-607-B-2011 - Commercial Building Grounding and Bonding Requirements for Telecommunications

D. NFPA 70E - Standard for Electrical Safely in the Workplace

E. ANSI/NECA/BICSI-607 - Telecommunications Bonding and Grounding Planning and Installation methods for Commercial Buildings

F. UL 467 - Standard for Grounding and Bonding Equipment

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Unless noted otherwise, products in this section are intended as a basis of design and are open to substitutions per the product substitution procedures defined in Section 27 00 00.

2.2 GROUNDING AND BONDING CABLE

A. The grounding and bonding cable shall be solid stranded copper conductors. Gauge size as specified on project drawings or specifications.

B. The grounding and bonding cables shall have a green jacket color and riser or plenum rated as required.

C. Feeder and Branch Circuit Equipment Ground: Size as shown on drawings, specifications, or as required by NFPA 70, whichever is larger. Differentiate between normal ground and isolated ground when both are used on the same facility.

2.3 GROUNDING AND BONDING BUSBARS

A. Telecommunications Main Grounding Busbar (TMGB)

1. Factory-drilled solid copper with holes to accommodate lugs. Field manufactured busbars are not acceptable.

2. 0.25” thick x 4” wide

3. Sized for current applications and future growth

4. Insulated from its support

5. Shall be an electro-tin plated busbar

6. Maintain a minimum of 2” of clearance from wall

7. UL listed and BICSI certified

B. Telecommunications Grounding Busbar (TGB)

1. Factory-drilled solid copper with holes to accommodate lugs. Field manufactured busbars are not acceptable.

2. 0.25” thick x 2” wide

3. Sized for current applications and future growth

4. UL listed and BICSI certified

5. Horizontal Equipment Rack or Cabinet Busbar

6. Mounts to standard 19” Rack or Frame

7. Capacity: 6 Double hole lugs

8. Shall be an electro-tin plated busbar

9. UL listed and BICSI certified

C. Vertical Equipment Rack or Cabinet Busbar

1. Mounts to vertical rail or inside of cabinet in 19” or 23” equipment rack or frame.

2. Capacity: 9 Double hole lugs

3. Shall be an electro-tin plated busbar

4. UL listed and BICSI certified

D. Acceptable Manufacturers:

1. Chatsworth Products Inc (CPI)

2. Approved equivalent

2.4 MECHANICAL CONNECTORS

A. Mechanical connector bodies shall be manufactured from high strength, high conductivity cast copper alloy material. Bolts, nuts, washers, and lock washers shall be made of Silicon Bronze and supplied as a part of the connector body and shall be of the two bolt type.

B. Split bolt connector types are not allowed.

C. Connectors shall meet or exceed UL 467.

2.5 COMPRESSION LUGS

A. Shall be UL & CSA listed

B. Shall meet or exceed the performance requirements of IEEE 837, latest revision

C. Compression type

D. Shall be manufactured from pure wrought copper. Conductivity of this material shall be no less than 99% by IACS standards.

E. Lugs shall be 2-hole. Single hole lugs are not allowed

F. Long barrel that will allow a minimum of two crimps with standard industry colors

G. Each connector shall be filled with an oxide-inhibiting compound

H. Crimped with a compression, tool and die system, according to manufacturer’s recommendation

2.6 TAPS

A. Connections to the Conductor shall be made with irreversible compression connectors

B. Shall be UL & CSA listed

C. Requires a minimum of (2) crimps for C Tap or H Tap, 1 crimp for I-Beam and busbar Tap

D. Crimp according to manufacturer's recommendation

PART 3 - EXECUTION

3.1 GENERAL

A. Install products in accordance with manufacturer's instructions.

B. Inspect grounding and bonding system conductors and connections for tightness and proper installation.

C. Mechanical connections shall be accessible for inspection and maintenance.

D. No insulation shall be installed over mechanical ground connections.

E. Ground connection surfaces shall be cleaned and all connections shall be made so that disconnection or removal is impossible.

3.2 RESISTANCE MEASUREMENT

A. Measure ground resistance from system neutral connection at service entrance to convenient ground reference point using suitable ground testing equipment. Resistance shall not exceed 2 ohms.

3.3 TELECOMMUNICATIONS BONDING BACKBONE (TBB)

A. The intended function of a TBB is to reduce or equalize potential differences between telecommunications systems. While the TBB will carry some current under ac power ground fault conditions, it is not intended to provide the only ground fault return path.

B. The TBB shall:

1. Be connected to the TMGB & TGB connecting MDF and IDF rooms within the same structure. TGB shall not connect separate buildings.

2. Be a continuous copper conductor that shall be sized no less than 6 AWG to a maximum of 3/0 AWG. The TBB shall be sized in accordance to the following table:

Linear Length – ft.	Size (AWG)
Less than 13	6
14 - 20	4
21 - 26	3
27 - 33	2
34 - 41	1
42 - 52	1/0
53 - 66	2/0
Greater than 67’	3/0

3. The TBB conductors shall be installed and protected from physical and mechanical damage.

4. The TBB conductors should be installed with limited number of splices.

a. Where splices are necessary, the number of splices should be kept to a minimum and they shall be accessible and located within telecommunications spaces or j-box labeled as a telecommunications bonding backbone splice.

5. Joined segments of a TBB shall be connected using exothermic welding, irreversible compression-type connectors or equal.

C. A metallic cable shield shall not be used as a TBB.

3.4 GROUNDING EQUALIZER (GE)

A. The GE shall be a continuous copper conductor that shall be sized no less than 6 AWG to a maximum of 3/0 AWG. The GE shall match the size of the TBB.

B. The GE shall connect to the telecommunications grounding busbar(s) in the same-floor telecommunications rooms on the first, top, and every third floor in a building greater than 4 floors.

C. A metallic cable shield shall not be used as a GE.

3.5 TELECOMMUNICATIONS EQUIPMENT BONDING CONDUCTOR (TEBC)

A. Connects the TMGB/TGB to equipment racks and cabinets.

B. Shall be a continuous copper conductor that shall be sized per the length of cable.

C. Shall be separated from ferrous materials by 2” or be bonded to the ferrous metal.

D. May be routed within cable trays or suspended 2” under or off the side of the cable tray or ladder rack.

E. Shall be supported every 3ft.

F. 8” minimum bend radius.

G. May come cross other cable groups at a 90 degree angle only.

H. A metallic cable shield shall not be used as a TEBC.

3.6 RACK OR CABINET BONDING CONDUCTOR

A. A bonding conductor shall be used to connect the equipment racks and cabinets directly to the TMGB, TGB or underfloor ground mesh network.

B. All metallic enclosures, including remote mounted equipment cabinets and racks for telecommunications, security or audio/visual shall be bonded to the nearest TMGB or TGB using a minimum sized conductor of 6 AWG. Remote bonds shall be labeled on both ends stating the destination of the bond.

3.7 ELECTRICAL DISTRIBUTION PANEL (EDP)

A. The AC EDP serving the Telecommunications Room shall be bonded to the TMGB or TGB using a minimum of a 6 AWG cable.

B. A qualified electrician shall make all connections within an AC electrical distribution panel.

3.8 OPTICAL FIBER CONDUCTIVE CABLES

A. Conductive fiber-optic cables should be bonded and grounded as specified in the NEC.

3.9 LADDER RACK AND/OR CABLE TRAY

A. All low voltage cable runway sections shall be bonded together and bonded back to the nearest Telecommunications Room the runway is serving as close TMGB or TGB as practical.

B. Maintain an 8” minimum bend radius on the TEBC.

C. Keep a 2” separation from other cables both power and telecommunications.

D. Remove any paint, oxidation, etc. from the runway surfaces that are being bonded.

E. Drill two holes as required to accommodate the 2-hole compression lug.

F. Apply a thin coat of antioxidant around the holes and on the surface where the lug will be in contact.

G. Attach straps to the runway using stainless steel hardware sized for the lug holes.

H. Wipe off any excess antioxidant after installation of the lug.

3.10 LABELING

A. Each grounding/bonding cable shall be labeled at the TMGB or TGB.

B. All taps to the TBB shall be within an enclosure and labeled as to its purpose.

3.11 TESTING

A. Refer to Section 27 00 00 for additional requirements.

B. Perform testing in accordance with test instrument manufacturer’s recommendations using the fall-of potential method.

END OF SECTION

SECTION 27 11 00

COMMUNICATIONS EQUIPMENT ROOMS

PART 1 - GENERAL

1.1 SCOPE

A. Refer to Section 27 00 00 for additional project scope information.

B. This section describes the products and execution requirements relating to telecommunications cabling, termination components, racks, pathways, telecommunication rooms and related subsystems. Covered systems include the following:

1. Equipment room cable management system and equipment racks

2. Horizontal and backbone cable terminating equipment

3. Telecommunications grounds and related components

1.2 RELATED WORK

A. Section 27 00 00 – General Technology Requirements

B. Section 27 10 00 – Communications Cabling General Requirements

C. Section 27 10 05 – Grounding and Bonding for Technology Systems

D. Section 27 13 00 – Communications Backbone Cabling

E. Section 27 15 00 – Communications Horizontal Cabling

F. Section 27 16 00 – Communications Connecting Cords

G. Section 27 18 00 – Communications Labeling and Identification

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Unless noted otherwise, products in this section are intended as a basis of design and are open to substitutions per the product substitution procedures defined in Section 27 00 00.

2.2 CATEGORY 6 PATCH PANELS

A. Standard Data Cables shall be terminated at the telecommunication rooms on high-density integrated patch panels incorporating Category 6 jacks (non-keyed 8-pin), meeting the specifications for the telecommunications outlet detailed in the section above.

B. Patch panel configuration shall be 48 ports.

C. The patch panel shall exceed ANSI/TIA/EIA 568-C.2-1 Category 6 component compliance standard. All pair combinations shall be considered, with the worst-case measurement being the basis for compliance.

D. The patch panels shall be interoperable and backwards compatible to lower performing cabling systems.

E. Panels shall incorporate cable support and/or strain relief mechanisms to secure the horizontal cables at the termination block and to ensure that all manufacturers' minimum bend radius specifications are adhered to.

F. The patch panel shall have color-coded designation strips to identify cable count.

G. Manufacturers:

1. Leviton 69586-U48

2.3 CATEGORY 6A PATCH PANELS

A. All specialty cables (WAPS, UPLINK) shall be terminated at the telecommunication closets on high-density integrated patch panels incorporating Category 6a jacks (non-keyed 8-pin), meeting the specifications for the telecommunications outlet detailed in the section above. Specialty cable shall not be mixed with standard data cables within the patch panels.

B. Patch panel configuration shall be 48 ports.

C. The patch panel shall exceed ANSI/TIA/EIA 568-C.2-1 Category 6a component compliance standard. All pair combinations shall be considered, with the worst-case measurement being the basis for compliance.

D. The patch panels shall be interoperable and backwards compatible to lower performing cabling systems.

E. Panels shall incorporate cable support and/or strain relief mechanisms to secure the horizontal cables at the termination block and to ensure that all manufacturers' minimum bend radius specifications are adhered to.

F. The patch panel shall have color-coded designation strips to identify cable count.

G. Manufacturers:

1. Leviton 6A586-U48

2.4 VOICE BACKBONE TERMINATION FIELD

A. Wall Mounted 110 Blocks

1. At the MDF room, voice “backbone” cables shall be terminated on high-density wall mounted 110 blocks.

2. The Proposer shall provide 100 pairs rack mounted 110 panels. The panel shall allow voice backbone cables to be terminated directly on the wall.

3. The panels shall incorporate the openings between rows to allow cables to be routed from behind the panel directly to the point of termination.

4. The panels shall be with cable managers and covers. Termination strips on the base shall be notched and divided into 5-pair increments.

5. The mechanical termination shall:

a. Have the ability of terminating 22-26 AWG plastic insulated, solid, and stranded copper conductors.

b. Provide a direct connection between the cable and jumper wires.

c. Have less than 0.2-dB of attenuation from 1 - 100 MHz.

d. Have less than 100 mw of DC resistance.

e. Have less than 5 mw of resistance imbalance.

f. Have minimal signal impairments at all frequencies up to 100 MHz.

6. Blocks shall identify pair position by a color designation: blue, orange, green, brown, and slate (backbone only).

B. OSP Protectors shall be solid-state type units for all cable pairs to be used for data transmission; Circa 3B1S-300 or approved equivalent.

C. Interior backbone 110 panels shall be Leviton 41AW1-50 or equal.

2.5 FIBER OPTIC PATCH PANELS

A. The Contractor shall provide a fiber optic patch panel at each location where a fiber optic cable terminates.

B. All terminated fibers shall be mated to duplex LC couplings mounted on enclosed patch panels. Couplers shall be mounted on a panel that, in turn, snaps into the enclosure. The proposed enclosure shall be designed to accommodate a changing variety of connector types, including SC, ST, Fixed Shroud Duplex (e.g., “FDDI Connector”), Biconic, and FC by changing panels on which connector couplings are mounted.

C. The patch panel enclosure shall be sized to accommodate the total fiber count to be installed at each location as defined in the specifications and Drawings, including those not terminated (if applicable), PLUS 50% future growth.

D. The Contractor shall provide all required connector panels and connector couplings (sleeves, bulkheads, etc.) adequate to accommodate the number of fibers to be terminated.

E. Patch panels shall be designed for easy installation, front removal, and expansion of snap-in adapter panels.

F. Patch panels shall be enclosed assemblies affording protection to the cable subassemblies and to the terminated ends. The enclosures shall incorporate a hinged or retractable front cover designed to protect the connector couplings and fiber optic jumpers.

G. The patch panel's enclosure shall provide for strain relief of incoming cables and shall incorporate radius control mechanisms to limit bending of the fiber to the manufacturer's recommended minimums or 1.2", whichever is larger.

H. Access to the inside of the patch panel enclosure during installation shall be from the front and rear. Panels that require any disassembly of the cabinet to gain entry will not be accepted.

I. All patch panels shall provide protection to both the "facilities" and "user" side of the coupling. The patch panel enclosure shall be configured to require front access only when patching. The incoming cables (backbone, riser, etc.) shall not be accessible from the patching area of the panel. The enclosure shall provide a physical barrier to access of such cables.

J. Where singlemode fibers are installed, the fibers contained in these cables may be terminated either by (1) splicing of factory-terminated cable assemblies ("pigtails") or (2) use of a "fan-out" kit. In the latter approach, individual fibers are to be secured in a protective covering (such as an Aramid reinforced tube, for example) with connectors mated to the resulting assembly. In both instances, the proposed termination hardware shall incorporate a mechanism by which cable and subassemblies are secured to prevent damage. Splicing shall be by the "fusion" method. Individual splice loss shall not exceed 0.2 dB.

K. Fiber optic patch panels shall be:

1. Leviton 5R2UH-S06 in IDF rooms.

2. Leviton 5R4UH-S12 in MDF or Server Rooms.

L. 50-micron LC adaptor panels shall be Leviton SDX 12-port Aqua #5F100-2QL.

M. Singlemode LC adaptor panels shall be Leviton SDX 12-port Blue #5F100-2LL.

2.6 CABLE MANAGEMENT SYSTEM

A. The cable management system shall be used to provide a neat and efficient means for routing and protecting fiber and copper cables and patch cords on telecommunication racks and enclosures. The system shall be a complete cable management system comprising 4-post and 2-post floor mount racks, wall mount racks, equipment cabinets and vertical and horizontal cable managers to manage cables on both the front and rear of the rack. The system shall protect network investment by maintaining system performance, controlling cable bend radius, and providing cable strain relief.

1. 2-Post Equipment Racks

a. The Contractor shall provide and install 2-post adjustable equipment racks to house cable termination components (e.g., copper data and fiber optic) and network electronics (by others) as shown on the drawings. Prior to installation, the Contractor shall coordinate exact placement with Owner.

b. Rack shall be 84" in height and shall be self-supporting.

c. Channel uprights shall be spaced to accommodate industry standard 19" mounting and have pass-through holes with smooth edges to protect cables.

d. Rack shall be constructed of aluminum.

e. Rack shall be double side drilled and tapped to accept 12-24 screws. Uprights shall also be drilled on back to accept cable brackets, clamps, power strip(s), etc. Hole pattern on rack front shall be per EIA/TIA specifications (5/8"-5/8"-1/2"). Hole pattern on the rear shall be at 3" intervals to accept cable brackets.

f. Rack shall be supplied with at least 24 spare screws.

g. Rack shall be supplied with a ground bar and #6 AWG ground lug.

h. Manufacturers:

1) Chatsworth #55053-703

2) Approved equal.

2. Vertical Cable Management

a. At the telecommunication rooms, vertical cable management shall be furnished and installed to adjacent racks to organize cables on front and rear of telecommunication racks.

b. Vertical cable managers shall include components that aid in routing, managing, and organizing cable to and from equipment. Panels shall protect network equipment by controlling cable bend radius and providing cable strain relief. Panels shall be a universal design mounting to EIA 19" or 23" racks.

c. Vertical cable management system shall feature the following:

1) Open cabling section on the rear that provides easy access and routes cable bundles feeding into the back of patch panels and 1 RMU cable guide on the front designed for fanning and managing patch cords.

2) Edge-protected pass-through ports designed for easy routing of cable from front channel to back.

3) Vertical slots along the center separator to allow securing cable bundles neatly with management straps.

4) Door/cover (front only) that is easily opened from the right or left and still easily removed to allow for quick moves, adds, and changes.

5) Movable wire retainers to retain the cables during cover removal.

d. Vertical cable management at the end of rack rows shall be 6”.

e. Vertical cable management between racks shall be 10”

f. Manufacturers:

1) Chatsworth Products Industries (CPI) 30165-703 & 30163-703

2) Approved equal

2.7 POWER DEVICES

A. Refer to Section 27 00 00 for additional requirements.

B. Power strip shall provide surge protection and power conditioning.

C. Contractor shall provide one (1) power strip per rack/cabinet.

D. Manufacturers:

1. APC

2. Or approved equal

2.8 HORIZONTAL CABLE MANAGEMENT

A. Horizontal cable managers shall include components that aid in routing, managing, and organizing cable to and from equipment. Panels shall protect network equipment by controlling cable bend radius and providing cable strain relief. Panels shall be a universal design mounting to EIA 19" racks and constructed of steel bases with PVC duct attached. The duct fingers shall include retaining tabs to retain the cables in place during cover removal. The covers shall be able to hinge from either side yet still be easily removed to allow for quick moves, adds, and changes.

B. The cable managers shall be provided with movable wire retainers to retain the cables during cover removal and #12-24 mounting screws. An integral strain relief bracket shall be provided on either end of the duct to allow for easy cover placement.

C. Double-Sided horizontal cable managers shall be placed above and below each patch panel.

D. The Contractor shall also supply (1) additional manager for every horizontal patch panel installed for network electronics (electronics provided by others).

E. Manufacturers

1. Chatsworth Products Industries (CPI) #30130-719

2. Cooper/B-Line

3. Approved equal

2.9 TELECOMMUNICATION GROUND

A. The Telecommunication Contractor is responsible for providing an appropriate ground for all racks, trays, and telecommunications equipment installed by this Contractor.

2.10 WIRE BASKET RUNWAY TRAY

A. Within each Telecommunications Room, the Contractor shall provide and install sufficient wire basket tray to support cable bundles from corridor to equipment racks or as shown on the Project Drawings, this Contractor shall provide and install sufficient basket tray to support cable bundles from corridor to equipment racks or cabinets.

B. The Contractor shall provide all necessary labor, supervision, materials, equipment, tests, and services to install complete wire basket runway systems in the telecommunication closet.

C. Wire basket runway systems shall include, but are not limited to, straight sections of continuous wire mesh, field formed horizontal and vertical bends, tees, drop outs, supports, and accessories.

D. Specifications and Drawings are for assistance and guidance, but exact routing, locations, distances, and levels will be governed by actual field conditions.

E. All straight section longitudinal wires shall be straight (with no bends).

F. Wire basket runway shall be made of high strength steel wires and formed into a standard 2-inch by 4-inch wire mesh pattern with intersecting wires welded together. All wire ends along runway sides (flanges) shall be rounded during manufacturing for safety of cables and installers.

G. All fittings shall be field formed as needed.

H. All splicing assemblies shall be the bolted type using serrated flange locknuts. Hardware shall be either yellow zinc dichromate in accordance with ASTM B633 SC2 or AISI Type 304 stainless steel. Splicing assemblies shall provide a continuous ground connection.

I. Wire Basket Tray shall be grounded to the Telecommunications Room ground bus bar.

J. Construction: Overhead Cable Management shall be 18-inch Universal Cable Runway made of 3/8” x 1-1/2” x .065” wall rectangular steel tubing with cross members welded at 12 inch intervals. Cable Runway shall be installed utilizing appropriate hardware to support, join, or attach sections to structures, and shall be supported at a minimum of 5 foot intervals.

K. Acceptable Manufacturers:

1. Chatsworth Products Industries (CPI)

2. Cooper/B-Line

3. Approved equivalent

L. Cable Drop Out/Waterfall

1. Where cables bundles transition from tray and drop to the rack, cabinets or ladder rack, the Contractor shall provide and install a radius control device. This device shall be a waterfall or drop out device and shall be properly sized to accommodate cable bundle plus 20% future growth.

M. T-sections of tray shall be made using T-section fittings.

N. Straight section splices shall be made using splice plates.

O. Wire basket runway supports shall be wall mounted brackets and trapeze hangers when spanning the room.

P. Trapeze hangers shall be supported by 3/8 inch diameter rods.

Q. Provide size as indicated on the drawings.

R. Tray shall have flat Black finish.

S. Accessories (connectors, splice plates…) shall be painted to match tray finish.

T. Acceptable Manufacturers:

1. Chatsworth Products Industries (CPI)

2. Cooper/B-Line

3. Approved equivalent

2.11 LADDER RACK

A. Within each Telecommunications Room, the Contractor shall provide and install ladder rack as shown on the Project Drawings.

B. Within each Telecommunications Room with a vertical conduit riser the Contractor shall provide and install vertical ladder rack connecting the ground conduit sleeve penetrations with the ceiling conduit sleeve penetrations.

C. The Contractor shall provide all necessary labor, supervision, materials, equipment, tests, and services to install a complete ladder rack system in the telecommunications room as shown on the Drawings.

D. Specifications and Drawings are for assistance and guidance, but exact routing, locations, distances, and levels will be governed by actual field conditions.

E. All splicing assemblies shall be the bolted type using serrated flange locknuts. Hardware shall be either yellow zinc dichromate in accordance with ASTM B633 SC2 or AISI Type 304 stainless steel.

F. Cable Drop Out/Waterfall

1. Where cables bundles transition from tray and drop into the racks/cabinets, the Contractor shall provide and install a radius control device. This device shall be a waterfall or drop out device and shall be properly sized to accommodate cable bundle plus 20% future growth.

G. Size ladder rack as indicated on the Contract Documents.

H. Accessories (connectors, splice plates…) shall be painted to match tray finish.

I. Manufacturers:

1. Chatsworth Products Industries (CPI)

2. Cooper/B-Line

3. Approved equal

PART 3 - EXECUTION

3.1 EQUIPMENT RACK AND CABINETS

A. Prior to permanently securing racks or cabinets, the Contractor shall coordinate a walk through with the Owner to determine exact placement of racks.

B. The Contractor shall bolt the rack to the floor as recommended by the manufacturer. Multiple racks shall be joined and the ground made common on each. Rack shall also be stabilized by extending a brace extending to the wall. Alternately, overhead cable tray over which the cabling accesses the equipment rack(s) shall provide this function.

C. A space between the rack upright and the wall (~6") shall be planned to allow for cabling in that area. The rear of the rack shall be ~40" from the wall to allow for access by maintenance personnel. In all cases, a minimum of 40" workspace in front of the rack is also required. Locations where these guidelines cannot be followed shall be brought to the attention of the Consultant for resolution prior to installation.

D. All hardware and equipment is to be mounted at least 18" above floor level. This is to afford easy access and, in the case of the lower limit, prevent damage to the components. Positioning of hardware shall be reviewed and approved by the Consultant and Site Coordinator(s) prior to installation.

E. Equipment rack shall be equipped with cable management hardware to allow an orderly and secure routing of twisted pair cabling to the data patch panels. At minimum, one such horizontal jumper management panel shall be placed below each fiber optic patch panel installed by the Contractor. Additional jumper management panels may be required pending installation of other cable types on the rack. The rack shall be grounded to the telecommunications ground (TGB) using a #6 AWG (or larger) insulated stranded copper conductor (GREEN jacket).

3.2 WIRE BASKET TRAY AND LADDER RACK RUNWAY

A. Runway shall be installed in accordance with recognized industry practices, to ensure that the cable tray equipment complies with requirements of NEC, applicable portions of NFPA 70B and NECA’s “Standards of Installation” pertaining to general electrical installation practices.

B. Coordinate installation of runway with other electrical work as necessary to properly interface installation of wire basket runway with other work.

C. Provide sufficient space encompassing runways to permit access for installing and maintaining cables.

D. Test runways to ensure electrical continuity of bonding and grounding connections and to demonstrate compliance with specified maximum grounding resistance.

END OF SECTION

SECTION 27 13 00
COMMUNICATIONS BACKBONE CABLING

PART 1 - GENERAL

1.1 SCOPE

A. Refer to Section 27 00 00 for additional project scope information.

B. This section describes the products and execution requirements relating to telecommunications voice, data and video backbone cabling and termination components.

C. Backbone Cabling is the cable and hardware interconnecting telecommunication rooms (TRs), building demarcation rooms, equipment rooms and server rooms. The backbone cabling shall consist of the following cable types:

1. 50-micron Multimode Fiber Optic Cable

2. Singlemode Fiber Optic Cable

3. Multi-Pair Copper Voice Backbone Cable

1.2 RELATED WORK

A. Section 27 00 00 – General Technology Requirements

B. Section 27 10 00 – Communications Cabling General Requirements

C. Section 27 10 05 – Grounding and Bonding for Technology Systems

D. Section 27 11 00 – Communications Equipment Rooms

E. Section 27 15 00 – Communications Horizontal Cabling

F. Section 27 16 00 – Communications Connecting Cords

G. Section 27 18 00 – Communications Labeling and Identification

1.3 TEST DATA – FIBER OPTIC MEDIA

A. The test result information for each link shall be recorded in the memory of the field tester upon completion of the test.

B. The test result records saved by the tester shall be transferred into a Windows-based database utility that allows for the maintenance, inspection, and archiving of these test records. A guarantee shall be made that these results are transferred to the PC unaltered, i.e., “as saved in the tester” at the end of each test.

C. The database for the completed job shall be stored and delivered on USB media device. This USB media device shall include the software tools required to view, inspect, and print any selection of test reports.

D. A paper copy of the test results shall be provided that lists all the links that have been tested with the following summary information:

1. The identification of the link in accordance with the naming convention defined in the overall system documentation.

2. The overall Pass/Fail evaluation of the link-under-test including the Attenuation worst-case margin (margin is defined as the difference between the measured value and the test limit value as defined in this document).

3. The date and time the test results were saved in the memory of the tester.

E. The following general information is to be provided in the electronic database containing the test result information for each link:

1. The identification of the customer site as specified by the end user.

2. The overall Pass/Fail evaluation of the link-under-test.

3. The name of the standard selected to execute the stored test results.

4. The cable type and the value of the ‘index of refraction’ used for length calculations.

5. The date and time the test results were saved in the memory of the tester.

6. The brand name, model, and serial number of the tester.

7. The revision of the tester software and the revision of the test standards database in the tester.

F. The detailed test results data to be provided in the electronic database for each tested optical fiber shall contain the following information:

1. The identification of the link/fiber in accordance with the naming convention defined in the overall system documentation.

2. The insertion loss (attenuation) measured at each wavelength, the test limit calculated for the corresponding wavelength, and the margin (difference between the measured attenuation and the test limit value).

G. The link length shall be reported for each optical fiber for which the test limit was calculated.

H. Contractor shall provide accurate as-built Construction Drawings at the site during construction.

I. The Drawings are to include cable routes and outlet locations. Outlet locations shall be identified by their sequential number as defined elsewhere in this document. Numbering, icons, and drawing conventions used shall be consistent throughout all documentation provided. The Owner will provide floor plans in paper and electronic (“.dwg”, AutoCAD rel. 2004 and “.dxf”) formats on which as-built construction information can be added. These documents will be modified accordingly by the Contractor to denote as-built information as defined above and returned to the Owner.

J. The Contractors shall annotate the base Drawings and return to the Consultant in hard copy (same plot size as originals) and electronic (AutoCAD rel. 2004 and “.dxf”) form.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Unless noted otherwise, products in this section are intended as a basis of design and are open to substitutions per the product substitution procedures defined in Section 27 00 00.

2.2 BACKBONE VOICE CABLING

A. The voice backbone cable shall link the Main Closet and Telecommunications Rooms serving the building. The cables shall be CMP rated. These cables shall be terminated on rack mounted 110 type blocks at MER and TR.

B. Voice backbone cable shall incorporate 24 AWG solid annealed copper conductors insulated with a polyvinyl chloride skin over expanded polyethylene. Conductors shall be twisted to form pairs and fully color-coded.

C. The voice backbone cable shall be sized as detailed on the Drawings.

D. Conductors shall be identified by the insulation color of each conductor. The color code shall follow the industry standard composed of ten (10) distinctive colors to identify 25 pairs in accordance with ICEA publication S-80-576-1988. Marking of each mate of the primary conductor in a pair with the color of that primary conductor is optional.

E. The voice backbone cable shall meet or exceed the EIA/TIA Category 3 performance requirements.

F. When cables of larger than 25 pairs are required, the core shall be assembled into 25-pair subunits, each color-coded in accordance with ICEA publication S-80-576-1988. Cables with over 600 pairs shall have 25-pair binder groups combined into super units. These super units shall be wrapped with a solid color thread that follows the primary color scheme of white, red, black, yellow, and violet. Binder color code integrity shall be maintained wherever cables are spliced.

G. All cables and equipment shall be furnished, installed, wired, and tested by the Contractor.

H. Acceptable Manufacturers:

1. Berk-Tek, General, Hitachi

2. Or Approved Equivalent.

2.3 INTRA-BUILDING BACKBONE COPPER CABLING

A. General: Copper backbone cable shall be used to provide voice connectivity between the MDF or IDF-1 and IDF-2 Spaces. Cable shall be installed within conduits, sleeves/cores and/or the cable tray system between spaces.

B. Codes and standards: Multi-conductor cable shall be acceptable for IEEE 802.3 applications. Cables shall be type CMP (communications plenum cable) or type CMR (communications riser cable) as required per the installation environment and as outlined in NEC Sections 800-51(a) and 800-51(b) respectively. Cable shall also conform to Bell Laboratories specification L-780011 and be UL listed.

C. Conductors: Conductors shall be #24 AWG solid annealed copper twisted to form individual non-shielded pairs. The twisted pairs shall be color-coded using standard telephone industry color codes.

D. Insulation: Polyvinylchloride skin over polyethylene or a Teflon material as required per the installation.

E. Jacket: Riser rated cable jacket shall be of fire resistant riser rated material equivalent to polyvinylchloride plastic or better. Cable jacket shall enclose an overlapped corrugated aluminum shield. Plenum rated cable jacket shall be of fire resistant plenum rated material equivalent to a copolymer or better.

F. The total number of cable pairs supplied in each run shall equal the total pair count as shown on the drawings.

G. Acceptable Manufacturer/Product:

1. Berk-Tek, General, Hitachi

2. Or Approved Equivalent.

2.4 OUTSIDE PLANT (OSP) INTER-BUILDING FIBER OPTIC CABLE

A. General: Loose tube fiber optic backbone cable shall be used for connectivity between buildings. Cable will be run within innerduct in underground conduit between buildings and within the building.

B. Fiber construction shall consist of both single mode OM4 multi-mode with a core/cladding size of 9/125 micron single mode and 50.0/125 micron multi-mode in a composite cable. Contractor shall furnish and install the appropriate fan out or breakout materials as required and dictated by the application and fiber optic cable type.

C. The total number of fibers supplied in each cable run shall equal the total number of fibers shown on the contract drawings. The cable structure shall be such that the fibers are grouped for easy handling. The cable shall contain appropriate strength members to satisfy the mechanical and environmental specifications provided herein.

D. The core shall consist of filled buffer tubes surrounding a central dielectric strength member. Water-Swellable and Flame Retardant Tape and yarns shall surround the fibers to provide further weather and mechanical protection. The Contractor shall ensure that the core construction of the cable proposed for installation is such that the environmental and mechanical requirements of the installation are met.

E. The maximum attenuation of loose tube fiber optic strands shall be:

1. 50.0/125 multi-mode (850 nanometers):3.0 dB/km (1300 nanometers): 1.0 dB/km

2. 9.0/125 single-mode (1310 nanometers): 0.4 dB/km (1550 nanometers): 0.3 dB/km

F. The minimum OFL bandwidth of OM3 multi-mode cable shall not be less than 1500 MHz-km @ 850 nm and 500 MHz-km @ 1300 nm.

G. The minimum OFL bandwidth of OM4 multi-mode cable shall not be less than 3000 MHz-km @ 850 nm and 500 MHz-km @ 1300 nm.

H. The minimum Laser bandwidth of OM3 multi-mode cable shall not be less than 2000 MHz-km @ 850 nm and 500 MHz-km @ 1300 nm.

I. The minimum Laser bandwidth of OM4 multi-mode cable shall not be less than 4700 MHz-km @ 850 nm and 500 MHz-km @ 1300 nm.

J. All finished fibers must be color-coded by the manufacturer for identification. The fibers shall be connectorized utilizing field-installed terminations or spliced pigtails. The nominal connector loss using either termination method shall not be greater than 0.40 dB per mated pair.

K. The fiber cable shall be able to withstand a short-term tensile load of 2700 N (600 lbf.) and a long-term tensile load of 600 N (135 lbf.) with maximum elongation of less than 0.5% and no breakage of fibers.

L. The minimum static or no load (0-180 lb.) bending radius for the cable shall be no less than 10 times the outside diameter of the cable. Cables shall be able to withstand being flexed at their minimum static bending radius +/- 90 degrees for at least 20 cycles at 20-40 cycles per minute at 20 degrees C. The minimum dynamic or loaded (181-600 lb.) bending radius shall be no greater than 20 times the outside diameter of the cable.

M. The cable shall be able to withstand twisting of +/-360 degrees over a length of 2 meters for at least 10 cycles at 10 cycles per minute. The cable shall be able to withstand storage and operating temperatures of -40 to +70 degrees C. The cable shall withstand a compressive force of 600 N/cm without breakage, and there shall be no attenuation increase after the force is removed.

N. Acceptable Product:

1. Berktek

2. General

3. Hitachi

4. Or Approved equivalent

O. TIGHT-BUFFERED OPTICAL FIBER CABLES FOR INDOOR DISTRIBUTION APPLICATIONS

1. General Considerations

a. The cable shall meet the requirements of the National Electrical Code (NEC) Section 770.

b. For plenum applications, the cable shall meet applicable flame tests: ANSI/UL 910 (NFPA 262-1994).

c. Cables shall be listed OFNP (OFCP).

1) Berktek

2) General

3) Hitachi

4) Approved equivalent.

d. Finished cables shall conform to the applicable performance requirements of Tables 8-6 and 8-7 of the Insulated Cable Consultants Association, Inc. (ICEA) Standard for Fiber Optic Premises Distribution Cable (ICEA S-83-596).

2. Cable Construction

a. The coated fiber shall have a layer of Teflon placed between the acrylate coating of the optical fiber and the thermoplastic buffer. The diameter of the thermoplastic buffer coating shall be 900 ±50µm. The fiber coating and buffer shall be removable with commercially available stripping tools in a single pass for connectorization or splicing.

b. Cables with 2 to 24 fibers layered aramid yarns shall serve as the tensile strength member of the cable.

c. A ripcord shall be applied between the aramid yarns and the outer jacket to facilitate jacket removal.

d. The outer jacket shall be extruded over the aramid yarns for physical and environmental protection. The jacket shall be continuous, free from pinholes, splits, blisters, or other imperfections. The jacket shall have a consistent, uniform thickness. The jacket shall be smooth, as is consistent with the best commercial practice.

e. The fibers shall be stranded around a dielectric central member.

f. For cables containing 12-24 fibers, the fibers shall be arranged in two layers.

g. The central member shall be over coated with a thermoplastic, when required, to achieve dimensional sizing to accommodate and support the 900 µm buffered fibers.

h. Cables with 24 to 60 fibers shall have unitized riser and plenum constructions.

i. The buffered fibers shall be grouped in six-fiber subunits.

j. The fibers shall be stranded around a dielectric central member in the subunit.

k. Layered aramid yarns shall serve as the tensile strength member of the subunit.

l. A ripcord may be applied between the aramid yarns and the subunit jacket to facilitate jacket removal.

m. The subunit jacket shall be extruded over the aramid yarns for physical and environmental protection. The jacket shall be continuous, free from pinholes, splits, blisters, or other imperfections. The jacket shall have a consistent, uniform thickness. The jacket shall be smooth, as is consistent with the best commercial practice.

n. The subunits shall be stranded around a dielectric central member. A ripcord shall be inserted beneath the outer jacket to facilitate jacket removal. The outer jacket shall be extruded around the subunits. The strength members shall be of a high modulus aramid yarn. The aramid yarns shall be helically stranded around the buffered fibers. Non-toxic, non-irritant talc shall be applied to the yarns to allow them to be easily separated from the fibers and the subunit jacket.

3. Outer Cable Jacket

a. The jacket shall be continuous, free from pinholes, splits, blisters, or other imperfections. The jacket shall have a consistent, uniform thickness; jackets extruded under high pressure are not acceptable. The jacket shall be smooth, as is consistent with the best commercial practice. The jacket shall provide the cable with a tough, flexible, protective coating, able to withstand stresses. The nominal thickness of the cable outer jacket shall be sufficient to provide adequate cable protection while meeting the mechanical, flammability, and environmental test requirements of this document over the life of the cable.

b. The indoor distribution cable specified herein shall have an interlocking armor made of steel or aluminum. The interlocking armor for plenum cables shall have a PVC jacket.

c. The color of the armor jacket shall match the jacket color of the optical fiber cable located inside of the armor. The armor for these cables shall be comparable to liquid tight flexible metal conduit if jacketed, or flexible metal conduit.

4. Fiber Identification

a. The individual fibers shall be color-coded for identification. The optical fiber color-coding shall be in accordance with ANSITIA/EIA-598-B “Optical Fiber Cable Color Coding.” The coloring material shall be stable over the temperature range of the cable, shall not be susceptible to migration, and shall not affect the transmission characteristics of the optical fibers. Color-coded buffered fibers shall not adhere to one another.

b. When buffered fibers are grouped into individual subunits, each subunit jacket shall be numbered for identification, with the exception of filler subunits where used. The number shall be repeated at regular intervals. The subunit jacket color shall be orange for subunits containing multimode fibers, yellow for subunits containing singlemode fibers, and white for filler subunits.

c. The outer jacket for all dielectric cable shall be marked with the manufacturer name or UL file number, date of manufacture, fiber type, flame rating, listing symbol, and sequential length markings every two feet. The marking shall be in contrasting color to the cable jacket. The cable jacket color shall be orange for cables containing multimode fibers and yellow for cables containing singlemode fibers.

d. Cables with a PVC jacket over interlocking armor shall be marked with the manufacturer name, date of manufacture, fiber type, flame rating, listing symbol, and sequential length markings every two feet. The marking shall be in contrasting color to the cable jacket. The cable jacket color shall match the color of the core optical fiber cable.

5. Cable Specifications

a. Temperature Range

1) Non-Plenum Applications: The storage temperature range for the cable on the original shipping reel shall be -40 to +70ºC. The installation/operating temperature range for riser cables shall be -20 to +70 ºC. Testing shall be in accordance with FOTP-3.

2) Plenum Applications: The storage temperature range for the cable on the original shipping reel shall be -40 to +70ºC.The installation/operating temperature range for plenum cables shall be 0 to +70ºC.Testing shall be in accordance with FOTP-3.

b. Compressive Load Resistance

1) When tested in accordance with FOTP-41, Compressive Loading Resistance of Fiber Optic Cables, the cable shall withstand a minimum compressive load of 89 N/cm (50 lbf/in) applied uniformly over the length of the compression plate. While under compressive load, the fiber shall not experience an attenuation change greater than 0.4 dB at 1550 nm (singlemode) or greater than 0.6 dB at 1300 nm (multimode). After the compressive load is removed, the fibers shall not experience an attenuation change greater than 0.2 dB at 1550 nm (singlemode) or greater than 0.4 dB at 1300 nm (multimode).

c. Cyclic Flexing

1) When tested in accordance with FOTP-104, Fiber Optic Cable Cyclic Flexing Test, the cable shall withstand 25 mechanical flexing cycles at a rate of 30 ± 1 cycle per minute. The fiber shall not experience an attenuation change greater than 0.2 dB at 1550 nm (singlemode) or greater than 0.4 dB at 1300 nm (multimode).

d. High and Low Temperature Bend

1) When tested in accordance with FOTP-37, Fiber Optic Cable Bend Test, Low and High Temperature, the cable shall withstand four full turns around a mandrel at test temperatures of 0 ºC and +50 ºC. The fibers shall not experience an attenuation change greater than 0.2 dB at 1550 nm (singlemode) or greater than 0.5 dB at 1300 nm (multimode).

e. Impact Resistance

1) When tested in accordance with FOTP-25, Repeated Impact Testing of Fiber Optic Cables and Cable Assemblies, the cable shall withstand a minimum of 20 impact cycles for riser cables and 10 impact cycles for plenum cables. The fibers shall not experience an attenuation change greater than 0.2 dB at 1550 nm (singlemode) or greater than 0.4 dB at 1300 nm (multimode).

f. Temperature Cycling

1) When tested in accordance with FOTP-3, Procedure to Measure Temperature Cycling Effects on Optical Fiber, Optical Cable, and Other Passive Fiber Optic Components, the change in attenuation at extreme operational temperatures (0 to +50 ºC) shall not exceed 0.3 dB/km at 1550 nm (singlemode) or 0.6 dB/km at 1300 nm (multimode). The change in attenuation is measured with respect to the baseline values measured at room temperature before temperature cycling.

g. Twist-Bend

1) When tested in accordance with FOTP-91, Fiber Optic Cable Twist-Bend Test, a length of cable no greater than 2 meters shall withstand 10 cycles of mechanical twisting and bending around a mandrel 20 times the cable outer diameter. The fibers shall not experience an attenuation change greater than 0.2 dB at 1550 nm (singlemode) or 0.4 dB at 1300 nm (multimode).

6. Multimode (50/125 µm)

a. The multimode fiber utilized in the optical fiber cable shall meet EIA/TIA-492AAAA-A-1997, Detail Specification for 50µm Core Diameter/125µm Cladding Diameter Class Ia Graded-Index Multimode Optical Fibers (OM4 type). Cable shall have the following specifications:

1) Core Diameter: 50 ± 3 µm

2) Core Non-Circularity: ≤5%

3) Cladding Diameter: 125± 2 µm

4) Cladding Non-Circularity: <2.0%

5) Core-to-Cladding Concentricity: ≤ 3 µm

6) Coating Diameter: 245 ± 2 mm

7) Refractive Index Profile: Graded index

8) Numerical Aperture: 0.275 ± 0.015

9) Maximum Attenuation: less than 3.0 dB/km at 850 nm and 1.0 dB/km at 1300 nm.

b. IEEE 802.3z Performance: The fiber shall support laser-based 10 Gigabit Ethernet (10GbE) operation for up to 500 meters.

c. Attenuation at the Water Peak: The attenuation coefficient at 1380 nm shall not exceed the attenuation coefficient at 1300 nm by more than 1.0 dB/km.

d. Macrobend Attenuation: The attenuation due to 100 turns of fiber around a 75-± 2 mm diameter mandrel shall not exceed 0.5 dB at 850 nm or1300 nm.

7. Singlemode

a. The singlemode fiber utilized in the optical fiber cable shall meet EIA/TIA-492CAAA, Detail Specification for Class IVa Dispersion-Unshifted Singlemode Optical Fibers, and ITU recommendation G.652, Characteristics of Singlemode Optical Fiber Cable. The cable shall meet the following specifications:

1) Core Diameter (Characterized): 8.3 µm

2) Cladding Diameter: 125. ±1.0µm

3) Core-to-Cladding Concentricity: ≤ 0.8 µm

4) Cladding Non-Circularity: ≤1.0 %

5) Coating Diameter: 245 ±10µm

6) Attenuation: The maximum attenuation shall be 0.5 dB/km at 1310 nm and 0.4 dB/km at 1550 nm.

b. Attenuation Uniformity: There shall be no point discontinuity greater than 0.10 dB at either 1310 nm or 1550 nm.

c. Attenuation at the Water Peak: The attenuation at 1383 ± 3 nm shall not exceed 2.1dB/km.

d. Cutoff Wavelength: The cabled fiber cutoff wavelength shall be ≤1260 nm.

e. IEEE 802.3z Performance: The fiber shall support laser-based Gigabit Ethernet (GbE) operation in the 1000BASE-LX (1300 nm) operating window at 5000 m.

f. Mode Field Diameter: The mode field diameter of the fiber shall be 9.30 ±0.50µm at 1310 nm 10.50 ±1.0µm at 1550 nm.

g. 12 Macrobend Attenuation: The attenuation due to 100 turns of fiber around a 75-± 2mm diameter mandrel shall not exceed 0.05 dB at 1310 nm and 0.10 dB at 1550 nm.

h. Zero Dispersion Wavelength (∂o): The zero dispersion wavelength of the fiber shall be 1301.5 nm ≤ ∂o ≤ 1321.5 nm.

i. Zero Dispersion Slope (So): The zero dispersion slope of the fiber shall be ≤0.092 ps/(nm•km).

j. Maximum Dispersion: The maximum dispersion shall be ≤ 3.2 ps/(nm•km) from 1285 nm through 1330 nm and shall be ≤18 ps/(nm•km) at 1550 nm.

8. The cable shall be Berk-Tek, Corning, General, Mohawk or other equivalent products that meet these specifications.

2.5 FIBER OPTIC CONNECTOR

A. The optical connector shall be LC-type.

B. The connector ferrule shall be ceramic or glass-in-ceramic. The optical fiber within the connector ferrule shall be secured with an adhesive. The attenuation per mated pair shall not exceed 0.35 dB (individual) and 0.2 dB (average). Connectors shall sustain a minimum of 200 mating cycles per EIA/TIA-455-21 without violating specifications.

C. The connector shall meet the following performance criteria:

1. Cable Retention (FOTP-6) 0.2 dB

2. Durability (FOTP-21) 0.2 dB

3. Impact (FOTP-2) 0.2 dB

4. Thermal Shock (FOTP-3) 0.2 dB

5. Humidity (FOTP-5) 0.2 dB

6. Connectors shall be Leviton field polished, 3M Hot Melt or other approved connector.

PART 3 - EXECUTION

3.1 TESTING

A. Refer to Section 27 00 00 for additional requirements.

B. Field Test Requirements for Fiber Optic Cabling System

1. The fibers utilized in the installed cable shall be traceable to the manufacturer. Upon request by the Owner, the Contractor shall provide cable manufacturer's test report for each reel of cable provided. These test reports shall include the manufacturer's on reel attenuation test results at 850-nm and 1300-nm for each optical fiber of each reel prior to shipment from the manufacturer.

2. Factory data shall be provided upon request, showing on-the-reel bandwidth performance results as tested at the factory.

3. Every fiber optic backbone link in the installation shall be tested in accordance with the field test specifications defined by the Telecommunications Industry Association (TIA) standard ANSI/TIA/EIA-568-C or by the appropriate network application standard(s), whichever is more demanding.

4. The test shall include the representative connector performance at the connecting hardware associated with the mating of patch cords. The test does not, however, include the performance of the connector at the interface with the test equipment.

5. 100% of the installed cabling links shall be tested and shall pass the requirements of the standards mentioned above and as further detailed in this document. Any failing link shall be diagnosed and corrected at no additional cost to the Owner. The corrective action shall be followed with a new test to prove that the corrected link meets the performance requirements. The final and passing result of the tests for all links shall be provided in the test results documentation in accordance with RFP.

6. Trained technicians who have successfully attended an appropriate training program and have obtained a certificate as proof thereof shall execute the tests. These certificates may have been issued by any of the following organizations or an equivalent organization:

a. The manufacturer of the fiber optic cable and/or the fiber optic connectors

b. The manufacturer of the test equipment used for the field certification

c. Training organizations authorized by BICSI

7. Field test instruments for multimode fiber cabling shall meet the requirements of ANSI/TIA/EIA-526-14-A. The light source shall meet the launch requirements of ANSI/EIA/TIA-455-50B, Method A. This launch condition can be achieved either within the field test equipment or by use of an external mandrel wrap (as described in clause 11 of ANSI/TIA/EIA-568-C.1) with a Category 1 light source.

8. Field test instruments for singlemode fiber cabling shall meet the requirements of ANSI/EIA/TIA-526-7.

9. The tester shall be within the calibration period recommended by the vendor in order to achieve the vendor-specified measurement accuracy.

10. The fiber optic launch cables and adapters shall be of high quality and the cables shall not show excessive wear resulting from repetitive coiling and storing of the tester interface adapters.

11. The Pass or Fail condition for the link-under-test is determined by the results of the required individual tests.

12. Pass or Fail result for each parameter is determined by comparing the measured values with the specified test limits for that parameter.

13. A representative of the Owner shall be invited to witness field testing. The representative shall be notified of the start date of the testing phase five business days before testing begins.

14. A representative of the Owner will select a random sample of 5% of the installed links. The results obtained shall be compared to the data provided by the installation Contractor. If more than 2% of the sample results differ in terms of the Pass/Fail determination, the installation Contractor, under supervision of the Owner representative, shall repeat 100% of the testing. The cost of retesting shall be borne by the installation Contractor.

C. Fiber Performance Test Parameters

1. The link attenuation shall be calculated by the following formulas specified in ANSI/TIA/EIA standard 568-B.

a. Link Attenuation = Cable_Attn + Connector_Attn + Splice_Attn

b. Cable_Attn (dB) = Attenuation_Coefficient (dB/km) * Length (Km)

c. The values for the Attenuation_Coefficient are listed in the table below:

Type of Optical Fiber	Wavelength (nm)	Attenuation_Coefficient (dB/km)
Multimode 50/125 µm	850	3.5
	1300	1.5
Singlemode (Inside plant)	1310	0.5
	1550	0.4
Singlemode (Outside plant)	1310	0.4
	1550	0.5

d. Connector_Attn (dB) = number_of_connector_pairs * connector_loss (dB)

e. Maximum allowable mated connectors_loss = 0.50 dB

f. Splice_Attn (dB) = number of splices (S) * splice_loss (dB)

g. Maximum allowable splice_loss = 0.1 dB (when tested bidirectionally)

2. Link attenuation does not include any active devices or passive devices other than cable, connectors, and splices—i.e., it does not include such devices as optical bypass switches, couplers, repeaters, or optical amplifiers.

3. Test equipment that measures the link length and automatically calculates the link loss based on the above formulas is preferred.

4. The above link test limits attenuation are based on the use of the One Reference Jumper Method specified by ANSI/TIA/EIA-526-14A, Method B and ANSI/TIA/EIA-526-7,Method A.1. The user shall follow the procedures established by these standards or application notes to accurately conduct performance testing.

5. The backbone link (multimode/singlemode) shall be tested in two directions at both operating wavelengths to account for attenuation deltas associated with wavelength.

6. Multimode backbone links shall be tested at 850 nm and 1300 nm in accordance with ANSI/EIA/TIA-526-14A.

7. Because backbone length and the potential number of splices vary depending upon site conditions, the link attenuation equation shall be used to determine limit (acceptance) values.

8. Multimode backbone links are designed to be used with network applications that use laser light sources (underfilled launch conditions). However, the link attenuation equation has been based upon the use of a light source categorized as Category 1, Overfilled.

9. Singlemode backbone links shall be tested at 1310 nm and 1550 nm in accordance with ANSI/TIA/EIA-526-7, Method A.1. All singlemode links shall be certified with test tools using laser light sources at 1310 nm and 1550 nm.

3.2 FIBER OPTIC CABLE INSTALLATION REQUIREMENTS

A. Cable slack shall be provided in each backbone fiber optic cable. This slack is exclusive of the length of fiber that is required to accommodate termination requirements and is intended to provide for cable repair and/or equipment relocation. The cable slack shall be stored in a fashion as to protect it from damage and be secured in the termination enclosure or a separate enclosure designed for this purpose. Multiple cables may share a common enclosure.

B. A minimum of 15 feet of slack cable (each cable) shall be coiled and secured at each end.

C. Exact cable termination locations shall be field verified with Owner.

END OF SECTION

SECTION 27 15 00
COMMUNICATIONS HORIZONTAL CABLING

PART 1 - GENERAL

1.1 SCOPE

A. This section describes the products and execution requirements relating to telecommunications voice, data and video horizontal (station) cabling and termination components.

B. Horizontal cabling is the cabling between the work area telecommunications outlet and the telecommunications room (TR). Horizontal cabling is often referred to as “station cabling”.

C. The horizontal cabling system will consist of the following:

1. Unshielded Twisted Pair (UTP) Cable
2. Outlet Termination Modules (jacks)
3. Outlet Termination Plates
4. Horizontal Fiber Optic/Copper Composite Cabling
5. Above Ceiling Cable Support Systems
6. Horizontal Cable Testing Requirements
7. Cable Pathway/Sleeve Requirements
8. Coaxial Cable

1.2 RELATED WORK

A. Section 27 00 00 – General Technology Requirements

B. Section 27 10 00 – Communications Cabling General Requirements

C. Section 27 10 05 – Grounding and Bonding for Technology Systems

D. Section 27 11 00 – Communications Equipment Rooms

E. Section 27 13 00 – Communications Backbone Cabling

F. Section 27 16 00 – Communications Connecting Cords

G. Section 27 18 00 – Communications Labeling and Identification

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Unless noted otherwise, products in this section are intended as a basis of design and are open to substitutions per the product substitution procedures defined in Section 27 00 00.

2.2 CATEGORY 6 HORIZONTAL COPPER CABLES (STANDARD DATA CABLES)

A. All cables and equipment shall be furnished, tested, installed and wired by the Contractor.

B. All horizontal data cables shall terminate on modular patch panels in the telecommunications rooms as specified on the Drawings.

C. Standard data cable specification defines the requirements for commercially available high performance Category 6 cable.

D. This cable shall be suitable for installation free-air, in building risers, in conduit, and/or in cable tray and shall carry CMP rating.

E. Standard data cable design described herein shall exceed transmission performance of Category 6 cables.

F. Cables shall be Underwriters Laboratory (UL) listed, comply with Article 800 (Communications Circuits) of the National Electrical Code, and meet the specifications of NEMA (low loss), UL 444, and ICEA. Conductor shall also conform to the requirements for solid annealed copper wire in accordance with ASTM B 3.

G. All cables, termination components, and support hardware shall be furnished, tested, installed, and wired by the Contractor.

H. The jacket color for data cables shall be BLUE.

I. IMPORTANT: Cable and termination components (jack, patch panel, wiring blocks) are specified to function as a system. The compatibility of the cable to be installed with the proposed termination components shall be recognized and documented by the termination component manufacturer.

J. Category 6 Cables shall be:

1. Berk-Tek - LANmark 1000

2. General Cable – Genspeed 6000

3. Or Hitachi – Supra 660

2.3 CATEGORY 6A HORIZONTAL COPPER CABLES (WAP AND UP-LINKS)

A. Category 6A cables shall be used to support all Wireless Access Point (WAP) and all Uplink connections connecting MDF/IDF rooms. All cables and equipment shall be furnished, tested, installed and wired by the Contractor.

B. All horizontal data cables shall terminate on modular patch panels in the telecommunications rooms as specified on the Drawings.

C. WAP and Uplink cable specification defines the requirements for commercially available high performance Category 6A cable.

D. This cable shall be suitable for installation free-air, in building risers, in conduit, and/or in cable tray and shall carry CMP rating.

E. WAP and Uplink cable design described herein shall exceed transmission performance of Category 6A cables.

F. Cables shall be Underwriters Laboratory (UL) listed, comply with Article 800 (Communications Circuits) of the National Electrical Code, and meet the specifications of NEMA (low loss), UL 444, and ICEA. Conductor shall also conform to the requirements for solid annealed copper wire in accordance with ASTM B 3.

G. All cables, termination components, and support hardware shall be furnished, tested, installed, and wired by the Contractor.

H. The jacket color for data cables shall be BLUE.

I. IMPORTANT: Cable and termination components (jack, patch panel, wiring blocks) are specified to function as a system. The compatibility of the cable to be installed with the proposed termination components shall be recognized and documented by the termination component manufacturer.

J. Category 6A Cables shall be:

1. Berk-Tek – LANmark-10G2

2. General Cable – Genspeed 10 MTP Thin-Profile

3. Or Hitachi – Supra 10G

2.4 OUTSIDE PLANT CATEGORY 6 COPPER CABLES

A. OSP category 6 cables shall be used for any exterior security devices that are not attached to the main building and any runs to separate buildings including but not limited to the mechanical building.

B. All cables and equipment shall be furnished, tested, installed and wired by the Contractor.

C. Standard data cable design described herein shall exceed transmission performance of Category 6 cables.

D. All cables, termination components, and support hardware shall be furnished, tested, installed, and wired by the Contractor.

E. IMPORTANT: Cable and termination components (jack, patch panel, wiring blocks) are specified to function as a system. The compatibility of the cable to be installed with the proposed termination components shall be recognized and documented by the termination component manufacturer.

F. Category 6 Cables shall be:

1. Berk-Tek - LANmark 1000 OSP or approved equal

2.5 COAXIAL CABLE (WHEN APPLICABLE)

A. RG-6 Quad Shield Coaxial Station Drop Cable

B. RG-6 coaxial cable shall be used for video connectivity from the video system main trunk cable to the individual CATV or broadcast outlet. The cable shall be placed within the cable tray system and shall be UL Listed CMP Plenum rated.

C. Center conductor shall be nominal 18AWG minimum, solid bare copper. The dielectric insulation shall be foam FEP. The outer conductor or shield shall be aluminum foil and 95% coverage tinned copper braid. Outer jacket shall be CommFlex V with minimum 80 degree Celsius temperature rating and white in color.

D. Maximum attenuation of the cable @ 20degrees Celsius shall be 6.05dB/100feet @ 720MHz. Velocity of Propagation shall be 84% NOMINAL. Nominal impedance shall be 75Ω ± 2Ω.

E. Acceptable Product:

1. General Cable

2. Belden

F. INDOOR/OUTDOOR FIBER OPTIC CABLING TO EXTERIOR UTILITY POLES

1. General

a. For each utility pole with security devices, as shown on project plans, SCC shall provide and install an indoor/outdoor fiber optic cable.

b. Cable shall be terminated on dedicated rack mounted fiber patch panel in the MDF room.

c. Cable shall be terminated in small wall mountd fiber surface box in pull box at the base of each utility pole as indicated on project drawings.

d. Cable specifications:

1) Cable shall be meant for indoor/outdoor applications meeting ICEA-596, ICEA-696 and ANSI/TIA-758 standards.

2) 6-strand, OS2 Single-Mode cable.

3) Have water-blocking technology with 250 uM, individually colored fibers.

4) Cable shall be Berktek Adventum or approved equal.

G. INFORMATION OUTLET

1. General

a. Station cables shall each be terminated at their designated workstation location in the connector types described in the subsections below. Included are modular jacks, faceplates, and surface mount raceway. The combined assembly is referred to as the Standard Information Outlet (SIO). These connector assemblies shall snap into a mounting frame.

b. SIOs shall be mounted (1) where existing boxes are in place, (2) on surface mount raceway typically in surface raceway with barrier, (3) on floor mount interface boxes, or (4) on power poles either currently owned or new.

c. The telecommunications outlet frame shall accommodate or incorporate the following:

1) A minimum of four (4) modular jacks, when installed on a wall-mounted assembly.

2) A maximum of 6 cables shall be in a single outlet box/faceplate. If more than 6 cable/jacks are needed at one location, contractor shall provide adjustment faceplates with not more than 6 jacks per faceplate.

3) A mechanism for adjusting the surface plate to a plumb position.

d. Multiple jacks are identified in close proximity on the Drawings. The Contractor shall determine the optimum compliant configuration based on the products proposed.

e. The same orientation and positioning of jacks and connectors shall be utilized throughout the installation. Prior to installation, the Contractor shall submit the proposed configuration for each SIO type for review by the Consultant.

2. Modular Jack

a. Data jacks shall be non-keyed 8-pin modular jacks.

b. Termination components shall be designed to maintain the cable's pair twists as closely as possible to the point of mechanical termination.

c. Jacks shall utilize a four-layer printed circuit board to control NEXT.

d. Jack housings shall fully encase and protect printed circuit boards and IDC fields.

e. Modular jack contacts shall accept 2500 plug insertions.

f. Modular jack contacts shall be formed flat for increased surface contact with mated plugs. These contacts shall be arranged on the PC board in two staggered arrays of four to maximize contact spacing and minimize crosstalk.

g. Modular jack contacts shall be constructed of Beryllium copper for maximum spring force and resilience.

h. Contact Plating shall be a minimum of 50 micro inches of gold in the contact area over 50 micro-inch of nickel, compliant with FCC part 68.5.

i. Jack termination shall be110 IDC, integral to the jack housing, laid out in two arrays of four contacts.

j. Jacks shall utilize a paired punch down sequence. Cable pairs shall be maintained up to the IDC, terminating all conductors adjacent to its pair mate to better maintain pair characteristics designed by the cable manufacturer.

k. Jacks shall utilize tin lead plated (60% tin/40%lead) phosphor bronze 110 insulation displacement contacts.

l. Jacks shall terminate 22-26 AWG stranded or solid conductors.

m. Jacks shall terminate insulated conductors with outside diameters up to .050".

n. Jacks shall be compatible with single conductor 110 impact termination tools.

o. Jacks shall be compatible with EIA/TIA 606 color code labeling and accept snap on icons for identification or designation of applications.

p. Jacks shall be Gray in color.

q. Jacks shall be marked as either T568A or T568B wiring.

r. Category 6 jacks shall be manufactured by Leviton 61110-RG6.

s. Category 6a jacks shall be manufactured by Leviton 6AUJK-RG6

3. Outlet Faceplates

a. Faceplates shall be ivory plastic and incorporate recessed designation strips at the top and bottom of the frame for identifying labels. Designation strips shall be fitted with clear plastic covers.

b. Any unused jack positions shall be fitted with a removable blank inserted into the opening.

c. Modular jacks shall have capability to incorporate a dust cover that fits over and/or into the jack opening. The dust cover shall be designed to remain with the jack assembly when the jack is in use. No damage to the jack pinning shall result from insertion or removal of these covers. Dust covers that result in deformation of the jack pinning shall not be accepted.

d. Wall-mounted “voice only” outlets shall be installed where identified on the floor plan Drawings to accommodate wall-mounted telephone sets. The wall plate shall be of ivory plastic construction, accommodate one (1) voice jack as defined below, mount on a standard single gang outlet box or bracket, and include mating lugs for wall phone mounting.

e. All standard information outlets and the associated jacks shall be of the same manufacturer throughout each/the building. An allowable exception, however, is the wall-mounted “voice only” outlet described above.

f. Faceplates shall be manufactured by modular jack manufacturer.

4. Surface Mount Interface Box

a. Low profile, surface mount boxes shall incorporate recessed designation strips at the top for identifying labels. Designation strips shall be fitted with clear plastic covers.

b. The box shall feature built-in cable management for both fiber and copper applications.

c. Any unused jack positions shall be fitted with a removable blank inserted into the opening.

d. Modular jacks shall have capability to incorporate spring-loaded shutter door for added protection from dust and other airborne contaminants. The dust cover shall be designed to remain with the jack assembly when the jack is in use.

e. The box shall have the capability to incorporate optional magnets that can be internally mounted.

f. Surface mount box shall be manufactured by modular jack manufacturer.

2.6 ADDITIONAL MODULES FOR COPPER CABLING

A. Additional modules for copper shall include the following:

1. 50 and 75 Ohm BNC coax coupler modules, male-male

2. F-type coax coupler module, male-male threaded

3. RCA connector modules with black, red, yellow, and white inserts

4. Solder, pass-through and punch-down termination types

5. S-Video connectors modules - coupler and punch-down termination types

6. Blank module to reserve space for future additions

7. The connectors shall be designed to allow snap-in installation into the outlet faceplates.

2.7 CABLE HOOK SYSTEMS

A. In the areas where the cables are required to be run in a “free-air” plenum, a cable hook system shall be used.

B. Cable hooks shall be capable of supporting a minimum of 30 lbs with a safety factor of 3.

C. Spring steel cable hooks shall be capable of supporting a minimum of 100 lbs with a safety factor of 3 where extra strength is required.

D. Follow manufacturer’s recommendations for allowable fill capacity for each size of cable hook.

E. Installation and configuration shall conform to the requirements of the ANSI/ EIA/TIA Standards 568A & 569, NFPA 70 (National Electrical Code), and applicable local codes.

F. Cable hooks shall:

1. Have a flat bottom and provide a minimum of 1 5/8" cable bearing surface.

2. Have 90-degree radiused edges to prevent damage while installing cables.

3. Be designed so the mounting hardware is recessed to prevent cable damage.

4. Have a retainer that shall be removable and reusable.

5. Be factory assembled for direct attachment to walls, hanger rods, beam flanges, purlins, strut, and floor posts, to meet job conditions.

G. Factory assembled multi-tiered cable hooks shall be used where required to provide separate cabling compartments, or where additional capacity is needed.

H. Cable hooks shall be:

1. B-Line series BCH21, BCH32

2. Cable trunks with less than 20 cables may be supported by Stiffy (Tomarco/CEAS Attachment Products).

PART 3 - EXECUTION

3.1 TWISTED PAIR TEST EQUIPMENT

A. Test equipment used under this contract shall be from a manufacturer who has a minimum of five years' experience in producing field test equipment. Manufacturers shall be ISO 9001 certified.

B. All test tools of a given type shall be from the same manufacturer and have compatible electronic results output. Test adapter cable shall be approved by the manufacturer of the test equipment. Baseline accuracy of the test equipment shall exceed TIA Level III, as indicated by independent laboratory testing.

C. Test equipment shall:

1. Be capable of certifying Category 5E, 6 and 6A permanent links.

2. Have a dynamic range of at least 100dB to minimized measurement uncertainty.

3. Be capable of storing full frequency sweep data for all tests and printing color graphical reports for all swept measurements.

4. Include S-band time domain diagnostics for NEXT and return loss.

5. Be capable of running individual NEXT, return loss, etc., measurements in addition to AutoText.

6. Include a library of cable types, stored by major manufacturer.

7. Store at least 1000 Category 5e, 6 or 6A autotests in internal memory.

8. The measurement reference plane of the test equipment shall start immediately at the output of the test equipment interface connector. There shall not be a time domain dead zone of any distance that excludes any part of the link from the measurements.

9. The approved manufacturer of the test equipment is Fluke.

3.2 CABLE SUPPORT

A. J-hooks fabricated to contain data/voice and video cables may be used to support 25 or fewer cables in each hook. J-hooks are to be fastened to building steel with beam clamps, suspended from ceiling slab with threaded rod, or anchored to the wall. All J-hooks shall be hung straight and level. No other installation technique will be authorized unless pre-approved.

B. Three tiered double-sided J-hook configurations shall contain a maximum of 25 cables per hook or 150 cables. Smaller configurations may be used as bundles decrease in size, maintaining no more than 25 cables per hook.

C. Bundles surpassing 150 cables shall be supported by hangers, fabricated of 3/8” threaded rod and 24” Unistrut. Hangers shall also be installed where the installation of a three-tiered J-hook system is not appropriate for the ceiling space, or where blocked by other trades’ work.

D. Cable bundles consisting of fewer than 20 cables may be supported by single J hooks or Stiffy (Tomarco/CEAS Attachment Products)

E. All cable support in the cable path shall be installed every four and five feet (staggered).

F. A sag shall be maintained between supports of 6”, to reduce cable strain. Velcro is an appropriate method of securing cables, when properly used and not over tightened.

G. Proper cable support is extremely important to the Owner, and care shall be taken by the Contractor to provide and install the appropriate supports. Supports found to be inadequate will be replaced.

H. Cable bundles including voice/data cabling shall not have plastic cable ties.

I. All cable trunks shall have radius controlled cable waterfalls where trunk drops from conduit, sleeve or tray from horizontal path to vertical path.

3.3 STATION CABLING

A. Information outlet cables with copper media (voice & data UTP and “TV” coax) shall be located as detailed on the Project Drawings.

B. The Contractor shall utilize these documents in determining materials quantities and routing.

C. Station cables shall be run to the information outlet from the MER/TR serving each area in conduit, free-air above drop ceiling, in cable tray, and/or in modular furniture.

D. The maximum station cable drop length for UTP cables shall not exceed 295 feet (90 meters) in order to meet data communications performance specifications. This length is measured from the termination panel in the wiring closet to the outlet and shall include any slack required for the installation and termination. The Contractor shall install station cabling in a fashion to avoid unnecessarily long runs.

E. Contractor shall verify cable lengths comply with published standards; prior to installation of any horizontal cabling, this Contractor shall verify cable paths and confirm no horizontal cable will exceed 295 total feet. If it is determined that the cable will exceed 295’, this Contractor shall route the cabling to another MER/TR or determine shorter path so cables are under 295’. If this is not possible, the Contractor shall notify the Consultant prior to installation. Failure to do this step will not result in a change order from the Contractor.

F. The minimum station cable drop length for UTP cables shall be no less than 45 feet. The Contractor shall install station cabling in a fashion to avoid runs less than 45 feet. If cable slack is required to accommodate the minimum length requirements, the Contractor is responsible for storing the slack in a fashion as to protect the cable from damage. The cable slack shall be secure above the ceiling tiles in a figure 8 form by means of J-hooks or D rings anchored to the building structure. The cable slack shall be coiled to maintain from 100% to 200% of the cable recommended minimum bend radius. Multiple cables may share a common support.

G. The minimum station cable drop count shall be two cables/jacks per drop location.

H. All cables shall be installed splice-free unless otherwise specified.

I. During pulling operation, an adequate number of workers shall be present to allow cable observation at all points of duct entry and exit as well as the feed cable and operate pulling machinery.

J. Avoid abrasion and other damage to cables during installation.

K. All cable shall be free of tension at both ends. In cases where the cable shall bear some stress, Kellum grips may be used to spread the strain over a longer length of cable.

L. Where installed free-air, installation shall consider the following:

1. Cable shall run at right angles and be kept clear of other trades' work.

2. Cables shall be supported according to code, using "J-hooks" anchored to ceiling concrete, walls, piping supports, or structural steel beams.

3. Hooks shall be designed to maintain cable bend to larger than the minimum bend radius (typically 4 x cable diameter).

4. Supports shall be spaced at a maximum 4-foot interval unless limited by building construction. If cable "sag" at mid-span exceeds 6 inches, another support shall be used.

M. Cable shall never be laid directly on the ceiling grid.

N. Cables shall not be attached to existing cabling, plumbing, or steam piping, ductwork, ceiling supports, or electrical or communications conduit.

O. Manufacturers' minimum bend radius specifications shall be observed in all instances. Use of plastic cable ties is not acceptable. Cable bundles shall be neatly dressed with use of Velcro type straps.

P. Cable sheaths shall be protected from damage from sharp edges. Where a cable passes over a sharp edge, a bushing or grommet shall be used to protect the cable.

Q. A coil of one foot in each cable shall be placed in the ceiling at the last support (e.g., J-hook) before the cables enter a fishable wall, conduit, surface raceway, or box. At any location where cables are installed into movable partition walls or modular furniture via a service pole, approximately 15 feet of slack shall be left in each station cable under 250 feet in length to allow for change in the office layout without re-cabling. These “service loops” shall be secured at the last cable support before the cable leaves the ceiling and shall be coiled from 100% to 200% of the cable recommended minimum bend radius.

R. To reduce or eliminate EMI, the following minimum separation distances from ≤480V power lines shall be adhered to:

1. Twelve (12) inches from power lines of <5-kVa

2. Eighteen (18) inches from high voltage lighting (including fluorescent)

3. Thirty-nine (39) inches from power lines of 5-kVa or greater

4. Thirty-nine (39) inches from transformers and motors

S. All openings shall be sleeved and firestopped per prevailing code requirements upon completion of cable installation.

3.4 INFORMATION OUTLET

A. Information outlets shall be flush mounted on wall-mounted boxes, in floor-mounted boxes, on surface raceway, or on modular furniture.

B. Any outlets to be added where these conditions are not met shall be positioned at a height matching that of existing services or as directed otherwise by the Site Coordinator and the Consultant. Nominal height (from finished floor to center line of outlet) in new installation shall be as follows:

1. Standard Voice & Data Outlet (SIO) shall match adjacent electrical outlets.

2. Wall-Mounted Telephone Outlet (Standard Voice only) shall meet ADA requirements.

C. The Contractor shall coordinate the style of the telecommunication outlets to be installed in the floor mount boxes and surface mount raceways with the Owner.

3.5 CABLE TERMINATION

A. At the telecommunication closet, all data and voice cables shall be positioned on termination hardware in sequence of the outlet ID, starting with the lowest number.

B. Termination hardware (blocks and patch panels) positioning and layout will be reviewed and approved by the Consultant prior to construction. The review does not exempt the Contractor from meeting any of the requirements stated in this document.

C. Cable Termination – Data/Voice UTP

1. Data/voice patch panels shall be designed and installed in a fashion as to allow future station cabling to be terminated on the panel without disruption to existing connections.

2. Data patch panels shall be sized to accommodate a minimum of 20% growth in the quantity of stations relative to the initial installation.

3. At information outlets and data/voice patch panels, the installer shall ensure that the twists in each cable pair are preserved to within 0.5 inch of the termination for data/voice cables. The cable jacket shall be removed only to the extent required to make the termination.

D. Cable Termination – Fiber Optic

1. All fibers shall be terminated using the specified connector type.

2. All terminated fibers at the telecommunications closets shall be mated to couplings mounted on patch panels. Couplings shall be mounted on a panel that, in turn, snaps into the housing assembly. Any unused panel positions shall be fitted with a blank panel inhibiting access to the fiber optic cable from the front of the housing.

3. All couplings shall be fitted with a dust cap.

4. Fibers from multiple locations may share a common enclosure, but they shall be segregated on the connector panels and clearly identified. Fibers from multiple destinations may be secured in a common enclosure, provided they are clearly identified as such. Fibers from different locations shall not share a common connector panel (e.g., “insert”).

5. Slack in each fiber shall be provided as to allow for future re-termination in the event of connector or fiber end-face damage. Adequate slack shall be retained to allow termination at a 30” high workbench positioned adjacent to the termination enclosure(s). A minimum of one meter (~39”) of slack shall be retained regardless of panel position relative to the potential work area.

6. Contractor shall install a plastic twist-on bushing on each end of interlocking armored fiber to protect cable from sharp edges of the armor.

3.6 TEST DATA – COPPER MEDIA

A. The test result records saved by the tester shall be transferred into a Windows-based database utility that allows for the maintenance, inspection, and archiving of these test records. A guarantee shall be made that these results are transferred to the PC unaltered, i.e., “as saved in the tester” at the end of each test. Comma separated value (CSV) format is not acceptable.

B. The database for the completed job – including twisted-pair copper cabling links, if applicable –shall be stored and delivered on CD-ROM. This CD-ROM shall include the software tools required to view, inspect, and print any selection of test reports.

C. A paper copy of the test results shall be provided that lists all the links that have been tested with the following summary information:

1. The identification of the link in accordance with the naming convention defined in the overall system documentation.

2. The overall Pass/Fail evaluation of the copper channel-under-test, including the NEXT worst-case margin (margin is defined as the difference between the measured value and the test limit value).

3. The overall Pass/Fail evaluation of the fiber link-under-test, including the Attenuation worst-case margin (margin is defined as the difference between the measured value and the test limit value).

4. The date and time the test results were saved in the memory of the tester.

3.7 COPPER STATION CABLES

A. Station cabling testing shall be from the jack at the outlet in the work area to the termination block on which the cables are terminated at the MDF or IDF.

B. Testing shall be of the permanent link. Contractor shall warrant performance, however, based on channel performance and provide patch cords that meet channel performance criteria. All cabling not tested strictly in accordance with these procedures shall be retested at no cost to the Owner.

C. Testing shall be from the jack at the SIO to the patch panel on which the cables are terminated at the wiring hub.

D. Horizontal “station” cables shall be free of shorts within the pairs and shall be verified for continuity, pair validity and polarity, and wire map (conductor position on the modular jack). Any defective, split, or mispositioned pairs shall be identified and corrected.

E. Testing of the cabling systems rated at TIA Category 6/6a and above shall be performed to confirm proper functioning and performance.

F. Testing of the transmission performance of station cables (Category 6/6a) shall include the following:

1. Length
2. Attenuation
3. Pair to Pair NEXT
4. ACR
5. PSNEXT Loss
6. Return Loss
7. Pair to Pair ELFEXT Loss or ACRF
8. PSEFEXT Loss or PS-ACRF
9. Propagation Delay
10. Delay Skew
11. Return Loss

G. The maximum length of station cable shall not exceed 90 meters, which allows 10 meters for equipment and patch cables.

H. Worst case performance at 20°C, based on a horizontal cable length of 90 meters and equipment cord length of 4 meters, shall be as follows:

a. CATEGORY 6 (PERMANENT LINK)

Frequency (MHz)	Insertion Loss (Maximum dB)	NEXT Loss Pair to Pair (dB)	PS-NEXT Loss (dB; Worst Case)	ELFEXT Loss Pair to Pair (dB)	PSELFEXT loss (dB)
1.0	1.9	65.0	62.0	64.2	61.2
4.0	3.5	64.1	61.8	52.1	49.1
8.0	5.0	59.4	57.0	46.1	43.1
10.0	5.5	57.8	55.5	44.2	41.2
16.0	7.0	54.6	52.2	40.1	37.1
20.0	7.8	53.1	50.7	38.2	35.2
25.0	8.8	51.5	49.1	36.2	33.2
31.25	9.8	50.0	47.5	34.3	31.3
62.5	14.1	45.1	42.7	28.3	25.3
100.0	18.0	41.8	39.3	24.2	21.2
200.0	26.1	36.9	34.3	18.2	15.2
250.0	29.5	35.3	32.7	16.2	13.2

b. CATEGORY 6A (PERMANENT LINK)

Frequency (MHz)	Insertion Loss (Maximum dB)	NEXT Loss Pair to Pair (dB)	PS-NEXT Loss (dB; Worst Case)	ACRF Pair to Pair (dB)	PS-ACRF (dB)
1.0	1.9	65.0	62.0	64.2	61.2
4.0	3.5	64.1	61.8	52.1	49.1
8.0	5.0	59.4	57.0	46.1	43.1
10.0	5.5	57.8	55.5	44.2	41.2
16.0	7.0	54.6	52.2	40.1	37.1
20.0	7.8	53.1	50.7	38.2	35.2
25.0	8.8	51.5	49.1	36.2	33.2
31.25	9.8	50.0	47.5	34.3	31.3
62.5	14.1	45.1	42.7	28.3	25.3
100.0	18.0	41.8	39.3	24.2	21.2
200.0	26.1	36.9	34.3	18.2	15.2
250.0	29.5	35.3	32.7	16.2	13.2
300.0	32.7	34.0	31.4	14.6	11.6
400.0	38.5	29.9	27.1	12.1	9.1
500.0	43.8	26.7	23.8	10.2	7.2

I. In the event results of the tests are not satisfactory, the Contractor shall make adjustments, replacements, and changes as necessary and shall then repeat the test or tests that disclosed faulty or defective material, equipment, or installation method. The Contractor shall make additional tests as the Consultant deems necessary at no additional expense to the Owner or Consultant.

J. All data shall indicate the worst-case result, the frequency at which it occurs, the limit at that point, and the margin. These tests shall be performed in a swept frequency manner from 1 MHz to highest relevant frequency, using a swept frequency interval that is consistent with TIA and ISO requirements. Information shall be provided for all pairs or pair combination and in both directions when required by the appropriate standards.

K. Cables shall be tested to the maximum frequency defined by the standards covering that performance category. Transmission Performance Testing shall be performed using a test instrument designed for testing to the specified frequencies. Test records shall verify “PASS” on each cable and display the specified parameters—comparing test values with standards-based “templates” integral to the unit.

END OF SECTION

SECTION 27 16 00

COMMUNICATIONS CONNECTING CORDS

PART 1 - GENERAL

1.1 SCOPE

A. This section describes the products relating to high quality Category 6 voice and data patch cords.

B. In this section the term patch cords refers to the cords that connect Owner provided data network electronics to the horizontal cable infrastructure.

C. It is important that the horizontal cable system and the provided patch cords work as one complete system for guaranteed channel performance. Patch cords shall be manufactured by the same manufacturer as the jack and patch panels.

D. The Contractor shall provide and deliver all cords as listed in this section. The Owner will be responsible for installation of cords.

1.2 RELATED WORK

A. Section 27 00 00 – General Technology Requirements

B. Section 27 10 00 – Communications Cabling General Requirements

C. Section 27 10 05 – Grounding and Bonding for Technology Systems

D. Section 27 11 00 – Communications Equipment Rooms

E. Section 27 13 00 – Communications Backbone Cabling

F. Section 27 15 00 – Communications Horizontal Cabling

G. Section 27 18 00 – Communications Labeling and Identification

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Unless noted otherwise, products in this section are intended as a basis of design and are open to substitutions per the product substitution procedures defined in Section 27 00 00.

2.2 CATEGORY 6/6A PATCH CORDS

A. The Owner has the right to determine the final length of the patch cords after the contract is awarded.

B. All Category 6/6A UTP patch cords shall be round and consist of eight insulated 23 AWG, stranded copper conductors, arranged in four color-coded twisted pairs within a flame retardant jacket and be backwards compatible with lower performing categories. Modular patch cords shall utilize ISO termination method that is designed to reduce and control near-end cross talk (NEXT) and far end cross talk (FEXT) without compromising signal impedance.

C. Both ends of the cord shall be equipped with modular 8-position (RJ45 style) plugs wired straight through with standards compliant wiring. All modular plugs shall exceed FCC CFR 47 part 68 subpart F and IEC 603.7 specifications, and have 50 micro inches of gold plating over nickel contacts. Cable shall be label-verifiable. Cable jacket shall be factory marked at regular intervals indicating verifying organization and performance level. Category 6/6A cords shall have color-coded insert molded strain relief boot with a latch guard to protect against snagging. Additional color-coding shall be available by the use of snap-in icons.

D. Patch cords shall be wired straight through. Pin numbers shall be identical at each end and shall be paired to match T568B patch panel jack wiring per ANSI/TIA/EIA-568-B. Patch cords shall be unkeyed.

E. The manufacturer of the cords shall be the same as the manufacturer for UTP termination hardware (jacks & patch panels). Cords shall be highest quality Category 6/6A cords available by connectivity manufacturer.

F. In each MDF or IDF, furnish to the owner at the time of final inspection (1) Category 6 modular non-booted patch cord for each terminated horizontal data cable plus 25 percent. 50 percent of the total quantity shall be blue and the other 50 percent shall be green in the following proportions:

1. Blue – Cat 6 [Standard data]

    a. 33% 7-foot

    b. 33% 10-foot

    c. 33% 14-foot

2. Green – Cat 6 [Standard phone]

    a. 33% 7-foot

    b. 33% 10-foot

    c. 33% 14-foot

3. Yellow - Cat 6A [Wireless APs]

    a. 100% 7-foot

4. Red – Cat 6 [Fire Alarm or Security Equipment]

a. 100% 10-foot.

5. Orange – Cat 6A [Copper Backbone Uplinks]

a. 100% 7-foot

6. Cat 6 Cords shall be Leviton 6D460-xxx

7. Cat 6A Cords shall be Leviton 6AS10-xxx

G. For outlets, furnish to the owner at the time of final inspection (1) Category 6 modular non-booted patch cord for each terminated horizontal data cable plus 25 percent. 50 percent of the total quantity shall be blue and the other 50 percent shall be green in the following proportions:

1. Blue – Cat 6 [Standard data]

a. 50% 10-foot

b. 50% 14-foot

2. Green – Cat 6 [Standard phone]

a. 50% 10-foot

b. 50% 14-foot

3. Yellow - Cat 6A [Wireless APs]

a. 100% 7-foot

4. Red – Cat 6 [Fire Alarm or Security Equipment]

a. 100% 10-foot.

5. Cat 6 Cords shall be Leviton 6D460-xxx

6. Cat 6A Cords shall be Leviton 6AS10-xxx

PART 3 - EXECUTION

3.1 ORDERING AND DELIVERY

A. Prior to ordering patch cords the Contractor shall schedule meeting with Owner to verify patch cord lengths, colors and quantities.

B. Contractor shall coordinate delivery of patch cords with Owner. Contractor shall have list of delivered cords and shall have Owner sign delivery sheet at time of delivery.

END OF SECTION

SECTION 27 18 00

COMMUNICATIONS LABELING AND IDENTIFICATION

PART 1 - GENERAL

1.1 SCOPE

A. This section describes the products and execution requirements relating to labeling of telecommunications cabling, termination components, and related subsystems. Covered systems include the following:

B. Equipment room backboards and equipment racks

C. Station cable and terminating equipment

D. Telecommunications grounds and related components

1.2 RELATED WORK

A. Section 27 00 00 – General Technology Requirements

B. Section 27 10 00 – Communications Cabling General Requirements

C. Section 27 10 05 – Grounding and Bonding for Technology Systems

D. Section 27 11 00 – Communications Equipment Rooms

E. Section 27 13 00 – Communications Backbone Cabling

F. Section 27 15 00 – Communications Horizontal Cabling

G. Section 27 16 00 – Communications Connecting Cords

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Unless noted otherwise, products in this section are intended as a basis of design and are open to substitutions per the product substitution procedures defined in Section 27 00 00.

2.2 LABELS

A. All labels shall be permanent and be machine generated (e.g., Brady or Panduit). No handwritten or non-permanent labels shall be allowed. Labels shall be Brady “I.D. Pro” or XC-Plus or equivalent. Labeling on backboards and/or equipment racks may be pre-cut adhesive type.

B. Characters on all labels shall be black printed on a white background.

C. Label size shall be appropriate to the cable size(s), outlet faceplate layout, patch panel design, or other related equipment sizes and layouts.

D. All labels to be used on cables shall be self-laminating, white/transparent vinyl, and be wrapped around the cable sheath. The labels shall be of adequate size to accommodate the circumference of the cable being labeled and properly self-laminated over the full extent of the printed area of the label.

E. Labels used to identify innerduct carrying fiber optic cable shall be labeled with a durable yellow polyethylene tag that reads “CAUTION Fiber Optic Cable” and includes blank spaces for adding (1) fiber count and (2) destination information. An example of a compliant product is VIP Products’ “Caution Write-On Coverall Tag.”

PART 3 - EXECUTION

3.1 GENERAL

A. Clean surfaces before attaching labels.

B. Install all labels firmly. Labels attached to terminating equipment such as backboards, faceplates, 110 blocks, and patch panels shall be installed plumb and neatly on all equipment.

3.2 LABELING OF CABLING AND TERMINATION COMPONENTS

A. Backboard and Equipment Racks

1. Backboards and equipment racks shall be labeled by the Contractor identifying the telecommunication room. Additionally, equipment racks shall have an alpha character after the room number unique to that particular communications closet. For example, TR1-A would be the first rack in TR1.

2. Character height shall be 1-inch (minimum).

B. Cabling

1. Horizontal cables shall have a machine generated wrap around cable label within 4” of each end of the cable. Label shall be clearly legible and meet TIA-EIA 606 standards. Character height shall be .25” (minimum).

C. Voice/data/video backbone cables shall have a machine generated wrap around cable label within 12” of each end of the cable. Label shall be clearly legible and meet TIA-EIA 606 standard. Character height shall be .5” (minimum).

3.3 FIBER OPTIC BACKBONE, RISER CABLES, AND TERMINATION COMPONENTS

A. All fiber optic backbone and copper (inter-building, riser, and tie) cables shall be identified AT BOTH ENDS with a designation that identifies where the opposite end of the same cable terminates (e.g., equipment room or telecommunications room I.D.). In addition, labeling of all fiber optic cables shall include the number of fibers in the cable.

B. Each fiber optic termination panel shall be clearly labeled indicating the destination of the cable(s) and the fiber number of each fiber position. The cable identifiers are to be secured to (1) the side and (2) the front cover of the panel enclosure.

3.4 STANDARD INFORMATION OUTLET (SIO) FACEPLATES

A. All faceplates shall be clearly labeled indicating the destination of the cable(s) (telecommunication room number), the data patch panel(s) letter designation, the data port number(s) on the data patch panel(s), and the voice cable number(s).

B. Telecommunications outlets are to be labeled (1) on the cover of the assembly and (2) on each cable terminated at that location.

C. Station cables shall be labeled within two inches of the cable end.

3.5 DATA PATCH PANELS

A. All data patch panels shall be clearly labeled indicating the telecommunication room number, the data patch panel letter designation, and the data port number on the data patch panel (ports 1 through 48). Each telecommunication room shall start with data patch panel ‘A’ and continue through the alphabet.

B. A data port schedule for each telecommunication room shall be created in spreadsheet format (Excel) with the telecommunication room number, data patch panel letter designations, data port numbers, and room numbers identified in the spreadsheet. In addition, for each data patch panel port, a field shall be provided in the spreadsheet for the Owner to manage the cabling infrastructure by recording the device and any special notes pertaining to the room utilizing the data cable terminated to the port.

C. Refer to Telecommunication “T” Series Project Drawings for standard information outlet faceplate and data & voice patch panel labeling scheme requirements. A sample of the data and voice port schedules is to be provided to the Owner, in the cable record book and in electronic format (Excel spreadsheet), with final documents provided on the Project Drawings.

3.6 FIBER OPTIC CABLES AND TERMINATION COMPONENTS

A. All fiber optic cables, termination enclosures and connector panels, and splice closures shall be clearly labeled.

B. In addition, labeling of all fiber optic cables shall include the number of fibers in the cable.

C. Each fiber optic termination panel shall be clearly labeled indicating (1) the destination(s) of the cable(s) and (2) fiber number of each fiber position. The cable identifiers are to be secured to (1) the side and (2) the front cover of the panel enclosure.

3.7 GROUND SYSTEM LABELING

A. All grounds shall be labeled as close as practical to the point of termination (for ease of access to read the label). Labels shall be nonmetallic and include the following statement: “WARNING: If this connector or cable is loose or must be removed, please call the building telecommunications manger.” Refer to ANSI/TIA/EIA 606 for additional labeling requirements.

END OF SECTION

SECTION 27 60 00
PHYSICAL SECURITY GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 SCOPE

A. Refer to Section 27 00 00 for additional project scope information.

B. This section describes the general product and execution requirements related to furnishing and installing Physical Security Systems. Physical Security Systems includes Video Surveillance and Electronic Access Control.

C. Contractor shall be responsible for providing complete and functional systems as described in this specification and project drawings.

D. Contractor shall provide low voltage power and control lines to and from power supplies, remotely controlled equipment, and other devices, even though not explicitly indicated on drawings or listed in equipment tables.

E. Contractor coordinate with Electrical Contractor for provision of high voltage power and conduits/raceway, where necessary.

F. Contractor shall be responsible for any and all related programming and end-user training unless noted otherwise.

1.2 RELATED WORK

A. Section 27 00 00 – General Technology Requirements

B. Section 27 15 00 – Communications Horizontal Cabling

C. Section 27 62 00 – Video Surveillance System

D. Section 27 64 00 – Electronic Access Control System

E. Section 27 65 00 – Emergency Communications Equipment

1.3 REFERENCE

A. In addition to any requirements below, Contractor shall abide by requirements delineated in 27 00 00 including but not limited to:

1. General: Definitions, reference standards and codes, qualifications, pre-construction submittals, construction progress submittals, closeout submittals, and correction period.

2. Products: Substitutions, product specifications, miscellaneous material, cable, connectors, power devices, and interface panels.

3. Execution: Coordination, testing, training, warranty, and cable management.

1.4 QUALIFICATIONS

A. Training: Programmer shall have received manufacturer-provided and/or manufacturer approved training in the configuration of the physical security system(s) being provided.

B. Certification: Programmer shall hold the highest applicable manufacturer programming certification(s) offered by the manufacturer(s) of the physical security system(s).

C. Submittal: Certification certificate shall be submitted with physical security system(s) submittals.

1.5 PRE-CONSTRUCTION SUBMITTALS

A. Hardware, Application Software, and Network Requirements: A system description including analysis and calculations used in sizing equipment required by the Physical Security Systems. The description shall show how the equipment will operate as a system to meet the performance requirements of the systems. The following information shall be supplied as a minimum:

1. Description of site (field) control equipment (Controllers/Field Panels) and their configuration

2. Operating System(s) Software, where software is provided or upgraded

3. Application Software, with Optional and Custom Software Modules supplied in this project

4. Integration Schemes: Proposed connectivity, software, development requirements, and SDK information, for inter-system communication.

5. Network reliability requirements

6. Number and location of LAN ports required

7. Number of IP addresses required.

8. Other specific network requirements, preferences, and constraints

9. Backup/archive system size and configuration

10. Access Control Power Calculations

11. Start-up operations

12. Battery backup requirements

1.6 CLOSEOUT SUBMITTALS

A. Quick-Reference Guides: Contractor shall create a concise quick-reference guide covering normal system operation and basic troubleshooting procedures for each room/system type. Length of each quick-reference guide shall be commensurate with the information needed for successful operation, subject to Owner approval.

1. Upon Owner approval, Contractor shall provide two (2) laminated copies and one (1) digital copy for each room/system type.

B. Serial Numbers: Contractor shall provide a list of serial numbers for all supplied components with serial numbers and with a unit price greater than $99. Organize list by room/system type.

PART 2 - PRODUCTS

2.1 REFER TO INDIVIDUAL SECTIONS.

PART 3 - EXECUTION

3.1 NETWORK TIME PROTOCOL (NTP) SYNCHRONIZATION

A. All security systems as well as additional integrated systems such as intercom/PA, SQL/database servers and data logging servers shall synchronize to a common NTP server.

B. All systems including servers and workstations shall be within 50ms of each other or less depending on specific system requirements such as failover. The synchronization frequency shall be no less than every 3 hours.

C. The Contractor shall coordinate with the Owner for a NTP server connection. The Contractor shall verify the accuracy of the Owners NTP server before utilizing it.

D. When a reliable NTP server is not available from the Owner the Contractor shall not utilize the built in Microsoft Windows NTP servers or registry tweaks shall not be utilized. The Contractor shall use software such as NetTime (www.timesynctool.com) installed on the appropriate server.

E. Workstations on the private security network shall have an NTP client such as NetTime operating as a Windows service to sync the workstations clock to the same NTP server as the rest of the security systems.

F. When an external internet connection is not available the Contractor shall provide a GPS based NTP server such as the Veracity Timenet or equal.

3.2 TRAINING

A. On-Site Training

1. General: Present, review and describe equipment and materials to the Owner and Owner's operating personnel and fully demonstrate the operation and maintenance of the systems, equipment and devices specified herein.

2. Include with new systems, Contractor to arrange and provide for video recording of each onsite training session.

    a. Provide professional video and audio recording of each software screen option with Owner approval of content.

    b. Provide end user video recording for Department of Safety & Security approved processes.

    c. Provide Security Systems Specialists approved recording of maintenance and troubleshooting process.

3. Training shall comprise two separate levels of training;

    a. User Group upon substantial completion of the project.

        1) User group training shall include a site/building walk through indicating locations of equipment and their usage.

        2) User group training shall include the operation of workstation capability of system monitoring, command override and report generation.

    b. Maintenance Group upon completion of the project prior to close out.

        1) Maintenance group training shall include a site/building walk through indicating locations of equipment and their usage at up to six representative sites.

        2) Review of a-build documentation at each controller location.

        3) Troubleshooting techniques in hardware and software.

4. The training shall cover the overall system, each individual system, each subsystem, and each component. The training shall also cover procedures for database management, normal operations, and failure modes with response procedures for each failure. Each procedural item shall be applied to each equipment level.

B. Duration: Refer to the individual sections for the minimum time requirements.

3.3 WARRANTY

A. Furnish and guarantee maintenance, repair and inspection service for the system using factory trained authorized representatives of the manufacturer of the equipment for a period of one year after final acceptance of the installation.

B. Third Party Device warranties are transferred from the manufacturer to the Contractor, which may then transfer third party warranties to the Owner. Specific third party warranty details, terms and conditions, remedies and procedures, are either expressly stated on, or packaged with, or accompany such products. The warranty period may vary from product to product. These products include but are not limited to devices that are directly interconnected to the field hardware or computers and are purchased directly from the manufacturer.

C. Purpose

1. The Contractor shall repair any system malfunction or installation deficiency discovered by the Owner or their representatives during the burn in and warranty period.

2. The Contractor shall correct any installation deficiencies found against the contract drawings and specifications discovered by the Owner or their representatives during the warranty period.

3.4 EXAMINATION OF SITE AND DOCUMENTS

A. Bidder shall examine all documents, shall visit the site(s) prior to submitting proposal, record their own investigations, and shall inform themselves of all conditions under which the Work is to be performed at the site(s) of the Work, including the structure of the ground, the obstacles that may be encountered, and all of the conditions of the documents, including superintendence of the Work, requirements of temporary environmental controls, the time of completion, list of Subcontractors, and all other relevant matters that may affect the Work or the proposal process.

B. Verify cable lengths comply with published standards.

C. Notify Owner/Consultant of installation that would exceed maximum lengths prior to installation of cable.

D. Contactor shall consult with Owner/Consultant regarding alternative routing or location of cable.

E. Do not proceed until unsatisfactory conditions have been corrected.

F. Failure to make the examination shall not result in any Change Order requests.

G. The Bidder shall base the proposal on the site(s) examination, materials complying with the plans and specifications and shall list all materials where the proposal form requires.

H. The commencement of work by the Contractor shall indicate acceptance of existing conditions, unless a written notice of exceptions has been provided to the Owner/Consultant prior to commencement.

I. If the Contractor observes, during preliminary examinations or subsequent work, existing violations of fire stopping, electrical wiring, grounding, or other safety- or code-related issues, the Contractor shall report these to the Owner/Consultant in a timely manner.

3.5 INSTALLATION REQUIREMENTS

A. Contractor shall furnish and install all cables, connectors, and equipment as shown on Drawings and as specified herein.

B. It is the Contractor's responsibility to survey the site and include all necessary costs to perform the installation as specified. This includes any modifications required to route and conceal horizontal distribution wiring.

C. Beginning installation means Contractor accepts existing conditions.

D. Contractor shall furnish all required installation tools to facilitate cable pulling without damage to the cable jacket. Such equipment shall include, but not be limited to, sheaves, winches, cable reels, cable reel jacks, duct entrance tunnels, pulling tension gauge, and similar devices. All equipment shall be of substantial construction to allow steady progress once pulling has begun. Makeshift devices that may move or wear in a manner to pose a hazard to the cable shall not be used.

E. All cable shall be pulled by hand unless installation conditions require mechanical assistance. Where mechanical assistance is used, care shall be taken to ensure that the maximum tensile load for the cable as defined by the manufacturer is not exceeded. This may be in the form of continuous monitoring of pulling tension, use of a "break-away," or other approved method.

F. The Contractor shall be responsible for identifying and reporting to the General Contractor any existing damage to walls, flooring, tiles, and furnishings in the work area prior to start of work. All damage to interior spaces caused by the installation of cable, raceway, or other hardware shall be repaired by the Contractor.

G. Repairs shall match preexisting color and finish of walls, floors, and ceilings. Any Contractor-damaged ceiling tiles, floor, and carpet shall to be replaced to match color, size, style, and texture.

H. Where unacceptable conditions are found, the Contractor shall bring this to the attention of the construction supervisor immediately. A written resolution will follow to determine the appropriate action to be taken.

I. Qualified personnel utilizing state-of-the-art equipment and techniques shall complete all installation work. During pulling operation, an adequate number of workers shall be present to allow cable observation at all points of duct entry and exit as well as to feed cable and operate pulling machinery.

J. Cable pulling shall be done in accordance with cable manufacturer's recommendations and ANSI/IEEE C2 standards. Manufacturer's recommendations shall be a part of the cable submittal. Recommended pulling tensions and pulling bending radius shall not be exceeded. Any cable bent or kinked to radius less than recommended dimension shall not be installed.

K. All wiring shall be run "free-air," in conduit, in a secured plastic raceway or in modular furniture as designated on the Drawings. All cable shall be free of tension at both ends. PLENUM rated cable shall be used in areas used for air handling.

L. Avoid abrasion and other damage to cables during installation.

M. Pulling lubricant may be used to ease pulling tensions. Lubricant shall be of a type that is non-injurious to the cable jacket and other materials used. Lubricant shall not harden or become adhesive with age.

N. The cable system will be tested and documented upon completion of the installation as defined in the section below.

O. A pull cord (nylon; 1/8" minimum) shall be co-installed with all cable installed in any conduit or surface mount raceway. Should it be found by the Consultant that the materials or any portion thereof furnished and installed under this contract fail to comply with the specifications and Drawings with the respect or regard to the quality, amount of value of materials, appliances, or labor used in the work, it shall be rejected, removed, and replaced by the Contractor and all work distributed by changes necessitated in consequence of said defects or imperfections shall be corrected at the Contractor's expense.

P. All manufactured items, materials, and equipment shall be applied, installed, connected, erected, used, and adjusted as recommended by manufacturers or as indicated in their published literature, unless specifically noted herein to the contrary.

3.6 COOPERATION

A. The Contractor shall cooperate with Consultant's and Owner's personnel in locating work in a proper manner.

B. Should it be necessary to raise, lower, or move longitudinally any part of the work to better fit the general installation, such work shall be done at no extra cost to the Owner, provided such decision is reached prior to actual installation. The Contractor shall check location of electrical outlets with respect to other installations before installing.

3.7 COMMISSIONING SUBMITTALS

A. Provide the following to the Owner no later than 30 days prior to system commissioning/programming.

1. Commissioning Test Plan and Check-Off List: Specified elsewhere in this document.

2. Web-based Training: Access to web-based training modules.

3.8 COMMISSIONING

A. Provide programming and commissioning for each system as described in individual sections below.

B. This Contractor shall develop and submit a plan for coordination of settings and programming issues with the Consultant and Owner no later than 30 days prior to performing programming and commissioning.

C. The security Contractor is required to place entire system into full and proper operation as designed and specified.

D. Verify that all hardware components are properly installed, connected, communicating, and operating correctly.

E. Verify that all system software is installed, configured, and complies with specified functional requirements.

F. Perform final acceptance testing in the presence of Owner’s representative, executing a point-by-point inspection against a documented test plan that demonstrates compliance with system requirements as designed and specified.

1. Submit documented test plan to Owner at least 14 days in advance of acceptance test, inspection, and check-off.

2. Conduct final acceptance tests in presence of Owner’s representative, verifying that each device point and sequence is operating correctly and properly reporting back to control panel and control center.

3. Acceptance by Owner is contingent on successful completion of check-off; if check-off is not completed due to additional work required, re-schedule and perform complete check-off until complete in one pass, unless portions of system can be verified as not adversely affected by additional work.

4. The system shall not be considered accepted until all acceptance test items have been successfully checked-off. Beneficial use of part or all of the system shall not be considered as acceptance.

3.9 OPERATION AND MAINTENANCE MANUALS

A. Part One: Notwithstanding requirements specified elsewhere, submit the following labeled as the "Operating and Maintenance Manual" within thirty (30) days after Final Acceptance of the Installation:

1. Record Drawings: Submit two (2) copies of revised versions of drawings as submitted in the "Shop and Field" and "Equipment Wiring Diagrams" Submittals showing actual device locations, conduit routing, wiring and relationships as they were constructed. Include nomenclature showing as-built wire designations and colors. Drawings shall include room numbers coinciding with Owner space planning numbering. Drawings shall be submitted in electronic editable AutoCAD 2018 files, in ".dwg" format and Adobe Portable Document Format ".pdf" on USB flash drives.

2. Manuals: Submit one (1) copy of each of the following materials in an electronic PDF, with labeled dividers:

    a. A final Bill of Material for each system

    b. Equipment Instruction Manuals: Complete, project specific comprehensive instructions for the operation of devices and equipment provided as part of this work.

    c. Manufacturers Instruction Manuals: Specification sheets, brochures, Operation Manuals and service sheets published by the manufacturers of the components, devices and equipment provided.

    d. Include information for testing, repair, troubleshooting, assembly, disassembly and recommended maintenance intervals.

    e. Provide a replacement parts list with current prices. Include list of recommended spare parts, tools, and instruments for testing and maintenance purpose.

    f. Performance, Test and Adjustment Data: Comprehensive documentation of performance verification according to parameters specified herein.

    g. Warranties: Provide an executed copy of the Warranty Agreement and copies of all manufacturer's Warranty Registration papers as described herein.

B. Part Two: Within fourteen (14) days of receipt of Consultant reviewed Operating and Maintenance Manual (Phase One), submit three (3) electronic copies in AutoCAD 2018 editable .dwg format of the reviewed Record Drawings and three (3) copies of the reviewed Operating and Maintenance Manuals in Adobe Portable Document Format ".pdf" to the Owner, on USB flash drives.

1. Within each equipment enclosure and/or terminal cabinet, the Contractor shall place a Single Line drawing of the system(s) and the respective Terminal Cabinet Wiring Diagram in a clear plastic sleeve permanently attached to the inside cover of the terminal cabinet.

2. In each equipment enclosure the Contractor shall place a drawing providing device locations served by the equipment within the enclosure with identification that is identical to the wiring tags and with the software description of each point.

3. The Contractor shall provide to the Owner one (1) copy of new administration and user software, including required graphical maps, on USB flash drives.

C. Sufficient information, (detailed schematics of subsystems, assemblies and subassemblies to component level) clearly presented, shall be included to determine compliance with drawings and specifications.

3.10 CLOSEOUT PROCEDURES

A. Notification: Contractor shall provide written notification to Architect/Consultant and Owner when Contractor is satisfied that the work has been completed and is ready for inspection.

B. Closeout Submittals: Contractor shall provide closeout documentation to the Architect/Consultant. The Architect/Consultant shall receive the closeout submittals no less than 72 hours prior to the scheduled inspection time.

C. Inspection: Contractor shall be present for the inspection by the Architect/Consultant. Contractor shall supply all testing equipment needed to verify compliance with the specifications found in Bid package.

D. Punch List: Work or materials found to be incomplete, of unsatisfactory quality, failing to meet the specifications in the Bid package, and/or unacceptable to the Architect/Consultant shall be documented by the Architect/Consultant and provided to Contractor to rectify.

E. Re-Inspection: If a re-inspection is necessary, the costs of the Architect/Consultant’s additional travel, hours, and expenses may be deducted by the Owner from the contract amount due Contractor.

F. Punch List Approval: The punch list shall be considered complete only after having been signed by the Owner and Architect/Consultant.

G. The system has successfully completed a 30-day performance period.

H. Payment Authorization: Final payment will be authorized only after all closeout procedures and requirements have been followed and fulfilled by Contractor and approved in writing by the Owner and Architect/Consultant, including punch list(s) and/or re-inspection(s).

I. Response Time: Response time for service calls.

1. Emergency service calls where system is not responding to staff directed commands through the computer systems shall be within 2 hours to the project site.

2. Emergency service calls where controllers are not reporting shall be within 2 hours to the project site.

3. Normal service calls for device malfunctions shall be within 24 hours during normal working hours to the site.

J. Repair Time: Contractor shall stock parts in sufficient quantities such that repair or replacement shall be guaranteed within 12-hours. Temporary replacements within this time period shall be acceptable, provided temporary replacements do not compromise system functionality, and provided permanent replacement is achieved within 72 hours. Contractor may contact Owner representative for use of Owner supplied spare parts where delay of system repair will have negative impact on system performance.

K. Commencement: The warranty begins at the time of issuance of the statement of "Final Acceptance of the Installation" by the Owner.

L. Transferability: The warranty shall be transferable to any person or persons at the discretion of the Owner.

M. Transmittal: A copy of this Warranty shall be delivered to, and signed for by the Owner's representative whose primary responsibility is the operation and care of these systems. A copy of the signed Warranty document shall be delivered for review as part of the Final Submittals.

N. Registration: Register Warranty papers for all equipment and software in the name of the Owner. Furnish reproductions of all equipment Warranty papers to the Owner with the Final Submittals.

O. Subcontracting: Warranty service work may not be subcontracted except with specific permission and approval by the Owner.

P. Resolution of Conflicts

1. The Owner retains the right to resolve unsatisfactory warranty service performance at any time by declaring the work unsatisfactory, stating specific areas of dissatisfaction in writing.

2. If the Contractor or his approved Subcontractor does not resolve such stated areas of dissatisfaction within thirty (30) days, the Owner may appoint any alternative service agency or person to fulfill the terms of the Warranty; the cost of which shall be borne by the Contractor. This action may be taken repeatedly until the Owner is satisfied that Warranty service performance is satisfactory. Satisfactory resolution of a malfunction shall be considered adequate when the device, equipment, system or component which is chronically malfunctioning is brought into compliance with the standards of performance as contained herein and published by the manufacturers of the equipment installed.

END OF SECTION

SECTION 27 62 00
VIDEO SURVEILLANCE SYSTEM

PART 1 - GENERAL

1.1 SCOPE

A. Refer to Section 27 00 00 for additional project scope information.

1.2 RELATED WORK

A. Section 27 00 00 – General Technology Requirements

B. Section 27 60 00 – Physical Security General Requirements

C. Section 27 64 00 – Electronic Access Control System

1.3 REFERENCE

A. In addition to any requirements below, Contractor shall abide by requirements delineated in 27 00 00 including but not limited to:

B. General: Definitions, reference standards and codes, qualifications, pre-construction submittals, construction progress submittals, closeout submittals, and correction period.

C. Products: Substitutions, product specifications, miscellaneous material, cable, connectors, power devices, and interface panels.

D. Execution: Coordination, testing, training, warranty, and cable management.

1.4 GENERAL SUMMARY

A. System shall include IP cameras and a server based NVR with client stations and storage as described in this section and on the drawings.

B. The Category 6 cabling to each camera and patch cords shall be provided by the structured cabling Contractor.

C. System installation shall include, but not be limited to, installation, programming, and configuration of system components as well as all associated software upgrades, patches, and maintenance for three years.

D. Contractor is responsible for meeting with Owner’s representative at time of camera installation to verify exact placement and view of each camera to ensure coverage area is as intended.

E. Contractor shall coordinate with owner and provide labor and licenses to integrate new cameras in to owner’s existing Video Insight VMS. VMS software specification provided for reference only.

1.5 DRAWING SHEETS

A. All cameras are designated with a C symbol on the project drawings.

1.6 MOUNTING AND INSTALLATION

A. Contractor shall provide the appropriate mounting hardware for all ceiling types and wall types where cameras shall be located. Plastic anchors of any type are not allowed.

B. Wall mounted 180 degree cameras shall be mounted on a gooseneck.

C. Exterior cameras shall be mounted on a gooseneck.

D. Cameras mounted on a drop tile ceiling shall have a tile support bridge with a steel support cable connected to structure to prevent theft and vandalism. Camera shall be mounted to the back box on the tile bridge, no toggle bolts or other screw in hardware are permitted.

1.7 CODE AND STANDARD REQUIREMENTS

A. All work and materials shall conform in every detail to the rules and requirements of the National Fire Protection Association and any other codes as required by the AHJ.

B. All materials shall be listed by UL and shall bear the UL label. If UL has no published standards for a particular item, then other national independent testing standards shall apply and such items shall bear those labels. Where UL has an applicable system listing and label, the entire system shall be so labeled.

C. Cameras shall meet the following standards:

1. MPEG-4:

a. ISO/IEC 14496-10 AVC (H.264)

2. Networking:

a. IEEE 802.3af (Power over Ethernet)

3. Network Video:

a. ONVIF Profile S or better

PART 2 - PRODUCTS

2.1

1. The Server shall be designed to run on a Windows platform, supporting both Desktop and Server class operating systems including Windows 7 Pro and Enterprise editions, Windows 8 Pro and Enterprise editions, Windows 10 Pro, Enterprise and Education editions, Windows Server 2008 R2, Windows 2008 Enterprise, Standard and Web editions and Windows Server 2012 (All Versions).

2. Server shall run as a Window's Service. This service shall run as part of the local service account. This service shall be running as long as the system is booted and has started Windows. It shall not require the user to be logged in.

3. The Server will store settings in SQL Express and shall not require a full MS-SQL license.

4. The Server shall have an option for a 32-bit binary and a true 64-bit binary. In a 64-bit64-bit OS, the server shall run as a native 64-bit application, not merely a 32-bit application.

5. The service shall connect to the camera and handle streaming to the server. It shall not require each client to connect to individual cameras.

6. This service shall allow the cameras to be placed on one network and the clients on a separate network using a different IP range.

7. The software shall support the ONVIF standard (Profile S and Profile 1.02).

8. The software shall support Megapixel virtual cameras within a single camera license.

9. The server shall only require two ports for streaming video as well as handling any setting changes or commands from the client software.

10. The Server shall record the video streams from different cameras.

    a. The service shall handle transcoding of the camera streams if the cameras are MJPEG based. The video shall be re-encoded to WMV to reduce storage needs and to reduce the impact of streams to clients on the server.

    b. For MPEG-4 based cameras, the video shall be stored in the native codec of the server.

    c. For H.264 based cameras the video shall be stored in the native codec of the server.

    d. For H.265 based cameras, the video shall be stored in the native codec of the server.

    e. Each camera will have the option to be able to be stored in different locations (i.e. One locally, another on a NAS, a third on a different network share)

    f. Streaming from server to client shall support H.264 and H.265.

11. The Server shall support H.265, H.264, MPEG-4, MJPEG and MXPEG based cameras.

12. The Server shall support motion detection at the camera and at the software levels.

13. The Server shall provide graphic examples of what it determines as motion to thick clients if the thick client requests it.

    a. The software shall display the motion detection as an outline around the area moving.

    b. The software shall provide a bar showing the total percentage of change. This bar shall have a slider on it to allow the user to quickly set motion detection.

14. The Server shall allow for multiple zones to be set within an image that support differing motion detection values within a cameras field of view.

    a. There shall be no limit on the total number of zones allowed, either on a per camera or per server basis.

    b. Zones should allow the ability to ignore motion within an area.

    c. Motion zones should be able to be tied into a rules engine to allow the software use them as triggers for events.

15. The Server shall support the use of imported maps to show camera placement. These maps will be in .jpg, .gif, or .bmp formats as determined by the user.

    a. Hovering over a camera on a map shall cause it to be displayed in a window on the side.

    b. When the camera is displayed on the side, the option to review recently recorded video will be available to them.

    c. The user shall be able to embed layouts onto the facility map. Clicking on the layout shall change the display of the client software.

    d. Alarms from DIOs shall be able to be embedded as well.

    e. Audio sources shall also be an option.

    f. Other facility maps shall also be an option to embed. Clicking on a different embedded map shall bring up that map.

    g. Doors from certain access control systems can be imported and displayed. Hovering over the door shall display the last badge used to badge in, a live view of the camera associated with the door. The user from this pop up shall be able to see badge events and alarm events along with the associated video.

16. The Server shall not require the administrator to contact the manufacturer to replace a camera.

17. The Server shall support reporting to a diagnostic tool.

    a. The server will report the number of active cameras.

b. The server shall report active cameras offline.

c. The version of the server.

d. The amount of disk space left.

e. The recording status of the server.

18. The server shall support pre-motion and post motion recording.

19. The server shall support customizable layouts. The layouts will allow for blank spaces within the layout.

20. The server shall support an unlimited number of users.

a. Users can be drawn from either an Active Directory server, Novell eDirectory or entered manually.

b. There will be two different levels of user.

c. Users can be members of a group with settings set for the group. Individual user settings can override the group settings.

d. Permissions can be set for live viewing, access to recorded video, control of PTZ cameras, access to audio, the ability to export video, custom layouts, facility maps and rules. Permissions can be defined on a per camera basis.

e. The server shall support the option of having the users limited to being signed in to a single location.

21. The server will include a diagnostic version with limited interface, to allow for testing of the server.

22. The server shall support an optional secondary server with failover capacity.

23. A rules engine shall be included to allow the server to handle more complex tasks.

a. Triggers will include:

1) Dry contacts (DIO)

2) Motion detection of a camera stream.

3) Scheduled events. Events can be scheduled on daily, weekly, or monthly basis. Individual events can be handled as well.

4) An alert button for the user interaction in the Windows client.

5) Inputs sent programmatically via appropriate APIs.

6) Access control events from supported Access Control Vendors.

7) Video analytic events of Panasonic i-VMD and Vehicle Incident detection (VID).

8) Camera down.

9) User login to Windows client, Web Client or Mac/Mobile Client.

b. Actions will include:

1) Logging the event.

2) Displaying an alarm window on each Windows client.

3) Sending an audio alert to each Windows client.

4) Opening or closing a dry contact.

5) Changing the state of a door.

6) Sending an e-mail with a custom text message tied to the trigger. Multiple texts will be allowed for different triggers.

7) Sending an e-mail with an .avi clip from a selected camera.

8) Sending an e-mail with a .jpg of a selected event from a camera.

9) Sending an HTTP command to an URL.

10) Opening a live window for a user who is viewing.

11) Move a PTZ to a certain preset location or cycle presets.

12) Force recording.

c. Force recording with audio.

d. Instant Replay

e. Sending video to a Network Decoder

1) Switching single camera or layout views.

2) Message Instruction

3) Moving, copying or deleting of files.

4) Execute a program or batch file.

5) Send an ASCII string to a TCP port.

6) Create time lapse recordings (very low frame rate).

7) Mask/Unmask Monitor Points

8) Change selected camera color

24. The server shall support time out functionality.

25. A universal RTSP option shall exist for adding cameras if they are not currently supported through native APIs.

26. PTZ functionality within the camera will be supported.

27. Dewarping of Panoramic shall be supported for the following manufacturers:

a. Advidia

b. Panasonic

c. Sentry 360

d. Vivotek

e. Axis

f. Immervision

g. Mobotix

h. ACTi

28. The server will only stream video to clients that the clients request.

29. If live video is paused, then the server shall stop streaming video to the clients to conserve bandwidth.

30. The server shall have the ability to handle a total throughput of 600 Mbps for camera connections and video streaming from cameras.

31. The server shall support the failover edge recording for supported Panasonic i-PRO cameras. The cameras will function as failover devices to help ensure video storage in the event of network or server failure. After the failure recovers, the videos recorded in the cameras will be automatically transferred to the storage of the server.

32. The server shall support the second streams to get lower resolution video.

33. The server shall support the multicast streams to reduce network bandwidth.

34. The server shall support the encrypted streams (HTTPS) for Panasonic i-PRO cameras.

B. WINDOWS CLIENT

1. The Windows client shall be a thick client for viewing live and recorded video, along with handling administrative tasks.

2. The software shall not require a client license to operate.

3. The thick client shall support an encrypted XML file for storing settings. The file can be set up to be shared between many clients, allowing the administrator to update all clients with a single file push.

4. Clients shall be able to use Active Directory to authenticate users.

5. Clients shall be able to use Novell E-directory to authenticate users.

6. The Windows client shall have a searchable timeline for multiple events.

    a. Motion

    b. Access Control (integration required)

    c. Rules

    d. VCA (Video Content Analytic)

7. The Windows client shall display the servers it's connected to along with the server's cameras in a tree view on the left-hand side.

    a. The tree view shall allow the user to see the status of the servers that the instance of the Windows client is aware of.

    b. The tree view shall also include access to custom layouts, facility maps and action buttons.

    c. There shall be an option to hide the tree on start-up of the Windows client.

    d. The user shall be able search for cameras using a searchable box on the left-hand tree.

8. The thick client shall not be limited in the number of servers it can connect to.

9. Live view shall allow views of 1, 2, 4, 8, 9, 10, 13, 16, 25 and 36 cameras. A widescreen option for 18 and 24 cameras will also be available.

    a. Layouts will be selectable via icon.

    b. Layouts will not be limited to cameras from a single server.

    c. Users will be able to get layouts to cycle in the client's workspaces.

    d. Layouts shall be able to be put into groups.

10. If motion is detected on a camera, then the software shall have a red pulse around the edge of the live window.

11. Live view shall allow cameras to be dragged and dropped onto the live view from the left hand tree. Cameras can be duplicated in a view.

12. Users shall be able to invoke a digital zoom by drawing a box.

13. After invoking the digital zoom, the Windows client shall support the use of picture in picture within the zoomed image.

14. Digitally zoomed areas shall be treated as a digital PTZ.

15. PTZ Presets shall be listed in a drop down menu in the camera window.

16. Users shall be able to move the PTZ movements simply by clicking on the image or by using the scroll wheel.

17. Live view shall support a full screen mode that hides the UI. User shall be able to start the Windows client in this full screen mode with a setting.

18. Live view shall allow the user to de-warp the video from panoramic lenses and cameras.

19. Right-clicking on a camera in live view shall have the following behaviors:

    a. Right clicking on a camera within live view shall allow the user to be able to review the recently recorded video for that camera.

    b. Right clicking on a camera within live view shall also allow access to the properties dialog box for that camera.

20. The Windows client shall support synchronized playback of multiple recorded videos. It shall allow for the exporting of the view of up to nine cameras a single video file.

21. The thick client shall include a repair utility for corrupted video.

22. The Windows client will be able to display logging information, such as changes to the server, lost camera signals, who exported recorded video, when did users log-on/off and other errors. This functionality will be limited to administrative users. The log will be exportable as txt or to the Windows clipboard.

23. The Windows client shall also provide real time status updates for server status and camera status, including the CPU usage, disk usage, bandwidth usage, licensing and number and names of users who are logged in.

24. The system shall support an Alarm Log to make it easier to find DIO based events.

25. Facility maps shall be available in the software for viewing.

a. When the user hovers over a camera in the facility map it shall display the camera in a window off the side of the map.

b. Cameras shall be displayed where they are pointed.

c. Embedded layouts shall change the layout of the Windows client if they are clicked on.

d. Embedded Facility maps shall cause the current map to change to the embedded map if clicked on.

e. The user shall have the option of importing and placing doors from supported access control partners on the map. This shall allow them to see badge events as well as alarm events. It shall also support the ability to lock and unlock doors from the map.

26. The Windows client shall support the VideoTec Joystick as Intelligent USB joystick.

27. The software shall support the ability to open a live window that can be moved around. This window will be able to access the view of any camera or layout the user has access to.

28. The Windows client shall support multiple screen user environments for dynamic user interface.

29. The user shall be able to enable or disable the following settings:

a. Server name in the live view.

b. Camera name in the live view.

c. Audio notification on motion.

d. Forcing aspect ratio.

e. Use Direct Show for display.

f. Allowing multiple live windows.

g. Block live windows from popping up.

h. Live window always on top.

i. The speed in which layouts cycle.

j. Launching Facility maps on start-up.

k. Use Hardware decoding

l. Video Smoothing (Video buffering)

30. Users with Administrator privileges shall be able to configure the server and camera settings. Users shall also be able to test SMTP settings and database settings.

    a. Users shall be able to configure the framerate of the camera, including the option to have the server record continuously from 1 to 3 fps with the option to go to the cameras designated frame rate on motion detection.

    b. Users shall be able to select various time-lapse options for the camera.

    c. Users shall be able to select the camera stream type.

    d. Users shall be able to select camera or server side motion detection.

31. Users shall be able to access a graphic representation of what the server's motion detection settings are picking up.

32. Users shall be able to configure user settings as well as layout settings from within the thick client.

33. The software shall allow users to send video or messages to other users in the form of a popup window.

34. The Windows client shall allow users to send video to other users, allowing for remote live pop ups of video of important events.

35. The Windows client shall support Layout touring. Selecting a layout will cycle through a list of cameras.

36. User shall be able to allow for remote support via the Windows client.

37. The Windows client shall support to add an additional feature as Plug-in.

38. The Windows client shall support to create / delete a user preference workspace.

C. VMS WEB CLIENT

1. The Web Client shall be a thin client, using either an active-x control or an MJPEG streaming method.

2. It shall support IE, Firefox, Safari, Chrome and Opera.

3. It shall not be limited to Windows platforms only.

4. It shall not require a license.

5. Users shall not be able to change any settings within the server via the thin client.

6. Users shall be able to select layouts for live viewing, or individual cameras or groups of cameras.

7. Users shall be able to access recorded video.

8. Users shall be able to download recorded video from the system.

9. Users will be able to use the motion log to find recorded video.

10. The Web Client shall support the use of facility maps.

11. The Web interface shall support the use of custom layouts.

12. The web client shall use IIS as its web server.

13. The Web client shall allow remote access for iPhone, Blackberry, Windows Mobile, and Android mobile phones without the installation of an app.

D. VMS MOBILE CLIENT APP

1. The Contractor shall provide any mobile web servers and licenses required to support this functionality.

2. The mobile client shall support the following operating systems:

    a. Apple iOS

    b. Google Android

3. The mobile client shall support the following minimum functionalities:

    a. The app shall have access to live cameras.

    b. PTZ functionality shall be available in the app.

    c. The app shall have access to recorded video.

    d. Facility map functionality shall be available.

E. VMS SERVERS

1. VMS server hardware to be provided by owner. Contractor shall coordinate with owner to add new cameras to existing system.

F. VMS VIDEO STORAGE

1. Storage, framerate, motion, etc. shall be coordinated with owner. Contractor shall replicate owner’s existing standard for new cameras.

G. DIGITAL IP CAMERAS

1. General:

    a. All cameras shall be time synced to the Owner's NTP server.

    b. The Contractor shall select the appropriate mounting hardware for the situation.

    c. All cameras shall be equipped with remote autofocus or autoback focus with the exception of 180/360 degree cameras and encoded analog cameras.

    d. Multi-sensor 180 and 360 cameras shall have each sensor optimally calibrated independently to the conditions.

    e. All cameras shall be vandal proof and appropriate for the environment it is being installed in.

    f. All cameras shall have the latest VMS recommended firmware installed and all cameras of the same model shall have matching firmware versions.

    g. The contractor shall coordinate with the owner for IP addressing, network configuration and multicast network configuration.

    h. All cameras regardless of manufacturer/model shall have a consistent user name and non-standard password set. This shall be documented and provided to the owner and consultant prior to inspections.

    i. The camera requirements below represent general performance criteria. Approved equals will have slight differences in specifications. The Owner and Consultant have complete discretion to reject approved equals that stray too far from the minimum requirements.

2. Fixed Dome - Typical shall:

    a. The Fixed Dome Camera shall deliver H.265 stream and H.264 stream.

    b. The Fixed Dome Camera shall produce a resolution of 1,920 x 1,080 pixels (Full HD 1080p) at up to 60 fps with a 16:9 aspect ratio.

    c. The Fixed Dome Camera shall produce a resolution of 2,048 x 1,536 pixels at 30fps with a 4:3 aspect ratio.

    d. The Fixed Dome Camera shall utilize an approximate 1/3 type high sensitivity MOS image sensor.

    e. The Fixed Dome Camera shall feature a 144dB wide dynamic range based on Enhanced Super Dynamic and Adaptive Black Stretch technology (ABS).

    f. The Fixed Dome Camera shall produce a color image with a minimum illumination of 0.012 lux and a monochrome image with 0.006 lux at F1.6, maximum shutter of 1/30s and High gain mode.

g. The Fixed Dome Camera shall offer a built-in IR illumination to produce a clear monochrome image in zero lux conditions with 40m (131feet) irradiation distance.

h. The Fixed Dome Camera shall be equipped a special coated cover for increasing the operational utility of outdoor cameras in rain weather.

i. The Fixed Dome Camera shall generate multiple simultaneous video streams of up to four (4) H.265 (Main profile) or H.264 (High profile) streams and JPEG streams.

j. The Fixed Dome Camera shall be equipped with intelligent auto mode, the technology for shooting license plate and person's face more clearly.

k. The Fixed Dome Camera shall be equipped with GOP control and Smart Facial coding which control an image quality of a stationary area, a moving area and a face, as bitrate reducing technology.

l. The Fixed Dome Camera shall produce encrypted stream.

m. The Fixed Dome Camera shall realize SSL / TLS communication with CA certificate.

n. The Fixed Dome Camera shall offer Video Motion Detection (VMD) with four (4) programmable detection areas, 15 steps sensitivity level and 10 steps detection size.

o. The Fixed Dome Camera shall have Fog compensation function.

p. The Fixed Dome Camera shall have High light compensation (HLC) function.

q. The Fixed Dome Camera shall have Super Chroma Compensation (SCC) which realizes a better color reproducibility in the low illumination.

r. The Fixed Dome Camera shall provide up to eight (8) areas of electronic privacy masking.

s. The Fixed Dome Camera shall offer the prioritized stream control which transmits a video stream to a specified client PC or recorder preferentially.

t. The Fixed Dome Camera shall have a SD memory card slot that supports SD, SDHC and SDXC memory card for local storage.

u. The Fixed Dome Camera shall offer full-duplex bi-directional audio communication capability between the camera and monitoring site.

v. The Fixed Dome Camera shall have four (4) alarm sources of terminal input, VMD, command alarm and audio detection alarm that activate the processes such as SDXC/ SDHC/SD memory recording, E-mail notification, HTTP alarm notification, Indication on browser, FTP image transfer and Panasonic alarm protocol output.

w. The Fixed Dome Camera shall conform to the ONVIF standard.

x. Manufacturer and model:

y. Camera Type 1 (ceiling mounted)

1) Panasonic WV-S3531L

z. Camera Type 2 (wall mounted):

1) Indoor: Panasonic WV-S2231L

2) Outdoor: Panasonic WV-S2531L

3. Multi-Directional 180/270/360 Degree Camera shall:

a. The camera shall provide 360-degree field of view and produce video in quad view mode. It shall also provide digital PTZ along with automated video analytics to allow users to efficiently monitor large visual fields with capability to focus on certain areas when suspicious activity is observed.

b. Video Compression and Transmission – The multi-directional camera shall have the following properties relating to the video signals it produces.

1) H.265, H.264 and MJPEG compression, each derived from a dedicated encoder and capable of being streamed independently and simultaneously

a) H.265 and H.264 – Maximum of 30 fps at all resolutions

b) MJPEG – Maximum of 30 fps

2) The multi-directional camera shall be able to configure up to 10 independent video stream profiles with differing encoding, quality, frame rate, resolution, bit rate, and other video settings.

3) The multi-directional camera shall have four lenses and each lens shall provide the following resolutions.

a) 2560 x 1920 (5M), 2560 x 1440, 1920 x 1080, 1600 x 1200, 1280 x 1024, 1280 x 960, 1280 x 720, 1024 x 768, 800 x 600, 720 x 576, 720 x 480, 640 x 480, 320 x 240

4) Simultaneous unicast access by up to 20 users

5) Multicast or unicast capable

6) Dynamic DNS (DDNS) support.

7) The multi-directional camera shall provide smart codec (WiseStream, Dynamic GOV, and Dynamic fps) to efficiently manage bit rate of the video stream and reduce storage while producing video quality that is visually equal to the one without smart codec.

a) Viewing composition: Quad view

c. Camera – The multi-directional camera device shall have the following physical and performance properties:

1) IK10 rated for protection against impacts.

2) IP66 for protection against dust and water.

3) Auto day/night operation with removable IR cut filter

a) Low light level operation to 0.07 lux (color) and 0.007 lux (black and white)

4) 2D and 3D digital noise reduction

5) 32 privacy masking regions utilizing polygons

6) The multi-directional camera shall be able to capture high contrast scenes with 120 dB multi-exposure wide dynamic range.

7) One touch (Simple) or manual focus controllable remotely via network. The camera shall have motorized varifocal lens.

8) Advanced digital image stabilization with built in gyro sensor. The camera shall be able to measure movements in three axes and accurately enhance images from distortions caused by instability.

d. Intelligence and Analytics – The multi-directional camera shall have a suite of integral intelligent operations and analytic functions to include:

1) Motion detection with eight definable detection areas, minimum/maximum object size definition and a learning algorithm that ignores false alarms such as trees and waves on water. The camera shall also be able to send meta-data to NVR or VMS to allow users to search for motion events and generate video summary.

2) Detection of logical events of specified conditions from the camera’s video input

a) camera tamper (scene change)

b) loitering

c) directional detection

d) defocus detection

e) fog detection

f) virtual line

g) enter/exit

h) appear/disappear

e. Interoperability – The multi-directional camera shall be ONVIF Profile S compliant.

f. The multi-directional camera shall possess the following further characteristics:

1) Built-in web server, accessed via standard browsers including Internet Explorer, Firefox, Chrome & Safari

2) Micro SD/SDHC/SDXC memory card options, with configurable pre-alarm and post-alarm recording intervals

3) Alarms and notifications

a) alarm notification triggers:

b) alarm input

c) motion detection

d) video analytics

e) network disconnect

f) available notification means upon trigger:

g) file upload via FTP and e-mail

h) notification via e-mail

i) record to local storage (SD/SDHC/SDXC card)

j) external output

4) Pixel Counter available in the plug-in web viewer.

g. Provide Trendnet TI-IG60 and proper power supply with each C3 camera installed.

h. Manufacturer and model:

1) Panasonic WV-S8530N

2.2 ETHERNET WITH POWER OVER ETHERNET (POE) UTP SURGE SUPPRESSOR

A. When mounted in interior spaces:

1. Shielded RJ-45 jacks and ground stud

a. Connect ground stud directly to ground bar (TMGB/TGB) or ground.

b. Do not use shielded cable on the output.

2. Maximum supported data rate: 1000Mb/s (Gigabit)

3. Supports IEEE 802.3af (PoE)

4. Turn on Voltage: 150V L-L, L-G

5. RoHS compliant

6. UL 497B listed

7. Meets Telecordia GR-1089

8. Manufacturer:

a. DITEK DTK-MRJPOE

b. Or approved equal

2.3 FIBER OPTIC UNMANAGED SWITCH

A. The contractor shall provide fiber optic unmanaged switch at each NEMA enclosure installed outdoors that feeds network connected devices.

B. 4 port, hardened

1. 10/100/1000 Ethernet
2. Operating temperature of -40 - 75 degrees C
3. External AC power supply
4. Manufacturer:
    a. Transition Networks SISTG1040-242-LRT with Proper Single-Mode GBIC

2.4 COAXIAL MEDIA CONVERTER

A. The contractor shall provide Ethernet with PoE over coaxial cable media converters at each elevator containing a security camera.

B. Single port, interior, PoE output

1. 10/100/1000 Ethernet
2. Operating temperature of -40 - 75 degrees C
3. External AC power supply
4. Manufacturer:
    a. Transition Networks EOCPSE4020-110 & EOCPD4020-110

2.5 NEMA ENCLOSURE

A. Contractor shall provide a 24x24x10 NEMA 4 enclosure at the base of every exterior pole that has a mounted network connected device.

B. NEMA enclosure shall be properly secured to the pole using proper fasteners and support. Coordinate mounting and electrical receptacle requirements with Div 26 contractor.

C. Contractor shall coordinate with SCC contractor for network infrastructure.

D. Refer to security details for enclosure layout.

E. Provide with interior mounting panel A24P24

F. Manufacturer

1. Hoffman A24H24BLP

PART 3 - EXECUTION

3.1 TESTING

A. Refer to Section 27 00 00 for additional requirements.

B. Prior to energizing or testing the system, ensure the following:

1. All products are installed in a proper and safe manner per the manufacturer's instructions.

2. Dust, debris, solder, splatter, etc., is removed.

3. Cable is dressed, routed, and labeled; connections are consistent with regard to polarity.

4. All products are neat, clean, and unmarred, and parts are securely attached.

C. Contractor shall ensure that each device in the security system is functioning normally and in such a manner as to meet the functional and performance requirements in this specification.

3.2 TRAINING

A. Refer to Section 27 00 00 for additional requirements.

B. Provide system operations, administration, and maintenance training by factory-trained personnel qualified to instruct.

1. Contractor shall provide up to 12 hours of scheduled and dedicated training time in three (3) four (4) hour sessions for administration and investigation.

C. Contractor shall provide up to 2 hours of scheduled and dedicated training time for maintenance including lens and dome cleaning, focusing and positioning.

1. Provide printed training materials for each trainee, including product manuals, course outline, workbook or student guides, and written examinations for certification.

2. Provide hands-on training with operational equipment.

3. Training shall be oriented to the specific system being installed under this contract as designed and specified.

4. Contractor shall provide all necessary documentation of system operating parameters prior to scheduled training sessions.

3.3 WARRANTY

A. Refer to Section 27 00 00 for additional requirements.

3.4 INSTALLATION PRACTICES

A. All services provided shall be professional and conform to the highest standards for industry practices. The Owner reserves the right to halt any installation due to poor workmanship. All work shall be defect free, and the installer shall replace, at their expense, any work found to be defective.

B. The Owner reserves the right to halt any installation due to failure of Contractor to observe installation-free periods due to instructional or administrative requirements. To the maximum extent possible, the Owner will provide advance notice of such periods.

C. Contractor is responsible for providing a complete and functional video surveillance system.

D. All manufactured items, materials, and equipment shall be applied, installed, connected, erected, used, and adjusted as recommended by the manufacturers, or as indicated in their published literature, unless specifically noted herein to the contrary.

E. Contractor shall follow these standards and approved submittals for locations of power supplies. The Owner intends to limit the number and location of power supplies to facilitate more effective long-term support and maintenance of the system.

3.5 COORDINATION

A. Contractor shall provide up to 8 hours (up to four, 2-hour sessions) of scheduled and dedicated coordination time to assist Owner with camera positioning and coordination as requested by Owner or Consultant.

3.6 AESTHETICS

A. All cables and equipment terminating at panels frames shall be vertically straight, with no cables crossing each other, from twelve inches inside the ceiling area to the termination block.

B. All cable bundles shall be combed and bundled to accommodate individual termination block rows and panels.

C. For any given telecom room, a horizontal and vertical alignment for all mounting hardware will be maintained to provide a symmetrical and uniform appearance to the distribution frame.

D. All surface-mounted devices shall be firmly secured level and plumb

E. All rack mount equipment shall be securely installed.

3.7 HARDWARE LAYOUT

A. Hardware positioning and layout shall be reviewed and approved by the Owner prior to construction. The review does not exempt Contractor from meeting any of the requirements stated in this document.

3.8 VMS INSTALLATION PRACTICES

A. Verify that the manufacturer approved server hardware, OS meets the Owner's IT standards prior to ordering.

B. Coordinate server power, cooling, and mounting requirements with Owner prior to installation.

C. Coordinate virus scan/security software requirements with Owner and manufacturer prior to installation.

3.9 DEVICE CABLING/WIRING INSTALLATION PRACTICES

A. All external wire and cables shall be supported at least every five feet from the structure or as required to maintain not more than 12" cable sag between supports and without over tensioning the cables. Provide j-hooks as needed where cable tray or raceway is not available.

B. This Contractor shall coordinate installation with Division 27 05 00 cabling Contractor to ensure there is at least 2-inches of physical separation between security cabling and voice/data cabling throughout cable path. Voice/data cabling Contractor has first claim to cable tray.

C. All cables, regardless of length, shall be labeled within 18" of both ends with an identifier that is keyed to the door, room, or corridor number as identified.

D. All cables shall have 6-foot service loops neatly coiled in the equipment room. During initial cable rough-in, this Contractor shall have sufficient slack to route anywhere within the equipment room.

E. Cabling shall be adequately supported with Velcro wire wraps and horizontal support cable managers fastened to rack frame. Cables shall be dressed in a neat and orderly fashion. Any cabling or equipment installation that is deemed unacceptable by the Owner or Consultant shall be replaced or corrected by the Contractor at no additional cost. Plastic zip ties are not allowed.

F. All cables are to run at right angles to the structure, placed above the ceiling in halls or corridors.

G. Cables shall not run above red iron joist.

H. Contractor shall make every effort to conceal wiring and other apparatus into walls, floors, and ceilings, assuming code and good engineering practice allows and suggests.

I. Ties and straps shall be installed snugly without deforming cable insulation. Ties shall be spaced at uneven intervals not to exceed four feet. No sharp burrs shall remain where excess length of the cable tie has been cut.

J. Contractor shall notify Owner immediately if obstruction or hazard is discovered in a pathway provided by others.

K. Cable shall be stored and handled to assure that it is not stretched, kinked, crushed, or abraded in any way. Bend radiuses shall meet manufacturer specifications and/or recommendations. Cable shall not be installed in ambient temperatures or moisture conditions above or below the manufacturer's rating.

L. No splices shall be installed in any cable.

3.10 CABLE TERMINATION

A. Termination hardware (blocks and patch panels) positioning and layout shall be reviewed and approved by the Owner prior to construction. The review does not exempt Contractor from meeting any of the requirements stated in this document.

3.11 INTEGRATION WITH PHYSICAL SECURITY SYSTEMS AND INTERCOM/PA SYSTEM

A. The video surveillance system shall be integrated with the Physical Security Systems and Intercom/PA system via an Ethernet interface with the minimum follow features.

B. Graphical floor plan maps showing icons of all cameras, intercoms and other integrated systems.

C. Camera views associated with intercom stations and doors.

D. Camera views linked to other camera views for seamless tracking of a subject throughout a facility.

E. Device names brought in from the integrated systems.

F. Database entries for all actions performed.

G. Time syncing via common NTP server.

H. Microsoft Active Directory integration.

I. Microsoft Exchange integration for email notifications.

J. Intercom audio recorded to VMS server synchronized with the associated camera.

K. The Contractor shall provide any and all licensing to integrate the systems together including any additional items to be added to the yearly maintenance agreement.

L. Refer to the individual specification sections for additional specific integration requirements.

M. The Contractor shall set up a meeting between the Owner, Consultant and manufacturer to determine the exact functionality of the integration before the integration starts.

3.12 FIRE STOPPING

A. Fire stopping of openings between floors, fire-rated walls, and smoke-rated walls, created by others for This Contractor to pass cable through, shall be the responsibility of the This Contractor. Sealing material and application of this material shall be accomplished in such a manner that is acceptable to the local fire and building authorities having jurisdiction over this work.

B. Any openings created by or for This Contractor and left unused shall be sealed up by This Contractor.

C. This Contractor shall be responsible for creating a waterproof seal in and around any openings that This Contractor creates from the structure to the outside environment.

3.13 SYSTEM INSPECTION

A. Contractor shall coordinate with project representative for inspection after Contractor has completed testing of entire system.

B. Contractor shall have trained Contractor representative and testing equipment on site during inspection to assist with spot verification of tests.

C. Contactor shall verify with Project Representative the precise positioning of camera aim and shall make fine adjustments as requested.

3.14 LABELING

A. Contractor shall neatly label all security devices and cabling at both ends. All labels shall be on Project as-built drawings.

3.15 CAMERA INSTALLATION

A. Contractor shall field verify all camera locations and positioning with Owner prior to installation.

3.16 DOCUMENTATION

A. Upon completion of the installation, Contractor shall provide full documentation sets to the Consultant for approval as described in section 27 60 00. All documentation shall become the property of the Owner.

B. Documentation shall include the additional specific items detailed in the subsections below:

C. Contractor shall provide hard copy and electronic forms of the final test results.

D. Contractor shall provide a document including the following:

E. Camera label/identifier

F. Location of each drop by orientation/permanent landmark in the room

G. Contractor shall provide accurate as-built Construction Drawings. The drawings are to include cable routes and device locations.

3.17 PRE-CHECKOUT

A. The Contractor shall demonstrate the following to Owner during system demonstration.

B. The cameras are fully installed and functional.

C. Camera adjustments are complete to the Owner's satisfaction including.

D. Aim/Zoom

E. Focus/Back Focus

F. Dehumidification

G. Masking Zones

H. Motion Detection Zones

I. Pre-Sets/Tours

3.18 FINAL ACCEPTANCE

A. In addition to closeout requirements in section 27 60 00, This Contractor shall demonstrate the following before final approval.

B. Owner training is complete.

C. Punch list items are complete.

D. As-built documentation is complete and submitted to Owner/Consultant.

3.19 ANNUAL SUPPORT AGREEMENT

A. An annual support agreement (after the 1st year full of support/warranty) shall not be part of the bid. The Contractor shall work directly with the Owner at the end of the project to determine the ongoing hardware/software support. The Contractor shall send the Consultant a copy of the support agreement for review prior to finalization.

3.20 FINAL PROCEDURES

A. Perform final procedures in accordance with section 27 60 00.

END OF SECTION

SECTION 27 64 00

ELECTRONIC ACCESS CONTROL SYSTEM

PART 1 - GENERAL

1.1 SCOPE

A. Refer to Section 27 00 00 for additional project scope information.

B. This specification section covers the furnishing and installation of new components for an existing enterprise-wide, low-voltage, Electronic Access Control System (EACS).

C. Contractor shall furnish and install access control hardware devices, panel enclosures, mounting brackets, power supplies, switches, controls, consoles and other components of the system as shown and specified.

D. Contractor shall furnish and install access control related software to allow this system expansion. Software includes required license addition for access control readers and electrified portals, workstations and Video Management System (VMS) Integration.

E. Furnish and install outlets, junction boxes, conduit, connectors, wiring, and other accessories necessary to complete the system installation. Requirements shall be in accordance with Division 26 00 00, Electrical.

1.2 PRECEDENCE

A. Obtain, read and comply with General Conditions and applicable sub-sections of the contract specifications. Where a discrepancy may exist between any applicable sub-section and directions as contained herein, this section shall govern.

1.3 RELATED WORK

A. Division 08 - Door Hardware

B. Section 27 00 00 – General Technology Requirements

C. Section 27 60 00 – Physical Security General Requirements

D. Section 27 62 00 – Video Surveillance System

1.4 REFERENCE

A. In addition to any requirements below, Contractor shall abide by requirements delineated in 27 00 00 including but not limited to:

B. General: Definitions, reference standards and codes, qualifications, pre-construction submittals, construction progress submittals, closeout submittals, and correction period.

C. Products: Substitutions, product specifications, miscellaneous material, cable, connectors, power devices, and interface panels.

D. Execution: Coordination, testing, training, warranty, and cable management.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Unless noted otherwise, products in this section are intended as a basis of design and are open to substitutions per the product substitution procedures defined in Section 27 00 00.

2.2 SYSTEM DESCRIPTION

A. The access control system shall:

1. Regulate access through specific portals to secured areas.

2. Utilize card technology, keypad and/or biometric as its primary access devices.

B. Access control system functions shall be determined by the functionality and configuration of the access control system software.

C. The access control system shall support integration of all additional hardware and software components offered by the same Manufacturer.

D. The access control system software shall be accessible from any PC with a web browser, and with network IP access to the access control server.

E. The access control system shall be programmable via web browser for certain access control functions, as determined by the system administrator.

F. The access control system shall be capable of electronic downloads and firmware updates.

2.3 SYSTEM ARCHITECTURE:

A. The access control system shall consist of the following components:

1. System software resident on a network server (“access control server”)

2. Reader controllers

3. Reader interfaces

4. Input / Output expansion boards

5. Network and wireless locks

6. Off-line locks

7. Key switches

8. Request-to-exit buttons and motion sensors

9. Card readers

10. Credentials (cards)

11. Power Supplies and Backup Power

B. Operation

1. The access control system's functions shall be determined by the configuration of the system software.

2. The access control server shall communicate over an IP network to door controllers, and readers and locks.

3. Door controllers shall communicate downstream to non-IP devices over an RS-485 2-wire network.

2.4 SYSTEM SOFTWARE

A. The system software shall be provisioned on a server whose capability meets the requirements of the Manufacturer.

B. The system software shall be accessible from any authorized computer with network access via a web browser or SMS thick client.

C. The web browser shall allow a user to access, monitor and manage the access control system.

D. System Management: The software shall allow the user to simultaneously monitor and maintain a secure working environment.

1. The software shall provide the following functions:

a. Transaction & alarm management, monitoring, and routing

1) Color coded alarms

2) User-definable individual alarm instructions

3) Pre-defined responses

4) Send alarms to operator, group of operators, PC or email

5) Keypad duress alarm

6) Alarm annunciation

7) Alarm graphics

b. Anti-pass back

c. Web Client for operators

d. Card activation and expiration dates and times

e. Lockdown ability system wide by reader or by an input

f. Universal Triggers-enables an action in response to an input

g. Two-man rule and occupancy rule

h. First card in capability

i. Cardholder management, including user defined fields & special access needs

j. Management of online and off line locks/readers

k. Portrait capture and card production

l. Portrait monitor – ability to view photo on card read

m. Temporary badge and badge creation

n. Guest pass management for visitors

o. Elevator control

p. Report Scheduler

q. Audit Trail and reporting

r. Manual and automatic overrides

s. Automatic scheduling of predefined reports

t. Electronic software key licensing

2. At no additional cost the software shall have no limitations on the number of:

a. Card holders

b. Card readers

c. Alarms handled

d. Operators

e. Time zones

f. Number of reports

3. The system shall be capable of interfacing with an enrollment reader.

2.5 CONTACTLESS SMART CARD READERS

A. Utilize Wiegand communication.

B. Credentials:

1. Smart Card Model:

a. Operating Frequency: 13.56 MHz and 125 kHz (ISO 15693, 14443A & 14443B)

b. Secure Identity Object on MIFARE DESFire EV1

c. Able to read 37 bit card format.

C. Operating voltage range: 5-16 VDC

D. Current draw: 65mA average and 200mA peak @ 12VDC.

E. Color: Black

F. IP 55 exterior rated.

G. With attached pigtail

H. Provide adapter plate to mount on a single-gang backbox as required.

I. Firmware upgradable via pre-programmed cards.

J. Card readers shall be Schlage MT15 for standard applications and Schlage MT11 for mullion applications.

K. POWER SUPPLIES

1. Provide a power supply/chargers and sub-assemblies to power various access controller boards, locking hardware and other access control or security system components. The Contractor shall select the appropriate enclosure, power supply and sub-assemblies for each application. The Contractor shall include network monitoring modules for all power supplies.

2. Enclosures

a. Shall be capable of accommodating power supplies, sub-assemblies and other manufactures access control controller boards when required.

b. Wall mountable.

c. Include a cam-lock and tamper switch.

d. Trove 2 enclosures when housing access control electronics.

e. eFlow or Maximal enclosures when only power supply components will be within the enclosure.

3. Power Supplies

a. 115 VAC input

b. 12VDC or 24VDC selectable outputs at:

1) 2 amp continuous power @ 12VDC or 24VDC.

2) 4 amp continuous power @ 12VDC or 24VDC.

3) 6 amp continuous power @ 12VDC or 24VDC.

4) 10 amp continuous power @ 12VDC.

5) 10 amp continuous power @ 24VDC.

c. High capacity battery charging circuit.

1) Provide adequate battery backup as required by Authority Having Jurisdiction (AHJ) or a minimum of 4-hours.

d. Form “C” supervision contacts for AC Low, AC Fail, and battery presence.

e. Supervised Fire Disconnect.

f. Low power Disconnect.

g. Class 2 aux. output.

h. UL 294 listed sub-assembly for access control.

4. Sub-Assemblies

a. The Contractor shall provide all sub-assemblies to meet the project requirements

b. Access Control Module

1) Independently controlled fused protected outputs:

a) Fail-Safe and/or Fail-Secure power outputs.

b) Dry form “C” 5 amp rated relay outputs (fused).

c) Any combination of the above

c. Access Control System trigger inputs:

5. Normally open (NO) inputs.

a. Open collector sink inputs.

b. Any combination of the above.

6. Fire Alarm Disconnect:

a. Individually selectable for any or all outputs.

b. Latching or non-latch input FACP disconnect.

c. Normally open (NO), normally closed (NC) dry contact or polarity reversal from FACP signaling circuit trigger input.

d. LED indicates that the Fire Alarm Disconnect has been activated.

e. Form “C” relay output for auxiliary reporting.

7. Multi-Output Power Distribution Module

a. Single input distributed over four (4), eight (8) or sixteen (16) outputs.

b. Fused protected outputs.

c. Output terminals shall accommodate up to 12AWG wires.

8. Multi-Output Power Distribution Module with Dual Inputs

a. Two (2) inputs distributed over eight (8) outputs.

b. Outputs shall be configurable by input.

c. Fused protected outputs.

d. Output terminals shall accommodate up to 12AWG wires.

e. Network Communication Modules

9. Power Supply Network Interface

10. Interface for up to two (2) eFlow power supply/chargers.

11. Two (2) Network controlled From “C” relays.

12. Event timers.

13. Voltage Regulator

    a. The Contractor shall provide a voltage regulator to provide constant 5VDC or 12VDC outputs for access control boards, modules or other applicable components as well as a voltage regulator for door hardwiring requiring 12VDC.

    b. 24vdc Input.

    c. 5 or 12VDC output.

    d. Output rating of 6amp max.

    e. Stackable with both Networkable and dual input power distribution modules for space savings.

14. Power supplies and sub-assemblies shall be manufactured by Altronix or approved equal:

    a. eFlow3NB - 2amp 12vdc/24vdc power supply (UL listed Sub-assembly).

    b. eflow4NB - 4amp 12vdc/24vdc power supply (UL listed Sub-assembly).

    c. eFlow6NB - 6amp 12vdc/24vdc power supply (UL listed Sub-assembly).

    d. eFlow102NB - 10amp 12vdc power supply (UL listed Sub-assembly).

    e. eFlow104NB - 10amp 24vdc power supply (UL listed Sub-assembly).

    f. ACM4(CB) - Four (4) output Access Control Module (UL listed Sub-assembly).

    g. ACM8(CB) - Eight (8) output Access Control Module (UL listed Sub-assembly).

    h. PD4UL(CB) – Four (4) output power distribution module (UL listed Sub-assembly).

    i. PD8UL(CB) – Eight (8) output power distribution module (UL listed Sub-assembly).

    j. PD16W(CB) – Sixteen (16) output power distribution module (UL listed Sub-assembly).

    k. Linq2 - Network Communication Module (UL listed Sub-assembly).

    l. Linq8PD(CB) - Dual input eight (8) output Network Communication Module (UL listed Sub-assembly).

m. PDS8(CB) - Dual input eight (8) output power distribution module (UL listed Sub-assembly).

n. VR6 - Voltage Regulator (UL listed Sub-assembly).

2.6 CABLES

A. Provide cabling per manufacturer's recommendations and code requirements for riser rated, plenum, and non-plenum cable types.

B. UTP data cabling required will be provided, installed, terminated and tested by the Division 27 structured cabling Contractor.

C. UTP patch cables will be provided and installed by the Owner in the IDF and provided by Owner and installed by Contractor at the door. The EACS Contractor shall provide the Owner a list of patch cable lengths at the door side.

D. Bundled Composite Cable

1. Cables for electronic access controlled doors shall be bundled and include the followings conductor counts:

a. Card Reader – 6 conductor, 22 AWG shielded.

b. Lock Power – 4 conductor, 18 AWG unshielded.

c. Door Contact – 2 conductor, 22 AWG unshielded.

d. Request to Exit – 4 conductor, 22 AWG unshielded.

2. Manufacturer:

a. Superior Essex #AC-A12-68

b. Convergent #725116

c. General Cable #4EPL1S

d. Belden #658AFJ

e. CSC #702790

2.7 DOOR CONTACTS/DOOR POSITION SWITCHES

A. Sealed and potted magnetic reed switch in contact housing

B. Provide DPDT for applications with multiple security systems (Access Control/Intrusion Detection) utilizing a single door contact.

C. Provide color that matches door as close as possible.

D. Provide recessed switch whenever possible.

E. Armored whip for surface mount contacts.

F. Provide GE Interlogix 1078 Series for recessed applications.

1. Or approved equal.

G. Provide GE Interlogix 2500 Series for surface mount applications.

1. Or approved equal.

H. Provide GE Interlogix 2200 Series for overhead door applications.

1. Or approved equal.

2.8 REQUEST TO EXIT (REX) DEVICES

A. Request to Exit devices shall be integral to the door hardware whenever possible. The Contractor shall refer to the door hardware schedule and coordinate with the door hardware Contractor on locations and requirements. Motion based Request to Exit devices shall only be used when not available in the door hardware.

B. The motion based REX shall be a dual technology device with Passive Infrared (PIR) and Range-Controlled Radar (RCR) motion detector.

C. Reduces false alarms by sensing both heat and physical motion.

D. Independent adjustable beam pattern and radar depth.

E. Provide with mounting plate or wall mounting plate to mount over a single-gang backbox when required.

F. Provide color that matches door as close as possible.

G. DPDT output.

H. DC Power draw: 28mA max @ 12 VDC, 17mA max @ 24 VDC.

I. AC Power draw: 38mA max @ 12 VAC, 29mA max @ 24 VAC.

J. Dimensions: 1.76”H x 7.395”W x 1.85”D.

K. Utilize contact closure REX hardware built into the handle or crashbar whenever possible.

L. Provide UTC Interlogix RCR-REX.

1. Or approved dual technology equal.

2.9 INTELLIGENT CONTROLLERS

A. Panels shall be Vanderbilt VSRC-A as central intelligent controller for multiples of 16 doors with VRI-2S3 Dual reader interface panels for all Wiegand card readers.

B. VRCNX-A Panels Shall be used for all AD-300 Locksets.

C. Mercury MR50 or Vanderbilt VRI-1S3 panels are not to be used under any circumstances.

D. Contractor shall provide adequate number of access control panels, controllers, door interface panels and I/O panels for a complete turnkey system to support all components as indicated on project drawings.

E. All security interface panels shall be mounted in power supply enclosures as specified in 2.06 Power Supplies.

2.10 ELECTRONIC DOOR HARDWARE

A. For all locations on project drawings shown as Card Reader (CR) Type 3, contractor shall provide a Schlage AD-300-CY-70-MT-RHO-JD

B. For all locations on project drawings shown as Card Reader (CR) Type 5, contractor shall provide a Schlage AD-300-993R-70-MT-RHO-JD-LRX

C. ACS contractor shall coordinate with GC and Division 8 contractor the installation of lockset hardware and wiring.

D. Electronic Door Hardware installation shall be provided turnkey by the ACS contractor.

2.11 ADA POWER ASSIST DOOR OPERATOR INTEGRATION RELAYS

A. The Contractor shall provide all necessary relays to interface to the ADA operators at access-controlled doors with ADA door operators. The ADA operator interface shall be managed by the access control system. Local “smart relays” are not allowed.

B. Hardwired paddles

1. Provide with a DPDT relay. Replace existing relay in paddle as necessary.

a. Manufacturer:

1) Altronix RB1224

2.12 EXECUTION

2.13 TESTING

A. Prior to energizing or testing the system, ensure the following:

1. All products are installed in a proper and safe manner per the manufacturer’s instructions.

2. Dust, debris, solder, splatter, etc., is removed.

3. Cable is dressed, routed, and labeled; connections are consistent with regard to polarity.

4. All products are neat, clean, and unmarred, and parts are securely attached.

B. Contractor shall ensure that each device in the security system is functioning normally and in such a manner as to meet the functional and performance requirements in this specification.

2.14 TRAINING

A. Refer to Section 27 00 00 for additional requirements.

B. Provide system operations, administration, and maintenance training by factory-trained personnel qualified to instruct.

1. Contractor shall provide up to 6 hours of scheduled and dedicated training time in three (3) four (2) hour sessions for administration and investigation.

2. The Contractor shall provide up to 2 hours of dedicated training time for badge creation, printing and printer maintenance.

3. Provide printed training materials for each trainee, including product manuals, course outline, workbook or student guides, and written examinations for certification.

4. Provide hands-on training with operational equipment.

5. Training shall be oriented to the specific system being installed under this contract as designed and specified.

6. Contractor shall provide all necessary documentation of system operating parameters prior to scheduled training sessions.

2.15 INSTALLATION PRACTICES

A. All services provided shall be professional and conform to the highest standards for industry practices. The Owner reserves the right to halt any installation due to poor workmanship. All work shall be defect free, and the installer shall replace, at their expense, any work found to be defective.

B. The Owner reserves the right to halt any installation due to failure of Contractor to observe installation-free periods due to instructional or administrative requirements. To the maximum extent possible, the Owner will provide advance notice of such periods.

C. Contractor is responsible for providing a complete and system.

D. All manufactured items, materials, and equipment shall be applied, installed, connected, erected, used, and adjusted as recommended by the manufacturers, or as indicated in their published literature, unless specifically noted herein to the contrary.

E. Contractor shall follow these standards and approved submittals for locations of power supplies. The Owner intends to limit the number and location of power supplies to facilitate more effective long-term support and maintenance of the system.

2.16 COORDINATION

A. Contractor shall provide up to 8 hours (up to four, 2-hour sessions) of scheduled and dedicated coordination time to assist Owner with sequence of operation, rule creation and coordination as requested by Owner or Consultant.

2.17 ADA POWER ASSIST DOOR OPERATOR INTERFACE

A. Contractor shall coordinate integration of access control system with ADA door operator. System shall always allow free egress via ADA door operator button 24 hours/7 days a week on secure side of door. Card reader shall control operation of ADA door operator so ADA door operator button on non-secure side of door will not operate when building is locked unless a valid card read takes place.

B. Certain electric locking mechanisms with card access shall be connected (hardwired/wireless) to the ADA Power Assist Door Operator pushbutton. In this scenario, card reader shall be interfaced to the ADA Door Operator pushbutton to approve activation of door motor based on card authorization, intercom release, door release button, threat level, pre-programmed security schedule or any other time the door is in an unlocked state.

C. Door motor shall not be energized until authorized by the security system to prevent operation and eventual burn-out of the motor from hitting the button with the security system activated.

D. The door shall allow free egress via push paddle regardless if the door is in a locked or unlocked state. By pressing the paddle, the door shall unlock and swing open. A 1-second delay shall be in place to allow the electrified hardware to fully retract before the motor is actuated.

E. Contractor shall provide all necessary cable, hardware, relays, interfaces, and system programming to support all necessary functionality.

2.18 AESTHETICS

A. All cables and equipment terminating at panels frames shall be vertically straight, with no cables crossing each other, from twelve inches inside the ceiling area to the termination block.

B. All cable bundles shall be combed and bundled to accommodate individual termination block rows and panels.

C. For any given telecom room, a horizontal and vertical alignment for all mounting hardware will be maintained to provide a symmetrical and uniform appearance to the distribution frame.

D. All surface-mounted devices shall be firmly secured level and plumb

E. All rack mount equipment shall be securely installed.

2.19 HARDWARE LAYOUT

A. Hardware positioning and layout shall be reviewed and approved by the Owner prior to construction. The review does not exempt Contractor from meeting any of the requirements stated in this document.

2.20 SERVER INSTALLATION PRACTICES

A. Verify that the manufacturer approved server hardware, OS meets the Owner's IT standards prior to ordering.

B. Coordinate server power, cooling, and mounting requirements with Owner prior to installation.

C. Coordinate virus scan/security software requirements with Owner and manufacturer prior to installation.

2.21 DEVICE CABLING/WIRING INSTALLATION PRACTICES

A. All external wire and cables shall be supported at least every five feet from the structure or as required to maintain not more than 12" cable sag between supports and without over tensioning the cables. Provide j-hooks as needed where cable tray or raceway is not available.

B. This Contractor shall coordinate installation with Division 27 cabling Contractor to ensure there is at least 2-inches of physical separation between security cabling and voice/data cabling throughout cable path. Voice/data cabling Contractor has first claim to cable tray.

C. All cables, regardless of length, shall be labeled within 18" of both ends with an identifier that is keyed to the door, room, or corridor number as identified.

D. All cables shall have 6-foot service loops neatly coiled in the equipment room. During initial cable rough-in, this Contractor shall have sufficient slack to route anywhere within the equipment room.

E. Cabling shall be adequately supported with Velcro wire wraps and horizontal support cable managers fastened to rack frame. Cables shall be dressed in a neat and orderly fashion. Any cabling or equipment installation that is deemed unacceptable by the Owner or Consultant shall be replaced or corrected by the Contractor at no additional cost. Plastic zip ties are not allowed.

F. All cables are to run at right angles to the structure, placed above the ceiling in halls or corridors.

G. Cables shall not run above red iron joist.

H. Contractor shall make every effort to conceal wiring and other apparatus into walls, floors, and ceilings, assuming code and good engineering practice allows and suggests.

I. Ties and straps shall be installed snugly without deforming cable insulation. Ties shall be spaced at uneven intervals not to exceed four feet. No sharp burrs shall remain where excess length of the cable tie has been cut.

J. Contractor shall notify Owner immediately if obstruction or hazard is discovered in a pathway provided by others.

K. Cable shall be stored and handled to assure that it is not stretched, kinked, crushed, or abraded in any way. Bend radiuses shall meet manufacturer specifications and/or recommendations. Cable shall not be installed in ambient temperatures or moisture conditions above or below the manufacturer’s rating.

L. No splices shall be installed in any cable.

2.22 CABLE TERMINATION

A. Termination hardware (blocks and patch panels) positioning and layout shall be reviewed and approved by the Owner prior to construction. The review does not exempt Contractor from meeting any of the requirements stated in this document.

2.23 ACCESS CONTROL/VIDEO SURVEILLANCE/INTRUSION DETECTION INTEGRATION

A. The electronic access control system shall be integrated with the video surveillance system and intrusion detection system.

1. The access control/intrusion detection interface shall be via an RS-232 or Ethernet interface. Contact closure integration shall only be utilized if the system is existing and cannot be upgraded to support RS-232 or Ethernet. The Contractor shall supply all necessary expansion boards if contact closure integration will be required.

2. The access control/video surveillance integration shall be via a native IP interface.

3. The video surveillance /intrusion detection interface shall be via an RS-232 or Ethernet interface. Contact closure integration shall only be utilized if the system is existing and cannot be upgraded to support RS-232 or Ethernet. The Contractor shall supply all necessary expansion boards if contact closure integration will be required.

B. The Contractor shall provide any and all licensing to integrate the systems together including any additional items to be added to the yearly maintenance agreement.

C. The following minimum features shall be included in the integration; the following list is not all inclusive or exhaustive. The integration shall be a turnkey solution:

1. Call up live and/or recorded video from an alarm or event.

2. Graphical maps showing camera icons.

3. “Mouse over” camera viewing through the DVR/NVR browser and graphical maps.

4. Playback controls for recorded video.

5. Camera names brought in from the VMS.

6. PTZ camera mouse control.

7. Database entries for intrusion arm/disarm events on individual keypads.

8. Database entries for intrusion alarm events.

9. Graphical map symbols for intrusion keypads tied to camera views.

10. Intrusion devices or zones tied to camera views.

11. Alarm pop-ups and events shall include instructions and a sequence of operation to deal with events on the Intrusion Detection System, Video Management System and Electronic Access Control System.

12. Time syncing via common NTP server.

D. The Contractor shall set up a meeting between the Owner, Consultant and manufacturer to determine the exact functionality of the integration before the integration starts.

2.24 FIRE STOPPING

A. Fire stopping of openings between floors, fire-rated walls, and smoke-rated walls, created by others for This Contractor to pass cable through, shall be the responsibility of the This Contractor. Sealing material and application of this material shall be accomplished in such a manner that is acceptable to the local fire and building authorities having jurisdiction over this work.

B. Any openings created by or for This Contractor and left unused shall be sealed up by This Contractor.

C. This Contractor shall be responsible for creating a waterproof seal in and around any openings that This Contractor creates from the structure to the outside environment.

2.25 SYSTEM INSPECTION

A. Contractor shall coordinate with project representative for inspection after Contractor has completed testing of entire system.

B. Contractor shall have trained Contractor representative and testing equipment on site during inspection to assist with spot verification of tests.

C. Contactor shall verify with Project Representative the precise positioning of camera aim and shall make fine adjustments as requested.

2.26 LABELING

A. Contractor shall neatly label all security devices and cabling at both ends. All labels shall be on Project as-built drawings.

2.27 DOCUMENTATION

A. Upon completion of the installation, Contractor shall provide full documentation sets to the Consultant for approval as described in section 27 60 00. All documentation shall become the property of the Owner.

B. Documentation shall include the additional specific items detailed in the subsections below:

1. Contractor shall provide hard copy and electronic forms of the final test results.

2. Contractor shall provide a document including the following:

a. Door label/identifier

b. Location of each drop by orientation/permanent landmark in the room

3. Contractor shall provide accurate as-built Construction Drawings. The drawings are to include cable routes and device locations.

2.28 PRE-CHECK OUT

A. The Contractor shall demonstrate the following to Owner during system demonstration.

1. The card readers are fully installed and functional.

2.29 FINAL ACCEPTANCE

A. In addition to closeout requirements in section 27 60 00, This Contractor shall demonstrate the following before final approval.

1. Owner training is complete.

2. Punch list items are complete.

3. As-built documentation is complete and submitted to Owner/Consultant.

2.30 ANNUAL SUPPORT AGREEMENT

A. An annual support agreement (after the 1st year full of support/warranty) shall not be part of the bid. The Contractor shall work directly with the Owner at the end of the project to determine the ongoing hardware/software support. The Contractor shall send the Consultant a copy of the support agreement for review prior to finalization.

2.31 FINAL PROCEDURES

A. Perform final procedures in accordance with section 27 60 00.

END OF SECTION

SECTION 31 00 00

EARTHWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Contractor shall furnish all labor, materials, equipment and incidentals as shown, specified and necessary to complete the work of site preparation, erosion control, surface drainage, subsurface drainage, ground water control, construction of compacted fills, excavation, installation and removal of sheeting and bracing, backfilling and final site grading, including underfloor areas.

B. Contractor shall provide all backfill materials, including select backfill, crushed stone, backfill, clay, granular embedment, topsoil, porous granular fill and the satisfactory disposal of surplus and unacceptable materials.

C. No classification of excavated materials will be made. Excavation includes all materials regardless of type, character, composition, moisture, or condition thereof.

D. Contractor shall perform all earthwork, including backfilling all demolition areas.

1.3 DEFINITIONS

A. Excavation: Consists of the removal of material encountered to sub-grade elevations and the reuse or disposal of materials removed.

B. Sub-grade: The uppermost surface of an excavation or the top surface of a fill or backfill immediately below sub-base, drainage fill, or topsoil materials.

C. Borrow: Soil material obtained off-site when sufficient approved soil material is not available from excavations.

D. Sub-base Course: The layer placed between the sub-grade and base course in a paving system or the layer placed between the sub-grade and surface of a pavement or walk.

E. Flexible Base Course: The layer placed between the sub-base and surface pavement in a paving system.

F. Drainage Fill: Course of washed granular material supporting slab-on-grade placed to cut off upward capillary flow of pore water.

G. Unauthorized Excavation: Consists of removing materials beyond indicated sub-grade elevations or dimensions without direction by the Project Architect. Unauthorized excavation, as well as remedial work directed by the Architect, shall be at the Contractor's expense.

H. Structures: Buildings, footings, foundations, retaining walls, slabs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below ground surface.

I. Utilities: Include on-site underground pipes, conduits, ducts, and cables, as well as underground services within building lines.

1.4 COORDINATION

A. The Contractor shall expedite placement of compacted fills and embankments as per the Project Schedule.

1.5 PROJECT CONDITIONS

A. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shutoff services if lines are active. All existing underground utilities within the areas of buildings must be removed.

1.6 SOURCES OF MATERIALS

A. Fill materials for backfill and site grading may be obtained from on-site excavation work and/or obtained by the Contractor from off-site sources at Contractor's expense.

B. Select backfill (Flexible Base) materials shall be obtained by the Contractor from off-site sources at Contractor's expense.

C. Topsoil, except for topsoil stripped from the new work areas that meets the specific requirements for this material, shall be obtained by the Contractor from off-site sources at Contractor's expense. Reference Landscape plans.

D. Granular embedment materials shall be obtained by the Contractor from off-site sources at Contractor's expense.

E. Crushed stone fill materials shall be obtained by the Contractor from off-site sources at Contractor's expense.

F. Porous granular fill shall be obtained by the Contractor from off-site sources at Contractor's expense.

G. Pit run sand shall be obtained by the Contractor from off-site sources at Contractor's expense.

H. Clay materials for backfill shall be obtained from on-site excavation work and/or obtained by the Contractor from off-site sources at Contractor's expense.

1.7 QUALITY ASSURANCE

A. Owner will employ a Testing Laboratory to perform Soil Testing and Inspection Service for quality control testing during grading and excavation operations.

1.8 TESTING SERVICES

A. The testing of products: Testing for moisture content during placement and compaction of fill materials, and of compaction requirements for compliance with technical requirements of the Specifications shall be performed by the testing laboratory as designated in Section 01 40 00.

B. Testing Agency shall:
1. Test the Contractor's proposed materials in the laboratory and/or field for compliance with the Specifications.
2. Perform field moisture content and density tests to assure that the specified compaction of backfill materials has been obtained.
3. Report all test results to the Owner, Project Architect and the Contractor.

C. Authority and Duties of Testing Agency: Technicians representing the testing laboratory shall inspect the materials in the field and perform tests, and shall report their findings to the Owner, Project Architect and the Contractor. When the materials furnished or Work performed fails to fulfill Specifications requirements, the technician will direct the attention of the Owner, Project Architect and the Contractor to such failure.

D. Technicians representing the Testing Agency: Shall not act as foreman or perform other duties for the Contractor. Work will be checked as it progresses, but failure to detect any defective work or materials shall not in any way prevent later rejection when such defect is discovered, nor shall it obligate the Project Architect for final acceptance. Technicians are not authorized to revoke, alter, relax, enlarge, or release any requirements of the Specifications, nor to approve or accept any portion of the Work.

E. Responsibilities and Duties of the Contractor: The use of testing services shall in no way relieve the Contractor of his responsibility to furnish materials and construction in full compliance with the Drawings and Specifications.
1. Contractor shall secure and deliver to the testing agency, without cost, preliminary representative samples of the materials he proposes to use and which are required to be tested.
2. Contractor shall furnish such casual labor as is necessary to obtain and handle samples at the Project or at other sources of material.
3. Contractor shall advise the Owner and the Testing Agency sufficiently in advance of operations to allow for completion of quality tests and for the assignment of personnel.

1.9 REFERENCE STANDARDS: The Contractor shall comply with applicable provisions and recommendations of the following:

A. ASTM A 36, Structural Steel.

B. ASTM A 328, Steel Sheet Piling.

C. ASTM D 422, Particle-Size Analysis of Soils.

D. ASTM D 423, Liquid Limit of Soils.

E. ASTM D 427, Shrinkage Factors of Soils.

F. TEX–114–E (ASTM D 698), Moisture-Density Relations of Soils, using 5.5 lb Rammer and 12-in drop.

G. ASTM D 1140, Amount of Material in Soils Finer than the No. 200 Sieve.

H. ASTM D 1556, Density of Soil in Place by the Sand-Cone Method.

I. TEX–113–E (ASTM D 1557), Moisture-Density Relations of Soils, using 10.0 lb (4.5 kg) Rammer and 18- in. Drop.

J. ASTM D 2166, Unconfined Compressive Strength of Cohesive Soil.

1.10 SUBMITTALS

A. Should sheet and shoring be necessary, the Contractor shall prepare Drawings for the following: Sheeting and bracing for excavations over 5 foot deep. The Drawings shall be prepared by a Professional Engineer licensed in the State of Texas. The Drawings shall be submitted to the Project Architect for establishing that the terms of the Specifications are complied with. Calculations shall not be submitted. Drawing submissions will not be checked and will not imply approval by the Project Architect of the Work involved. The Contractor shall be wholly responsible for designing, installing and operating whatever system is necessary to accomplish satisfactory sheeting, bracing, dewatering, and protection.

B. Test Reports: Testing Laboratory shall submit copies of the following reports directly to the Owner, Project Architect and Contractor:
   1. Pavement sub-grade.
   2. Field density tests.
   3. Optimum moisture - maximum density curve for each soil used for backfill.
   4. Tests of actual unconfined compressive strength or bearing test of each strata.

C. Samples of all select backfill, backfill, clay, drainage material, granular embedment, porous granular fill, pit run sand and topsoil shall be submitted by the Contractor to the testing laboratory. Samples of the proposed material shall be submitted at least fourteen days in advance of its anticipated use.

1.11 SITE CONDITIONS

A. Geotechnical Information: A Geotechnical Investigation has been performed for the Owner by others. This report is available for review by Bidders. The Owner makes no warranty or representation as to the accuracy of said report. Bidders are encouraged to perform their own tests and draw their own conclusions from those tests before submitting bids. Owner is not responsible for Bidders' conclusions which result from the Geotechnical information found in the Owner's report.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Backfill and Fill Materials:

1. Materials acceptable for use as backfill or fill shall be materials obtained from excavations on site or from off-site sources whose gradation shows not more than 15 percent passing the No. 200 standard sieve as determined by ASTM D 1140, and whose Plasticity Index is not in excess of 20 percent as determined by ASTM D 424. The material shall contain no vegetative matter.
2. All material for use as backfill and fill shall be tested by the testing laboratory and approved by the Project Architect.

B. Select Backfill (Flexible Base - Base Material):

1. Select backfill for compaction backfill shall conform to the 2004 Texas Department of Transportation Standard Specifications Items 247 gradation Type A, Grade 1 or 2 as following:

Sieve Size	Percent Retained on Sieve
2 – ½" inch	0
1 – ¾" inch	0-10
No. 4	45 - 75
No. 40	60 - 85

2. The select backfill mixture shall contain no clay lumps or organic matter. The fraction passing No. 40 sieve shall have a liquid limit not greater than 40 and a plasticity index not greater than 12 as determined by ASTM D 424. The select backfill shall be deposited in uniform layers not exceeding 8 inches in uncompacted thickness. The backfill shall be compacted by a suitable vibratory roller or platform vibrator to not less than 95 percent of laboratory maximum density as determined by TEX-113-E.

C. Granular embedment material shall be crushed rock or pea gravel with not less than 95 percent passing a ½-inch sieve and not less than 95 percent retained on a No. 4 sieve.

D. Crushed stone shall be crushed rock conforming to the following gradation:

Sieve Size	Percent Retained on Sieve
3 inch	0
2-1/2 inch	0 -10%
2 inch	30 - 65%
1-1/2 inch	85 - 100%
3/4 inch	95 - 100%

E. Porous Granular Fill:

1. Porous granular fill for compaction backfill shall conform to the following:

Sieve Size	Percent Retained on Sieve
1-3/4 inch	0% - 10%
No. 4	45% - 75%
No. 40	60% - 85%
No. 200	90% - 100%

2. The porous granular fill material shall contain no clay lumps or organic matter.

The fraction passing the No. 40 sieve shall be non-plastic. The porous granular fill shall be deposited in uniform layers not to exceed 6 inches in uncompacted thickness. The backfill shall be compacted to not less than 95% of the laboratory maximum density as determined by TEX–114–E.

3. All material for porous granular fill must be tested by the testing laboratory and approved by the Project Architect.
4. No porous granular fill shall be placed without the Project Architect's approval.

F. Pit Run Sand:

1. Pit run sand for compaction backfill for use as shown conform to the following:

Sieve Size	Percent Retained on Sieve
No. 4	0
No. 200	90 - 100%

2. Pit run sand material shall contain no organic material. The maximum plastic limit of the material shall be less than 10. The pit run sand shall be deposited in uniform layers not to exceed 8 inches in uncompacted thickness. The backfill shall be compacted to not less than 95% of laboratory maximum density as determined by TEX–114–E.
3. All material for pit run sand must be tested by the testing laboratory and approved by the Project Architect.
4. No pit run sand shall be placed without the approval of the Project Architect

G. Clay:

1. Material for use as clay liner over top of backfill and/or select backfill or as otherwise shown shall conform to the following:

Sieve Size	Percent Retained on Sieve
No. 4	0 - 15%
No. 200	0 - 30%

2. The plasticity index shall be between 18 and 25%. Clay shall be deposited in uniform layers not to exceed 8 inches in uncompacted thickness. The clay shall be compacted to between 95% and 98% of maximum density as determined by TEX–114–E the clay shall be moisture conditioned between optimum and + 3%.
3. All material for clay must be tested by the testing laboratory and approved by the Project Architect.
4. No clay shall be placed without the approval of the Project Architect.

H. Drainage Material:

1. Drainage material for use as shown on the Drawings shall conform to the following:

Sieve Size	Percent Retained on Sieve
2 inch	0%
1-1/2 inch	0 - 10%
1 inch	45 - 75%
3/4 inch	90 - 100%
½ inch	95 - 100%

2. The drainage material shall be crushed rock. The drainage material shall be compacted by two passes of a hand activated vibratory compactor. The material shall have a LA abrasion number of 35 or less.
3. All drainage material must be tested by the testing laboratory and approved by the

Project Architect.

4. No drainage material shall be placed without the Project Architect approval.

I. Accessories:

1. Detectable Warning Tape: Acid-and alkli-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, six (6) inches wide and four (4) mils thick minimum, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 2'-6" deep. Detectable Warning Tape to be used on all PVC piping except perforated subsurface piping.
   a) Tape Colors: Provide tape colors to utilities as follows:
      (1) Red: Electric.
      (2) Yellow: Gas, oil, steam, and dangerous materials.
      (3) Orange: Telephone and other communications.
      (4) Blue: Water systems.
      (5) Green: Sewer systems.
      (6) Brown: Force mains
2. Filter Fabric: Manufacturer's standard nonwoven pervious geotextile fabric of polypropylene, nylon or polyester fibers, or a combination.
3. Provide Filter Fabrics: That meet or exceed the listed minimum physical properties determined according to ASTM D 4759 and the referenced standard test method in parentheses:
   a) Grab Ensile Strength (ASTM D 4632): 100 lb.
   b) Apparent Opening Size (ASTM D 4751): #100 U.S. Standard Sieve.
   c) Permeability (ASTM D 4491): 150 gallons per minute per sq. ft.

PART 3 - EXECUTION

3.1 SITE PREPARATION

A. The portions of the site on which the Work is to be constructed shall be cleared of all objectionable materials and debris (see Section 31 10 00, Site Clearing). Trees within the project limits except those indicated in Drawings to remain shall be completely removed, including stumps and roots. All materials and debris shall be disposed off site in accordance with applicable regulations.

3.2 STRIPPING AND STORING OF TOPSOIL

A. Those portions of the site on which the new Work is to be constructed shall be stripped of all topsoil to a minimum depth of 6 inches prior to other earthwork operations. Stripped materials shall not be used for compacted fill.

B. The stripped topsoil shall be stockpiled at the place or places approved by the Project Architect.

C. Topsoil to be suitable for re-use shall meet the requirements for topsoil described under Article 2.01G above, and shall be free from trash, debris, and surface vegetation.

D. After all of the other Work has been completed in each area, topsoil shall be placed and graded in accordance with the Grading Plan and as specified in the Landscape Drawings and Specifications.

3.3 EROSION CONTROL AND DEWATERING

A. In general, the construction procedures outlined herein shall be implemented to ensure minimum damage to the environment during construction.

B. Whenever possible, access and temporary roads shall be located and constructed to avoid environmental damage. Provisions will be made to regulate drainage, avoid erosion and minimize damage to vegetation.

C. Where areas must be cleared for storage of materials or temporary structures, provisions shall be made for regulating drainage and controlling erosion, subject to Project Architect approval.

D. Temporary measures shall be applied to control erosion and to minimize the siltation of the project site and adjacent property. Such measures shall include, but not be limited to, the use of silt fences, berms, baled straw silt barriers, gravel or crushed stone, mulch, grasses, slope drains and other methods. These temporary measures shall be applied to erodible materials exposed by any activities associated with the construction of this Project.
   1. Special care shall be taken to eliminate depressions that could serve as mosquito pools.
   2. Temporary measures shall be coordinated with the construction of permanent drainage facilities and other Work to the extend practicable to assure economical, effective, and continuous erosion and siltation control.
   3. Contractor shall provide special care in areas with steep slopes. Disturbance of vegetation shall be kept to a minimum to maintain stability.

E. Remove only those trees, shrubs and grasses indicated in the Drawings as such. Protect the rest to preserve their aesthetic and erosion-control values.

F. Install erosion and sediment control practices according to soil conservation district standards and specifications. The practices shall be maintained in effective working condition during construction and until the drainage area has been permanently stabilized.

G. In the event of any temporary work stoppage, the Contractor shall take steps to prevent any temporary or permanent environmental damage to the area undergoing construction.

H. In the event the Contractor fails to satisfactorily control erosion and siltation, the Owner reserves the right to employ outside assistance or to use its own forces to provide the corrective measures indicated. The cost of such Work, plus engineering costs, will be deducted from monies due the Contractor.

I. Contractor shall provide and maintain adequate dewatering equipment to remove and dispose of all surface and ground water entering excavations, trenches, or other parts of the Work. Each excavation shall be kept dry during subgrade preparation and continually thereafter until the structure to be built, or the pipe to be installed therein is inspected by the Project Architect and backfill operations have been completed and approved.

   1. The different working areas on the site shall be kept free of surface water at all times. The Contractor shall install drainage ditches and dikes and shall perform

all pumping and other work necessary to divert or remove rainfall and all other accumulations of surface water from the excavations and fill areas. The diversion and removal of surface water shall be performed in a manner that will prevent the accumulation of water behind temporary structures or at any other locations within the construction area where it may be detrimental.

2. The Contractor will be held responsible for the condition of any pipe, conduit or channel which he may use for drainage purposes and all such pipes, conduits or channels shall be left clean and free of sediment.

J. Refer to Article 3.19 of this Section for the TPDES General Permit requirements.

3.4 EXCAVATION

A. Contractor shall excavate and backfill in advance of the construction, test pits to determine conditions or location of the existing utilities. Contractor shall perform all Work required in connection with excavating, stockpiling, maintaining, sheeting, shoring, backfilling and replacing pavement for the test pits.
Contractor shall be responsible for the definite location of each existing utility involved within the area of his excavation for Work under this Contract. Care shall be exercised during such location work to avoid damaging and/or disrupting the affected utility. The Contractor shall be responsible for repairing, at his expense, damage to any structure, piping or utility caused by his Work.

B. Explosives will not be permitted on this project.

C. Contractor and/or Contractor's independently retained employee or structural design/geotechnical/safety/equipment consultant, if any, shall review the Drawings and any available geotechnical information and the anticipated installation site(s) within the project Work area in order to develop the Contractor's plans to implement the project described in the Contract Documents. The Contractor's plans shall provide for adequate trench safety systems that comply with, as a minimum, OSHA standards for trench excavations. Specifically, Contractor and/or Contractor's independently retained employee or safety consultant shall develop and implement a trench safety program in accordance with OSHA standards governing the presence and activities of individuals working in and around trench excavation. Contractor shall be required to provide an on-site representative to insure compliance and review of the trench safety program. Contractor shall be required throughout the construction process to insure that the appropriate safety system(s) is utilized for the soil condition encountered during the construction of the project.

D. Sheeting and shoring shall be provided as necessary for the protection of the Work and for the safety of personnel. The clearances and types of the temporary structures, insofar as they affect the character of the finished work, will be subject to the approval of the Project Architect, but the Contractor shall be responsible for the adequacy of all sheeting, bracing, cofferdamming, etc. No separate payment is to be made for providing or removing steel or wood sheet piling; payment shall be considered as having been included in the price bid for the Contract. All shoring, bracing and sheeting shall be removed as the excavations are backfilled and in a manner such as to prevent injurious caving; or, if so directed by the Project Architect, because in his opinion, removal would be damaging to structures or personnel, shall be left in place. Sheeting left in place shall be cut off 3 feet below the surface. Payment for sheeting left in place shall be considered as having been included in the Contract Price. All sheeting and bracing must be

maintained until replaced by other sheeting and bracing or until the permanent construction is able to withstand lateral pressures from soil and water. Remove sheeting and bracing from excavations unless otherwise ordered in writing by the Project Architect. Removal shall be done so as to not cause injury to the Work. Removal shall be equal on both sides of excavations to ensure no unequal loads on pipe or structure. Defer removal of sheeting and bracing, where removal may cause soil to come into contact with concrete until the following conditions are satisfied:

1. Concrete has cured a minimum of 7 days.
2. Wall and floor framing up to and including grade level floors are in place.

E. Excavation of every description and of whatever substances encountered within the grading limits of the Project shall be performed to the lines and grades indicated on the Drawings. All excavation shall be performed in the manner and sequence as required for the Work.

1. Excavation Work shall be performed in a safe and proper manner with appropriate precautions being taken against all hazards. Excavations shall provide adequate working space and clearances for the Work to be performed therein and for installation and removal of concrete forms. In no case shall excavation faces be undercut for extended footings.
2. Slope sides of open excavations to a slope of two horizontal to one vertical.
3. Subgrades for parking areas and trench bottoms shall be firm, dense, and thoroughly compacted to a 95% maximum density. The finished elevation or stabilized subgrades shall not be above subgrade elevations shown on the Drawings.
4. Exposed soil after excavations have been made shall be protected against detrimental damage and change in condition from physical disturbance and rain. Wherever possible, concrete footings shall be done the same day the excavation is made. If this is not done, the footing excavations shall be properly protected.

F. All excavated materials that meet the requirements for backfill shall be stockpiled within the site (but not less than 25 feet from the surface borders of any excavation) for use as backfill, or for providing final site grades. All excavated materials which are not considered suitable for fill, and any surplus or excavated material which is not required for fill shall be disposed of off the site by the Contractor. Upon completion of the Work all on-site waste and disposal areas shall be cleaned and the debris removed from the site.

1. Materials deposited off the site shall be transported and placed in accordance with all applicable rules and regulations of all authorities having jurisdiction thereof. No surplus or unacceptable excavated materials of any kind shall be deposited in any stream or water course or dumped on public property. The different Work areas on the site shall be kept free of surface water at all times.

3.5 EXCAVATIONS FOR STRUCTURES

A. Excavations for the construction of structures and foundations shall be carefully made to the depths indicated or required. Bottoms for footings, slabs, and grade beams shall be level, clean and clear of loose material, the lower sections to be true to size. Footings, slab and grade beam bottoms shall be approved by the Project Architect before any concrete is placed thereon.

B. When the excavation has reached the design subgrade, the exposed subgrade shall be proof rolled. Proof rolling operation shall be inspected by the Project Engineer. Any soft or unconsolidated zones or area detected by proof rolling operations shall be undercut as

directed by the Project Engineer. The undercut subgrade shall be scarified to a minimum depth of 6-inches and compacted to a minimum of 95% of the maximum density as determined by ASTM D 698. After the undercut subgrade has been scarified and compacted the undercut shall be backfilled with select backfill to the design subgrade elevation in accordance with these specifications. The final subgrade shall be inspected and approved by the Project Engineer.

C. In excavations for structures, where, in the opinion of the Project Architect, the ground, not affected by high water level, is spongy or otherwise unsuitable for the contemplated foundation, the Contractor will be required to remove such unsuitable earth and replace it with suitable material properly compacted.

D. Excavations for structures which have been carried below the depths indicated shall be refilled to the proper grade with select backfill material properly compacted, in accordance with these Specifications.

E. All pavement structure excavations shall be hand-trimmed to permit the placing of full widths, and subsurface drainage piping. Rounded and undercut edges will not be permitted.

F. Excavation shall be extended a minimum of two feet on each side of structures, footings, etc., unless otherwise indicated on the Drawings.

3.6 DRIVEWAY ENTRANCE DRIVE EXCAVATIONS

A. Excavation shall consist of excavation for the Driveway entrance drive in conformity with the lines, grades, cross sections, and dimensions shown on the Drawings and shall include the excavation of all unsuitable material from the subgrade.

B. The subgrade shall be compacted to 95% maximum dry density as determined by TEX–114–E.

3.7 TRENCH EXCAVATIONS

A. Trenches shall be excavated to a width which will provide adequate working space and clearances for proper pipe installation, jointing, and embedment, and subsurface drainage installation:

1. Where pipe elevations are not shown on the Drawings, trenches shall be excavated to a depth sufficient to provide a minimum cover over the top of the pipe of 4 feet.

B. Except where otherwise required, pipe trenches shall be excavated 6 inches below the underside of the pipe to provide for the installation of granular embedment pipe foundation material.

C. Where in earth, trench bottoms for 6 inch or smaller pipe may be excavated below the pipe subgrade and granular embedment material provided as specified or the trench bottom may be graded to provide uniform and continuous support (between bell holes or end joints) or the installed pipe.

D. Over-depths in trench excavation shall be backfilled with select backfill material properly compacted. Whenever unsuitable material that is incapable of properly supporting the pipe is encountered in the undercut required for bedding material, the unsuitable material shall be removed to the depth required and the trench backfilled to the proper grade with

select backfill material properly compacted.

E. Bell holes shall provide adequate clearance for tools and methods used in installing pipe. No part of any bell or coupling shall be in contact with the trench bottom, trench walls, or granular embedment when the pipe is jointed.

F. Where existing piping cross the new pipeline trench excavation, they shall be adequately supported and protected from damage due to construction. All methods for supporting and maintaining these facilities shall be subject to approval by the Project Architect. Care shall be taken to insure that the existing pipeline grades and alignment are maintained and that the pipe joints are not disturbed. Backfill shall be carefully placed and tamped to prevent damage or future settlement. Any damage or misalignment of the existing piping due to construction or settlement shall be repaired by the Contractor at his expense. Where sanitary sewer lines cross potable water lines, encase sewer line in concrete. Reference Utility drawings for locations.

3.8 TRENCH AND EXCAVATION SAFETY PROGRAM (Refer to Section 01 5000)

A. Contractor shall provide trench excavation protection.

B. Trench excavation protection shall be accomplished as required by the provisions of CFR 29, Part 19261, Subpart P - Excavations, Trenching and Shoring of the Occupational Safety and Health Administration Standards and Interpretations.

C. Contractor shall submit a trenching plan, which has been approved and sealed by a professional engineer registered in the State of Texas, to Project Architect prior to commencing construction.

D. The trenching plan submitted by Contractor shall, as a minimum, comply with the requirements of the OSHA Safety and Health Standards.

E. It is the sole duty, responsibility and prerogative of the Contractor, not the Owner, Engineer, or Project Architect to determine the specific applicability of the designed trench safety systems to each field condition and to make inspections of the trench safety systems.
1. The Contractor shall maintain a permanent record of inspections.

F. The Contractor shall protect persons from injury at excavations, by barricades, warnings and illumination. Any work within the City of LaCoste Public Right of Way shall comply to the latest revisions and requirements of the Texas Manual on Uniform Traffic Control Devices.

G. Contractor shall coordinate excavations with weather conditions, to minimize possibility of washouts, settlements and other damages and hazards.

H. Prior to commencing excavation, Contractor shall give written notice to emergency medical service (EMS) stating location and nature of work. Contractor shall post phone number of emergency medical service near phone at each site.

I. See Sections 01 5000 and 31 23 33 for additional trenching requirements.

3.9 UNAUTHORIZED EXCAVATION

A. All excavation outside the lines and grades shown, and which is not approved by the Project Architect, together with the removal and disposal of the associated material shall be at the Contractor's expense. The unauthorized excavation shall be filled and compacted with approved backfill by the Contractor at his expense.

3.10 PLACEMENT OF FILL AND BACKFILL

A. All select backfill and backfill required for structures, trenches and site demolition backfill required to provide the finishes grades shown and as described herein shall be furnished, placed and compacted by the Contractor.

B. Backfill excavations as promptly as Work permits, but not until completion of the following:
1. Acceptance by the Project Architect of construction below finish grade, including the basement level of the existing school structure.
2. Inspection, testing, approval, and recording of locations of underground piping.
3. Removal of concrete formwork.
4. Removal of shoring and bracing, and backfilling of voids with satisfactory materials.
5. Removal of trash and debris.

C. Fill containing organic materials or other unacceptable material shall be removed and replaced with approved fill material.

3.11 PLACEMENT OF SELECT BACKFILL, BACKFILL, AND FILL

A. Select backfill shall be placed to the grades shown on the Drawings. The lift thickness and compaction moisture content range given herein are approximate. These values will be determined from the laboratory test results on the fill materials. Every lift of fill material shall be tested unless the Project Architect determines that less quality control testing is acceptable.

B. All select backfill shall be placed in horizontal loose lifts not exceeding 8 inches in uncompacted thickness and shall be mixed and spread in a manner assuring uniform lift thickness after placing. Each lift shall be compacted by not less than two complete coverages of the specified compactor. Select backfill shall be placed to the underside of all compactor. Select backfill shall be placed to the underside of all concrete slabs. The maximum slope of select backfill to the subgrade shall be one vertical to one horizontal.

C. Backfill and fill around and outside of structures and over select backfill shall be deposited in layers not to exceed 8 inches in uncompacted thickness and mechanically compacted, using platform type tampers. Compaction of structure backfilled by rolling will be permitted provided the desired compaction is obtained and damage to the structure is prevented. Compaction of select backfill and/or backfill by inundation with water will not be permitted. All materials shall be deposited as specified herein and shown on the Drawings.

D. Select backfill (Flexible Base) material shall be placed in lifts with a maximum thickness of 8in. and compacted to a minimum of 95% of the maximum density at a moisture content within the range of -2% and +2% of optimum moisture content as determined by TEX-113-E. The contractor shall provide equipment capable of adding measured

amounts of water to the backfill and/or select backfill material to bring it to a condition within the range of the required moisture content. The Contractor shall provide equipment capable of disking, aerating, and mixing the soil to insure reasonable uniformity of moisture content throughout the fill material and to reduce the moisture content of the borrow material by air drying if necessary. If the subgrade or lift of earth material must be moisture conditioned before compaction, the fill material shall be sufficiently mixed or worked on the subgrade to insure a uniform moisture content throughout the lift of material to be compacted. Materials at moisture content in excess for the specified limit shall be dried by aeration or stockpiled for drying. The moisture content shall be maintained as described above until the fill is permanently covered.

E. No backfill or fill material shall be placed when free water is standing on the surface of the area where the fill is to be placed. No compaction of fill will be permitted with free water on any portion of the fill to be compacted. No fill shall be placed or compacted in a frozen condition or on top of frozen material. Any fill containing organic materials or other unacceptable material previously described shall be removed and replaced with approved fill material prior to compaction.

F. Each lift of compacted material shall be compacted by the designated number of coverages of all portions of the surface of each lift by a smooth-drum vibratory roller for granular material having a static weight not less than 5,500 pounds, a sheepsfoot roller for cohesive material exerting a pressure of 250 psi on the surface of the feet, or equivalent equipment approved by the Project Engineer prior to commencement of the Work. One coverage is defined as the condition obtained when all portions of the surface of the fill material have been subjected to the direct contact of the compactor. The compactor shall be operated at a forward speed not exceeding 40 feet per minute.

G. Compaction shall be performed with equipment suitable for the type of fill material being placed. The Contractor shall select equipment which is capable of providing the minimum density required by these Specifications. The gross weight of compacting equipment shall not exceed 7,000 pounds within a distance of ten feet from the wall of any completed structure. Equipment shall be provided that is capable of compacting in restricted areas next to structures and around piping. The effectiveness of the equipment selected by the Contractor shall be tested at the commencement of compacted fill Work by construction of a small section of fill within the area where fill is to be placed. If tests on this Section of fill show that the specified compaction is not obtained, the Contractor shall increase the amount of coverages, decrease the lift thickness or obtain a different type of compactor.

H. Levels of backfill against concrete walls shall not differ by more than 2 feet on either side of walls unless walls are adequately braced or all floor framing is in place up to and including grade level slabs. Particular care shall be taken to compact structure backfill which will be beneath pipes, roads, or other surface construction or structures. In addition, wherever a trench passes through structure backfill, the structure backfill shall be placed and compacted to an elevation 12 inches above the top of the pipe before the trench is excavated. Compacted areas, in each case, shall be adequate to support the item to be constructed or placed thereon.

I. The compaction requirements specified are predicated on the use of normal materials and compaction equipment. In order to establish criteria for the placement of a controlled

fill so that it will have compressibility and strength characteristics compatible with the proposed structural loadings, a series of laboratory compaction and/or compressive strength tests will be performed on the samples of materials submitted by the Contractor. From the results of the laboratory tests, the final values of the required percent compaction, the acceptable compaction moisture content range, and the maximum permissible lift thickness will be established for the fill material and construction equipment proposed.

3.12 BACKFILL IN PIPE TRENCHES

A. Pipeline trenches may be backfilled prior to pressure testing, but no structure shall be constructed over any pipeline until it has been tested.

B. All pipe larger than 6 inches in diameter shall be placed on granular embedment material. Pipe 6 inches in diameter and smaller shall be placed in granular embedment material unless the trench bottom has been graded to provide uniform and continuous support of the installed pipe.

C. Embedment materials both below and above the bottom of the pipe, classes of embedment to be used, and placement and compaction of embedment materials shall conform to the following requirements:

1. Granular embedment shall be spread and the surface graded to provide a uniform and continuous support beneath the pipe at all points between bell holes or pipe joints. It will be permissible to slightly disturb the finished subgrade surface by withdrawal of pipe slings or other lifting tackle. After each pipe has been graded, aligned, and placed in final position on the bedding material, and shoved home, sufficient pipe embedment material shall be deposited and compacted under and around each side of the pipe and back of the bell or end thereof to hold the pipe in proper position and alignment during subsequent pipe jointing and embedment operations. Embedment material shall be deposited and compacted uniformly and simultaneously on each side of the pipe to prevent lateral displacement.
2. Compacted backfill will be required for the full depth of the trench above the granular pipe embedment material. Where the trench for one pipe passes beneath the trench for another pipe or electrical ductbank, for the lower trench shall be compacted to the level of the bottom of the upper trench.
3. Each layer of embedment material shall be compacted by at least two complete coverages of all portions of the surface of each lift using approved compaction equipment. One coverage is defined as the conditions reached when all portions of the fill lift have been subjected to the direct contact of the compacting surface of the compactor.
4. The method for compaction and the equipment used shall be appropriate for the material to be compacted and shall not transmit damaging shocks to the pipe.
5. The degree of compaction required for granular embedment is expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 698.

3.13 BACKFILL IN ELECTRICAL DUCTBANK TRENCHES

A. Compacted backfill will be required for the full depth of the trench above the electrical ductbank. Where the trench for one ductbank passes beneath the trench for another pipe or ductbank select backfill shall be placed to the level of the bottom of the upper trench.

B. Placement and compaction of backfill in electrical ductbank trenches shall conform to the requirements of these Specifications.

C. The electrical ductbank shall be placed in sand envelopes shown on the Drawings.

3.14 COMPACTION DENSITY REQUIREMENTS

A. The degree of compaction required for all types of fills and exposed subgrades shall be as listed below. Material shall be moistened or aerated as necessary to provide the moisture content that will facilitate obtaining the specified compaction.

Material	ASTM	Required Density	Maximum Uncompacted Lift Thickness
Exposed Subgrade Crawl In Underfloor Space	ASTM D698	90%	8 inches
Select Backfill (Playground/ Non-use Open Areas)	ASTM D698	90%	8 inches
Select Backfill Below Parking Areas	TEX-113-E	95%	8 inches
Moisture Conditioned Subgrade	TEX-114-E	95%	8 inches
Backfill/Around Structures	ASTM D698	95%	8 inches
All Other Backfill	ASTM D698	95%	8 inches
Backfill/Flexible Base	ASTM D698	95%	8 inches
Backfill/Pipe Trenches	ASTM D698	95%	8 inches
Backfill/Electrical	ASTM D698	95%	8 inches
Porous Granular Fill	ASTM D698	95%	8 inches
Porous Granular Embedment/Pipe Trenches	ASTM D698	95%	8 inches
Pit Run Sand around Utility Trenches	ASTM D698	95%	8 inches
Clay	ASTM D698	95%	8 inches

B. The testing laboratory shall perform tests necessary to provide data for selection of fill material and control of placement water content.

C. Field density tests to insure that the specified density is being obtained will be performed by testing laboratory during each day of compaction work. Number of test shall be approved by Project Architect.

D. If the tests indicate unsatisfactory compaction, the Contractor shall provide the additional compaction necessary to obtain the specified degree of compaction. All additional compaction work shall be performed by the Contractor at no additional cost to the Owner until the specified compaction is obtained. This Work shall include complete removal of unacceptable (as determined by the Project Architect) fill areas and replacement and recompaction until acceptable fill is provided.

3.15 CRUSHED STONE PLACEMENT

A. Crushed stone shall be placed where shown on the Contract Drawings.

3.16 SHEETING, SHORING AND BRACING

A. Excavations for structures and pipe lines shall be open excavation, sheeted, shored and braced where necessary to prevent injury to workmen, structures, or pipe lines.

B. All municipal, county, state and federal ordinances, codes, regulations and laws shall be observed.

C. Used material shall be in good condition, not damaged or excessively pitted. All steel or wood sheeting designated to remain in place shall be new. New or used sheeting may be used for temporary work.

D. All timber used for breast boards (lagging) shall be new or used, meeting the requirements for Douglas Fir Dense Construction grade or Southern Pine No. 2 Dense S3.

E. All steel work for sheeting, shoring, bracing, cofferdams etc., shall be designed in accordance with the provisions of the "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings", of the AISC except that field welding will be permitted.

F. Steel sheet piling shall be manufactured from steel conforming to ASTM A 328. Steel for soldier piles, wales and braces shall be new or used and shall conform to ASTM A 36.

G. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Carry down shoring and bracing as excavation progresses.

H. Unless otherwise shown, specified, or ordered, all materials used for temporary construction shall be removed when work is completed. Such removal shall be made in a manner not injurious to the structure or its appearance or to adjacent Work.

3.17 SHEETING LEFT IN PLACE

A. Steel sheet piling shown to be left in place or ordered in writing to be left in place by the Project Architect, shall consist of rolled sections of the continuous interlocking type unless otherwise approved. The type and design of the sheeting and bracing shall conform to the above specifications for all steel work for sheeting and bracing. Steel sheeting installed but not removed shall be new.

B. Steel sheet piling to be left in place shall be driven straight to the lines and grades as shown or directed. The piles shall penetrate into firm materials with secure interlocking throughout the entire length of the pile. Damaged piling having faulty alignment shall be pulled and replaced by new piling.

C. The type of guide structure used and method of driving for steel sheet piling to be left in place shall be subject to the approval of the Project Architect. Jetting will not be permitted.

D. Contractor shall cut off piling left in place to the grades shown or ordered by the Project Architect and shall remove the cutoffs from the site.

E. Contractor shall thoroughly clean wales, braces and all other items to be embedded in the permanent structure, and shall make provisions that the concrete surrounding the embedded element is sound and free from air pockets or harmful inclusions. The provisions shall include the cutting of holes in the webs and flanges of wale and bracing members, and the welding of steel diaphragm waterstops perpendicular to the centerline of brace ends which are to be embedded.

F. Subsequent to removal of the inside face forms, and when removal of bracing is permitted, steel shall be cut back at least 2 inches inside the wall face and the opening patched with cement mortar. The concrete shall be thoroughly worked beneath wales and braces, around stiffeners and in any other place where voids may be formed.

G. Portions of sheeting or soldier piles and breast boards which are in contact with the foundation concrete shall be left in place, together with wales and bracing members which are cast into the foundation or superstructure concrete.

3.18 FINAL GRADING AND EMBANKMENTS

A. To the extent available backfill material from excavations shall be placed in accordance with these Specifications to final grades with a minimum compacted depth of 6 inches.

B. After other outside Work has been finished, and backfilling and embankments completed and settled, all areas on the site of the Work which are to be graded shall be brought to a subgrade suitable with the indicated elevations, slopes, and contours with suitable excess excavation material. Subgrade shall be left below the finished grades shown on the Drawings to allow for topsoil placement. Reference Landscape Specifications for topsoil depth, where applicable.

3.19 TEXAS POLLUTANT DISCHARGE ELIMINATION SYSTEM (TPDES) GENERAL PERMIT

A. The Contractor shall prepare and submit the following items to the Owner.
   1. Notice of Intent (NOI) for Storm Water Discharges Associated with Industrial Activity. This notice shall be prepared and filed with the TCEQ at least 48 Hrs. before the start of construction.

2. Conform to the storm water pollution prevention plan.
3. Notice of Termination (NOT) of coverage under the TPDES General Permit.
4. The above documents will be filed with the TCEQ by the General Contractor. Contractor is to coordinate with Project Civil Engineer as necessary.

END OF SECTION

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SECTION 32 12 16

ASPHALT PAVING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Asphaltic concrete paving and surface sealer.

B. Aggregate base course.

1.2 RELATED SECTIONS

A. Section 31 00 00 – Earthwork

1.3 REFERENCES

A. Texas Department of Transportation Standard Specifications, 2004 Edition.

1.4 PERFORMANCE REQUIREMENTS

A. Paving: Designed for parking.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with Texas Department of Transportation Standard Specifications.

B. Mixing Plant: Conform to Texas Department of Transportation Standards.

C. Obtain materials from same source throughout.

1.6 REGULATORY REQUIREMENTS

A. Conform to applicable Texas Department of Transportation Standards for paving Work on public property.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Do not place asphalt when base surface temperature is less than 40 degrees F (4 degrees C), or surface is wet or frozen.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Asphalt Cement: In accordance with Texas Department of Transportation Standards Item 340, Hot Mix Asphaltic Concrete Pavement, Type D and as indicated in Drawings.

2.2 ACCESSORIES

A. Primer: Homogeneous, medium curing, liquid asphalt. In accordance with Texas Department of Transportation Standards Item 300, Asphaltic, Oils and Emulsions.

B. Tack Coat: Homogeneous, medium curing, liquid asphalt. In accordance with Texas Department of Transportation Standards Item 300, Asphaltic, Oils and Emulsions..

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify base conditions prior to commencing Work.

B. Verify that compacted sub-grade is dry and ready to support paving and imposed loads.

C. Verify gradients and elevations of base are correct.

3.2 PREPARATION – PRIMER

A. Apply primer in accordance with Texas Department of Transportation Standards.

B. Apply primer evenly and smoothly on base or sub-base over sub-grade surface at uniform rate of 0.10 to 0.30 gallons/square yard of surface or as approved by Civil Engineer.

C. Use clean sand to blot excess primer.

3.3 PREPARATION - TACK COAT

A. Apply tack coat in accordance with Texas Department of Transportation Standards.

B. Apply tack coat to contact surfaces of existing asphalt surfaces where the new entrance drives transition to the existing street.

3.4 PLACING ASPHALT PAVEMENT

A. Asphalt placement shall conform to specification, item 340, Type D. Texas Department of Transportation Standard.

B. Place asphalt within twenty four (24) hours of applying primer or tack coat.

C. Compact pavement by rolling. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.

D. Asphalt shall be compacted to a minimum of 92% of maximum theoretical specific gravity (Rice) of the mixture as determined by TEX-227-F.

E. Develop rolling with consecutive passes to achieve even and smooth finish, without roller marks.

3.5 TOLERANCES

A. Flatness: Maximum variation of 1/4 inch measured with ten (10) foot straight edge.

B. Scheduled Compacted Thickness: Within 1/4 inch.

C. Variation from True Elevation: Within ½ inch.

3.6 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Section 01 40 00 'Quality Control Services'.

B. Pavement specimens shall be cored and tested in accordance with TEX-207-F.

C. Nuclear-Density testing shall be used during placement operations.

3.7 DEFECTIVE PAVEMENT

A. Recompact pavement sections not meeting specified densities or replace them with new asphaltic concrete material. Replace section of surface course pavement not meeting surface test requirements or having an unacceptable surface texture with new material. Patch asphalt pavement sections in accordance with procedures established by the Asphalt Institute. Replace asphalt pavement sections which did not meet the specifications.

3.8 DEFICIENT SURFACE THICKNESS

A. Any area of asphalt surface found deficient in thickness by more than ¼ inches shall be removed and replaced, at the Contractor's expense, with asphalt surface of the thickness shown on the drawings. Care should be taken not to damage or remove the pavement below the asphalt surface. Should damage to the pavement below the asphalt surface occur, it shall be removed and replaced at the Contractor's expense.

No additional payment over the contract price will be made for any asphalt surface of a thickness exceeding that required by the drawings.

3.9 PROTECTION

A. After placement, protect pavement from mechanical injury.

END OF SECTION

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PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 This Specification describes the minimum optical and physical properties required for a thermoplastic road marking compound that is to be applied in a molten state, onto a pavement surface, to provide traffic stripes and/or markings.

1.2 The appearance of the finished markings shall have a uniform surface, crisp edges with a minimum over-spray, clean cut-off, meet straightness requirements and conform to the design Drawings and/or Engineer instructions.

1.3 Parking Area and Asphalt Playground Area pavement marking paint: Chlorinated rubber-alkyd type, ready-mixed, complying with Federal Spec TTP115E, Type III. Reference drawings for location and color.

1.4 Drive Area pavement marking paint: Thermoplastic paint complying with City of San Antonio standard specifications. Reference drawings for location and color.

PART 2 - PRODUCTS

2.1 Thermoplastic pavement marking material shall be a product especially compounded for traffic markings for use on either asphaltic or portland cement concrete surfaces.

A. The following composition requirements shall be met:

	White	Yellow
Binder	18% Min.	18% Min.
Ti02 (Type 2 Rutile)	12% Min.	N/A
Glass Spheres *	48% Min.	48% Min.
Yellow Pigment	N/A	10% Min.

NOT USED ON THIS PROJECT.

2.2 BINDERS

A. The alkyd binder shall consist of maleic modified rosin ester and other plasticizers.

2.3 PIGMENT

A. The white pigment must be a rutile titanium dioxide meeting the standars of ASTM D 476, Type V.

B. The yellow pigment must be heat-resistant and weather-stable. The yellow pigment may be either a double-encapsulated medium chrome yellow or a lead-free, organic yellow pigment (C.I. Pigment Yellow 83, opaque version). Do not mix pigment types within a batch.

2.4 PHYSICAL REQUIREMENTS

A. The Meltdown Procedure for Thermoplastic, available from the Engineer, shall be used when conducting laboratory tests to verify the following property requirements.

2.5 COLOR

A. The white thermoplastic shall be pure white and free from any tint. Using a Colorimeter, such as a Gardner color Difference Meter, the materials shall not show deviations from a magnesium oxide color standard that are greater than the following:

Scale Definition	Magnesium Oxide Standard	Sample
RD	100	75%
Reflectance		
a Red-Green	0	-5 to +5
b Yellow-Blue	0	-10 to +10

PART 3 - APPLICATION - SURFACE PREPARATION

3.1 MOISTURE

A. All surfaces shall be inspected for moisture content prior to application of thermoplastic. Approximately two square feet of a clear plastic or tar paper shall be laid on the road surface and held in place for 15 to 20 minutes. The underside of the plastic or tar paper shall then be inspected for a build up of condensed moisture from the road surface. If the amount of condensed moisture is of a sufficient amount to result in water dripping from the plastic or tar paper when held in a vertical position, thermoplastic shall not be applied. This moisture test shall be repeated until the moisture in the pavement surface has been allowed to evaporate to a level whereby there is not excessive build up of condensed moisture on the underside of the plastic or tar paper.

3.2 CLEANING

A. All surfaces shall be clean and dry before thermoplastic can be applied. Loose dirt and debris shall be removed by blowing compressed air over the area to be striped. If the thermoplastic is to be applied over existing paint lines, the paint line shall be swept with a mechanical sweeper or wire brush to remove poorly adhered paint and dirt that would interfere with the proper bonding or the thermoplastic. Latence and curing compound shall be removed from all new Portland cement concrete surfaces by loose grain abrasive pressure blasting or wire brushing.

3.3 LAYOUT

A. The pavement markings shall be placed in proper alignment with guidelines established on the pavement. Deviation from the alignment established shall not exceed 2-inches and, in addition, the deviation in alignment of the marking being placed shall not exceed 1-inch per 200 feet or pavement nor shall any deviation be abrupt.

1. Longitudinal markings shall be offset at least 2-inches from construction joints of Portland cement concrete surfaces and joints and shoulder breaks of asphalt surfaces.

3.4 PRIMER AND SEALER

A. Primer sealer shall be used on all Portland cement concrete surfaces. A primer sealer shall be used on asphalt surfaces that are over two years old and/or on asphalt surfaces that are worn or oxidized to a condition where 50 percent or more of the wearing surface is exposed aggregate.

3.5 PRIMER SEALER APPLICATION

A. When required as described, the primer-sealer shall be applied to the pavement surface in a continuous film at a minimum thickness of 3 to 5 mils. Before the thermoplastic is applied, the primer-sealer shall be allowed to dry to a tacky state. The thermoplastic shall be applied within 4 hours after the primer application.

3.6 TEMPERATURE REQUIREMENTS: AMBIENT CONDITIONS

A. The ambient air and road surface shall be 55°F and rising before application of thermoplastic can begin.

3.7 MATERIAL REQUIREMENTS

A. The thermoplastic compound shall be heated from 400°F to 450°F and shall be a minimum of 400°F as it makes contact with pavement surface during application. An infrared temperature gun shall be used to determine the temperature of the thermoplastic as it is being applied to the pavement surface.

3.8 PACKAGING: CONTAINERS

A. The thermoplastic material shall be delivered in 50 pound cardboard containers or 50 pound bags of sufficient strength to permit normal handling during shipment and handling on the job without loss of material.

3.9 LABELING

A. Each container shall be clearly marked to indicate the color of the material, the process batch number and/or manufacturer's formulation number, the manufacturer's name and address and the date of manufacture.

3.10 MANUFACTURER'S RESPONSIBILITY: SAMPLING AND TESTING

A. The manufacturer shall submit test results from an approved independent laboratory. All material samples shall be obtained twenty (20) days in advance of the pavement marking operations. The cost of testing shall be included in the price of thermoplastic material. The approved independent laboratory's test results shall be submitted to the Engineer in the form of a certified test report.

3.11 BILL OF LADING

A. The manufacturer shall furnish the Material and Tests Laboratory with copies of Bills of Lading for all materials inspected. Bill of lading shall indicate the consignee and the destination, date of shipment, lot numbers, quantity, type of material, and location of source.

3.12 MATERIAL ACCEPTANCE

A. Final acceptance of a particular lot of thermoplastic will be based on the following:
1. Compliance with the Specifications for material composition requirements verified by approved independent laboratory with tests results.
2. Compliance with the specification for the physical properties required and verified by an approved independent laboratory with test results.
3. Manufacturer's test results for each lot thermoplastic have been received.
4. Identification requirements are satisfactory.

3.13 CONTRACTOR'S RESPONSIBILITY

A. The Contractor shall notify the Construction Inspector 72 hours prior to the placement of the thermoplastic markings enable the inspector to be present during the application operation. At the time of notification, the Contractor shall indicate the manufacturer and the lot numbers of the thermoplastic that he intends to use. A check should be made by the Contractor to insure that the approved lot numbers appear on the material package. Failure to do so is cause for rejection.

B. If the normal trade practice for manufacturers is to furnish warranties or guarantees for the materials and equipment specified herein, the Contractor shall turn the guarantees and warranties over to the School Project Manager for potential dealing with the Manufacturers. The extent of such warranties or guarantees will not be a factor in selecting the successful bidder.

END OF SECTION