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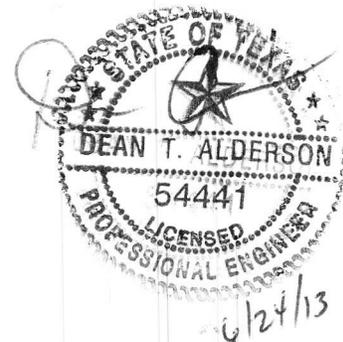
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SECTION 21 05 00

COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 GENERAL

1.1 SUMMARY

Applicable provisions of General Conditions, Special Conditions, and Special Instructions to Bidders govern work under this section and all of Division 21.

This section is in particular reference to and shall be considered a part of all Fire Suppression specifications sections following. It is intended that comments in this section be applicable to all parts of Division 21. Work described hereinafter shall be included as though written within each specific section of the specification.

The Contractor shall provide all items, articles, materials, operations, or methods listed, mentioned, or scheduled on the Drawings and/or herein, including all labor, materials, equipment, and incidentals necessary and required for their completion.

All work shall conform to requirements of all local construction codes, applicable sections of the National Fire Protection Association and Public Health Agencies, latest editions of all publications.

1.2 SECTION INCLUDES

- A. Above Ground Piping
- B. Valves
- C. Pipe Hangers and Supports

1.3 SCOPE

- A. Requirements specified in this section shall govern applicable portions of all fire suppression sections including paragraphs on related electrical work, whether so stated therein or not.
- B. Where items specified in the specific fire suppression sections conflict with requirements in this section, the former specific sections shall govern.
- C. The Contractor shall furnish all labor, plant, equipment, and materials, complete in connection with the installation of the fire suppression systems in strict accordance with this specification and accompanying plans. The Contractor shall submit his bid based on performing all work hereinafter specified or indicated on applicable plans. The Contractor shall furnish and install all connections and appurtenances necessary and usually furnished in connection with such work and systems even though not specifically mentioned or shown on the plans.

- D. These requirements cover information, work, equipment and accessories listed under the following headings:
  - 1. References, Definitions, Procedures
  - 2. Permits and Fees
  - 3. Utility Connections and Inspections
  - 4. Workmanship
  - 5. Fire Suppression Provisions
  - 6. Electrical Provisions
- E. Work of Other Sections: Requirements given within this Section apply to the Work of all Sections of this Division.
- F. Prime and protective painting shall be provided under this Division.
- G. Electrical interlock apparatus and other electrical apparatus, which is not an integral part of equipment specified under this Division, are specified under Division 26. Necessary conduit, wiring, boxes, and fittings are specified under Division 26.

#### 1.4 REFERENCES

- A. References:
  - 1. References to standards, codes, specifications and recommendations shall mean the latest edition of such publications adopted and published at date of invitation to submit Proposals.
  - 2. References to technical societies, trade organizations and governmental agencies is made in plumbing work sections in accordance with the following abbreviations:
    - a. ANSI American National Standards Institute
    - b. ASME American Society of Mechanical Engineers
    - c. ASSE American Society of Sanitary Engineering
    - d. ASTM American Society for Testing and Materials
    - e. AWS American Welding Society
    - f. AWWA American Water Works Association
    - g. FM Factory Mutual
    - h. NFPA National Fire Protection Association
    - i. NBS National Bureau of Standards
    - j. NEC National Electrical Code (NFPA Pamphlet No. 70)
    - k. NEMA National Electrical Manufacturers Association
    - l. UL Underwriters' Laboratories, Inc.
- B. American Society of Mechanical Engineers:
  - 1. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings.
  - 2. ASME B16.11 - Forged Steel Fittings - Socket-Welding and Threaded.
  - 3. ASME B16.25 - Buttwelding Ends.
  - 4. ASME B16.3 - Malleable Iron Threaded Fittings.
  - 5. ASME B16.4 - Gray Iron Threaded Fittings.
  - 6. ASME B16.5 - Pipe Flanges and Flanged Fittings.
  - 7. ASME B16.9 - Factory-Made Wrought Steel Buttwelding Fittings.

- C. ASTM International:
  - 1. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
  - 2. ASTM A135 - Standard Specification for Electric-Resistance-Welded Steel Pipe.
  - 3. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
- D. National Fire Protection Association:
  - 1. NFPA 13 - Installation of Sprinkler Systems.

## 1.5 DEFINITIONS

- A. Definitions of terms and expressions used in fire suppression work are:
  - 1. "Provide" shall mean "furnish and install" or "furnish labor and material required for installation of."
  - 2. "Herein" shall mean the contents of a particular section where this term appears.
  - 3. "Indicated" shall mean "indicated on contract drawings."
  - 4. "Section" shall mean one of the portions of fire suppression or electrical work sections indexed in Division 21 and 26.
  - 5. "Concealed" where used in connection with insulation and painting of piping, and accessories, shall mean that they are hidden from sight as in chases, furred spaces, or hung ceilings.
  - 6. "Exposed" where used in connection with painting of piping, and accessories shall mean that they are not "concealed" as defined herein above.
  - 7. "Piping" includes in addition to pipe, also fittings, valves, hangers and other accessories, which comprise a system.
- B. Drawings and Instructions
  - 1. Contract drawings for fire suppression work are performance spec-based and in part diagrammatic, intended to convey the scope of work and indicate general arrangement of piping and approximate locations of equipment and outlets. Fire Suppression trade shall follow these drawings in laying out their work, consult other trades and the existing building construction to familiarize themselves with all conditions affecting their work, and shall verify and coordinate spaces in which their work will be installed. The contract drawings shall be considered as a part of these specifications. It is intended that any Contractor making proposal to execute any work should study the drawings for his own particular trade, as well as all drawings of all other trades in order to fully understand the work he is expected to perform. As a qualification for bidding, the contractor shall visit the site and be responsible for determining all existing conditions in as far as it affects his work prior to submitting a proposal.

## 1.6 DRAWINGS

- A. General: The Drawings are schematic in nature and indicate approximate locations of the piping systems, except where specific locations are noted and dimensioned on the Drawings. All items are shown approximately to scale. The intent is to show how these items shall be integrated into the building. Locate all items by on-the-job measurements

and in accordance with the Contract Documents. Cooperate with other trades to ensure project completion as indicated.

- B. Unless otherwise expressly agreed to in writing, all rights to the specifications and drawings prepared by Alderson & Associates, Inc. shall belong to Alderson & Associates, Inc. The sole exception is that the specifications and drawings may be used for construction of the project for which the specifications and drawings were prepared if all other contractual obligations have been complied with, including the payment of fees. Each page of the drawings, if prepared in whole or in part by Alderson & Associates, Inc., and all pages of specifications of Division 21 and Division 26 are covered by copyright and may not be reproduced, published or used in any way without the permission of Alderson & Associates, Inc.

#### 1.7 DISCREPANCIES

- A. Clarification: Clarification shall be obtained before submitting a proposal for the Work under this Division as to discrepancies or omissions from the Contract Documents or questions as to the intent thereof.
- B. Contractor Agreement: Consideration will not be granted for misunderstanding of the amount of work to be performed. Tender of a proposal conveys full Contractor agreement of the items and conditions specified, shown, scheduled, or required by the nature of the project.
- C. The drawings intend that all equipment and piping be arranged as shown with necessary minor rearrangements to suit the equipment approved and to comply with the requirements of the various equipment manufacturers' recommendations. Some minor rearrangements are expected to best fit the structural conditions. It shall be the responsibility of the Contractor to make known his desires in such change, by shop drawings as required, to obtain agreement of the Engineer before proceeding with any change or variation. Changes required by job conditions, equipment employed, or structural conditions of the building shall be at no cost to the Owner.

#### 1.8 PRODUCT SUBSTITUTION PROCEDURES

- A. Engineer will consider requests for Substitutions. Engineer shall receive such requests a minimum of 10 days prior to scheduled bid date.
- B. Substitutions may be considered when a product becomes unavailable through no fault of Contractor.
- C. Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents.
- D. A request constitutes a representation that Bidder:
  - 1. Has investigated proposed product and has determined that it meets or exceeds quality level of specified product.
  - 2. Will provide same warranty for Substitution as for specified product.

3. Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to Owner.
  4. Waives claims for additional costs or time extension which may subsequently become apparent.
  5. Will reimburse Owner and Engineer for review or redesign services associated with re-approval by authorities having jurisdiction.
- E. Substitutions will not be considered when they are indicated or implied on Shop Drawing or Product Data submittals, without separate written request, or when acceptance will require revision to Contract Documents.
- F. Substitution Submittal Procedure:
1. Submit two copies of request for Substitution for consideration. Limit each request to one proposed Substitution.
  2. Submit Shop Drawings, Product Data, and certified test results attesting to proposed product equivalence. Burden of proof is on proposer.
  3. Engineer will notify Contractor in writing of decision to accept or reject request.

## 1.9 SUBMITTALS

- A. Submittal Procedures:
1. Submittal Preparation:
    - a. Minimum of six copies are required, complete (all items submitted at one time), index to each Section of Specifications and include the following information and action taken.
      1. Project Name
      2. Date
      3. Name and Address of Engineer
      4. Name, Address and Telephone Number of Contractor or Sub-contractors.
      5. Manufacturer's Name
      6. Published ratings or capacity data
      7. Detailed equipment drawing for fabricated items
      8. Wiring diagrams
      9. Installation instructions
      10. Other pertinent data
      11. All required submittals and data, bound together, submitted at one time.
    - b. Where literature is submitted covering a group or series of similar items, the applicable items must be clearly indicated on each copy with a highlighter pen, or other means of identification clearly legible.
    - c. Data and shop drawings shall be coordinated and included in a single submission. Multiple submissions are not acceptable except where prior approval has been obtained from the Engineer. In such cases, a list of data to be submitted later shall be included with the first submission. Failure to submit shop drawings that meet the requirements of the Drawings and Specifications in ample time for review shall not entitle

the Contractor to an extension of contract time, and no claim for extension by reason of such Contractor default shall be allowed.

- B. Submittal Organization:
  - 1. Organize all required data in a 3-ring black (in color) binder of sufficient size with index tabs with number and appropriate title of specification section.
- C. Provide a cover sheet and an index sheet listing all items submitted.
- D. The second and third sheet shall be blank for stamping of submittals. All submittals are to be processed at same date; partial submittals will not and are not acceptable.
- E. Show any revisions to equipment layout required by use of selected equipment. The Engineer shall receive submittals no later than thirty (30) working days from contract date with General Contractor and Owner.
- F. The Engineer's review of submittals is only for confirmation of adherence to design of project and does not relieve the Contractor of final responsibility for furnishing all materials required for a complete working system and in complying with the Contract Documents in all respects.

#### 1.10 SHOP DRAWINGS, DESCRIPTIVE DATA

- A. As soon as practical and within thirty days after the official award of contract and before any materials and equipment are purchased, the Contractor shall submit to the Engineer, for review, six (6) copies of the complete list of all materials and equipment identified and referenced to specification paragraphs together with applicable shop drawings. In addition, the names and addresses of the manufacturers, their catalog data, numbers, and trade names shall be furnished. Published performance data indicating pressure drops, balance points, etc., shall be furnished to indicate compliance with scheduled performance. This data will be marked "Reviewed" by the Engineer, dated and distributed to the several parties involved, with two (2) copies returned to the Contractor. The data shall include the following:
  - 1. Equipment-room layouts drawn to ¼" scale, including equipment, piping, accessories, to show clearances for operating and servicing.
  - 2. Equipment and materials as indicated in each Section.
  - 3. Wiring diagrams and controls for electrically operated equipment furnished by fire suppression trades.
  - 4. Composite drawings of crowded locations where there is a possibility of conflict among trades.
  - 5. Indicate exact locations and elevations of pipes, obtained from field measurements, after consultation and agreement among trades involved.
- B. Verification of Dimensions:
  - 1. The Contractor shall be responsible for the coordination and proper relation of his work to the building structure and to the existing lighting, conduit, heaters, and skylights. The Contractor shall verify all dimensions in the field and advise the Engineer of any discrepancy before performing the work. Adjustments to the

work required in order to facilitate a coordinated installation shall be made at no additional cost to the Owner.

- C. Equipment other than that shown should be used in bids only when approved by the Engineer prior to bidding. Those models and/or manufacturers identified in drawings and specifications were selected to provide minimum acceptable performance. These models are used in sake of brevity to establish a basis of quality, performance, capacities, etc., required. Any such alternate proposals must include all necessary changes and additions to the work occasioned by such substitution including but not limited to supports, electrical work, connections, piping, etc. which shall be paid for by the Contractor. In the event that the Contractor submits for approval any material, equipment, etc., that are not in conformity with the specifications, the Engineer reserves the right to reject this equipment, and the Contractor shall submit data on other equipment which meets the requirements of the specifications for approval.
- D. Installation Directions:
  - 1. Obtain manufacturer's printed installation directions to aid in properly executing work on equipment requiring such directions.
- E. Submit such directions to Engineer prior to time of installation for use in review of the work.
- F. Operating Instructions, Charts:
  - 1. Furnish manufacturer's printed operating and maintenance instruction for equipment and systems, which, in opinion of Engineer, require such instructions; obtain receipt for it.
- G. When so specified or instructed, mount operating instructions in approved frame with glass over; locate where directed.

#### 1.11 GENERAL INSTALLATION

- A. System Design and Installation:
  - 1. Uniformity: Unless otherwise specified, equipment or material of same type or classification, used for same purpose shall be the product of same manufacturer.
  - 2. Design: Equipment and accessories not specifically described or identified by manufacturer's catalog numbers shall be designed in conformity with ASME, AIEE or other applicable technical standards, be suitable for maximum working pressure and shall have neat and finished appearance.
  - 3. Installation: Erect system in neat and workmanlike manner; align, level and adjust for satisfactory operation; install so that all parts are easily accessible for inspection, operation, maintenance and repair. Minor deviation from indicated arrangements may be made, as approved.
- B. Protection of Equipment and Materials:
  - 1. Responsibility for care and protection of fire suppression work rests with the Contractor until it has been tested and accepted.

2. After delivery, before and after installation, protect equipment and materials against theft, injury or damage from all causes.
- C. Adjustments:
1. It shall be the responsibility of the Contractor to adjust properly any and all equipment and devices and to run reasonable operating tests together with more specific tests indicated in the separate sections of the specifications. If for some reason any piece of equipment does not function satisfactorily after the first adjustments are made, the Contractor shall continue on the job until satisfactory corrections and adjustments have been made. The Contractor is responsible for the proper performance, functioning, and integration, of the system and its components and equipment.
- D. Completeness:
1. The Contractor shall be responsible for the absolute completeness of his work, including all adjustments to obtain proper operation in all respects.
  2. Each system is intended to be complete and functional in performance. All such items as piping trim, electrical work, controls, and accessories, required shall be installed at no extra cost.

#### 1.12 PERMITS AND FEES

- A. All building permits and their required fees and all inspection fees for all fire suppression work shall be arranged and paid for by the Fire Suppression trade involved in the particular work for which the permit is taken, and for the pertinent inspection fee for the work involved by the Contractor.

#### 1.13 UTILITY CONNECTIONS AND INSPECTIONS

- A. Extensions: The Contractor shall provide or obtain and pay for all utility connections, utility extensions, and/or relocations and shall pay all costs and inspection fees for all work included therein.
- B. Compliance: The Contractor is required to comply in every respect with all requirements of local inspection departments, local ordinances and codes, and utility company requirements.
- C. Utilities: The Contractor shall check with the various utility companies whose services are required for this project and shall provide, complete in all respects, the required utility relocations, extensions, modifications, and/or changes.
- D. Certifications: Prior to final acceptance, the Contractor shall furnish without additional charge a certificate of acceptance from the inspection departments having jurisdiction over the work for any and all work installed under this Contract.
- E. Ordinances, Rules and Regulations:
1. All installations shall comply with applicable codes; ordinances and regulations except where drawings require a higher degree of work as indicated on the plans or specified hereinafter.

- F. Installations and equipment shall comply with applicable requirements of the National Fire Protection Association, Texas State Board of Insurance Underwriters, utility company, or other local, State or Federal agencies having jurisdiction. Compliance with these requirements shall be done at no additional cost to the Owner.
- G. Any changes to the contract required by the aforementioned requirements shall be submitted to the Engineer in writing for approval prior to execution.

#### 1.14 WORKMANSHIP

- A. All materials and equipment shall be installed in accordance with the approved recommendation of the manufacturer, and by workmen skilled in the trade involved shall accomplish the installation.

#### 1.15 FLAME SPREAD PROPERTIES OF MATERIALS

- A. Materials and adhesives incorporated in this project shall conform to ASTM Standard E84, "Test Method of Surface Burning Characteristics of Building Materials" and NFPA 90. The classification shall not exceed a flame spread rating of 25 for all materials, adhesives, finishes, etc., specified for each system, and shall not exceed a smoke developed rating of 50.

#### 1.16 ASBESTOS ABATEMENT

- A. In the event the Contractor encounters at the site material reasonably believed to be asbestos which has not been abated, the Contractor shall immediately stop work in the area affected and report the condition to the Owner. If in fact the material is asbestos and the asbestos has not been abated, the Contractor shall not resume the non-asbestos-related work in the affected area until the asbestos has been abated. The abatement action may be done in two ways, as the Owner may decide. The Owner may perform the abatement by its own forces, or the Owner may contract with a third party to perform the abatement.

#### 1.17 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

#### 1.18 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store valves in shipping containers, with labeling in place.
- B. Furnish cast iron and steel valves with temporary protective coating.
- C. Furnish temporary end caps and closures on piping and fittings. Maintain in place until installation.

1.19 WARRANTY

- A. Furnish one year manufacturer warranty for basic fire suppression materials and methods.

PART 2 PRODUCTS

2.1 VALVES

A. Manufacturers:

1. Viking.
2. Gem.
3. Reliable.

B. Gate Valves:

1. Up to and including 2 inches (50 mm): Bronze body and trim, rising stem, hand wheel, solid wedge or disc, threaded ends.
2. Over 2 inches (50 mm): Iron body, bronze trim, rising stem pre-grooved for mounting tamper switch, hand wheel, OS&Y, solid rubber covered bronze or cast iron wedge, flanged or grooved ends.
3. Over 4 inches (100 mm): Iron body, bronze trim, non-rising stem with bolted bonnet, solid bronze wedge, flanged ends, iron body indicator post assembly.

C. Ball Valves:

1. Up to and including 2 inches (50 mm): Bronze two piece body, brass, or stainless steel ball, teflon seats and stuffing box ring, lever handle threaded ends

D. Check Valves:

1. Up to and including 2 inches (50 mm): Bronze body and swing disc, rubber seat, threaded ends.
2. Over 2 inches (50 mm): Iron body, bronze trim, swing check with rubber disc, renewable disc and seat, flanged ends with automatic ball check.
3. 4 inches (100 mm) and over: Iron body, bronze disc with stainless steel spring, resilient seal, threaded, wafer, or flanged ends.

E. Drain Valves:

1. Compression Stop: Bronze with hose thread nipple and cap.
2. Ball Valve: Brass with cap and chain, 3/4 inch (20 mm) hose thread.

2.2 ABOVE GROUND PIPING

A. Steel Pipe: ASTM A53/A53M, Grade B; ASTM A135; ASTM A795; or ASME B36.10; Schedule 40 black.

1. Steel Fittings: ASME B16.9, wrought steel, butt welded; ASME B16.25, butt weld ends; ASTM A234/A234M, wrought carbon steel and alloy steel; ASME B16.5, steel flanges and fittings; or ASME B16.11, forged steel socket welded and threaded.
2. Cast Iron Fittings: ASME B16.1, flanges and flanged fittings; or ASME B16.4, threaded fittings.
3. Malleable Iron Fittings: ASME B16.3, threaded fittings or ASTM 47.

4. Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, "C" shaped elastomeric sealing gasket, steel bolts, nuts, and washers; galvanized for galvanized pipe.
5. Mechanical Formed Fittings: Carbon-steel housing with integral pipe stop and O-ring pocked and O-ring uniformly compressed into permanent mechanical engagement onto pipe.

### 2.3 PIPE HANGERS AND SUPPORTS

- A. Conform to NFPA 13.
- B. Hangers for Pipe Sizes 1/2 to 1-1/2 inch (15 to 40 mm): Carbon steel, galvanized, adjustable swivel, split ring.
- C. Hangers for Pipe Sizes 2 inch (50 mm) and Over: Carbon steel, galvanized, adjustable, clevis.
- D. Wall Support for Pipe Sizes to 3 inches (80 mm): Cast iron hook, galvanized.
- E. Wall Support for Pipe Sizes 4 inches (100 mm) and Over: Welded steel bracket and wrought steel clamp, galvanized.
- F. Vertical Support: Steel riser clamp.

## PART 3 EXECUTION

### 3.1 PREPARATION

- A. Ream pipe ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and foreign material, from inside and outside, before assembly.

### 3.2 INSTALLATION

- A. Install piping in accordance with NFPA 13 for sprinkler systems.
- B. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.
- C. Install piping to conserve building space, to not interfere with use of space and other work.
- D. Install pipe sleeve at piping penetrations through walls. Seal pipe and sleeve penetrations to maintain fire resistance equivalent to fire separation.
- E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

- F. Pipe Hangers and Supports:
  - 1. Install in accordance with NFPA 13.
  - 2. Install hangers to with minimum 1/2 inch (15 mm) space between finished covering and adjacent work.
  - 3. Place hangers within 12 inches (300 mm) of each horizontal elbow.
  - 4. Use hangers with 1-1/2 inch (40 mm) minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
- G. Slope piping and arrange systems to drain at low points. Install eccentric reducers to maintain top of pipe level.
- H. Prepare pipe and fittings for finish painting.
- I. Do not penetrate building structural members unless indicated.
- J. Die cut threaded joints with full cut standard taper pipe threads with red lead and linseed oil or other non-toxic joint compound applied to male threads only.
- K. Install valves with stems upright or horizontal, not inverted. Remove protective coatings prior to installation.
- L. Install drain valves at main shut-off valves, low points of piping and apparatus.

### 3.3 CLEANING

- A. Clean and flush entire piping system after other construction is complete.

### 3.4 SPACE REQUIREMENTS

- A. Clearance: Allow adequate space for clearance in accordance with the Code requirements and the requirements of the local inspection department.
- B. Materials and equipment shall be installed in accordance with manufacturers' recommendations and best standard practice for the type of work involved.
- C. All equipment shall be continuously protected, using temporary shelters, etc., from dirt, dust, moisture, damage, etc., and will not be accepted otherwise.

### 3.5 RELATED ELECTRICAL PROVISIONS

- A. Electrical Contractor To Provide:
  - 1. Line Voltage and hook-up to all Fire Suppression (Division 21) Equipment and devices.
- B. Fire Suppression Contractor to Provide:
  - 1. All Fire Suppression Equipment.
  - 2. All relays, contactors, and switches other than switches shown on and required by Division 26.

- C. The Electrical plans are based on the equipment and devices scheduled or shown on the drawings or as called for in the specifications. Should any fire suppression equipment, device, or associated devices be changed or accepted from those which are shown or noted, all electrical and fire suppression changes shall be made at the expense of the trade or contractor initiating the change with no expense to the Owner, Engineer or their representatives.
- D. General:
  - 1. All electrical equipment, control components and circuits not specifically covered herein shall conform to the requirements in Division 26, Electrical.
- E. Such items as electrical controls, interlocks, and devices shall be installed and wired into the system to conform to Division 26. They shall be complete with all required conduit, condulets, boxes, wire, grounds, etc. The electrical trades doing Division 26 work shall provide all power wiring of 115 volt or higher including interlocks. All control wiring shall be the responsibility of the fire suppression trades, who shall furnish all wiring and diagrams.
- F. Cleaning Piping:
  - 1. Piping shall be thoroughly cleaned of dirt, cuttings and other foreign substances. Should any pipe or other part of the systems be stopped by any foreign matter, disconnect, clean and reconnect wherever necessary for purpose of locating and removing obstructions. Repair work damaged in the course of removing obstructions.

### 3.6 GUARANTEES

- A. All work, including equipment, and materials, shall be guaranteed by the Contractor for a period of one (1) year after final acceptance of the work. All defects in labor and materials occurring during the one year after final acceptance of the work shall be immediately repaired or replaced by the Contractor at no additional cost to the owner.

END OF SECTION

SECTION 21 13 13

WET-PIPE SPRINKLER SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes wet-pipe sprinkler system, system design, installation, and certification.

1.2 REFERENCES

- A. National Fire Protection Association:
  - 1. NFPA 13 - Installation of Sprinkler Systems.

1.3 SYSTEM DESCRIPTION

- A. System to provide coverage for entire building.
- B. Provide hydraulically designed system to NFPA 13 ordinary hazard, Group 1 occupancy requirements.
- C. Perform water flow test to determine volume and pressure of incoming water supply to hydraulically design piping system.
- D. Interface system with building fire alarm system.
- E. Provide fire department connections as indicated on Drawings.

1.4 SUBMITTALS

- A. Shop Drawings: Indicate sprinkler locations coordinated with ceiling installation. Indicate detailed pipe layout, hangers and supports, sprinklers, components and accessories. Indicate system controls.
- B. Product Data: Submit data on sprinklers, valves, and specialties, including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.
- C. Design Data: Submit design calculations; signed and sealed by professional engineer.

1.5 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Record actual locations of sprinklers and deviations of piping from drawings. Indicate drain and test locations.

- B. Operation and Maintenance Data: Submit components of system, servicing requirements, record drawings, inspection data, replacement part numbers and availability, and location and numbers of service depot.

1.6 QUALITY ASSURANCE

- A. Perform Work in accordance with NFPA 13.

1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.
- C. Design system under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of Texas.

1.8 PRE-INSTALLATION MEETINGS

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

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Store products in shipping containers until installation.
- B. Furnish piping with temporary inlet and outlet caps until installation.

1.10 WARRANTY

- A. Furnish one year manufacturer warranty for entire fire suppression system.

1.11 EXTRA MATERIALS

- A. Furnish extra sprinklers under provisions of NFPA 13.
- B. Furnish suitable wrenches for each sprinkler type.
- C. Furnish metal storage cabinet located adjacent to alarm valve.

**PART 2 PRODUCTS**

2.1 SPRINKLERS

- A. Manufacturers:
  - 1. Ansul Incorporated.
  - 2. Automatic Sprinkler Corp.

3. Fike Protection Systems.
  4. Grinnell Corp.
  5. Reliable Sprinkler Corp.
  6. Viking
  7. WSA Inc.
- B. Suspended Ceiling Type:
1. Type: Semi-recessed pendant type with matching screw on escutcheon plate.
  2. Finish: Chrome plated.
  3. Escutcheon Plate Finish: Chrome plated.
  4. Fusible Link: Glass bulb type temperature rated for specific area hazard.
- C. Exposed Area Type:
1. Type: Quick response upright type, with guard where heads are less than 10 feet above floor.
  2. Finish: Brass.
  3. Fusible Link: Glass bulb type temperature rated for specific area hazard.
- D. Guards: Finish to match sprinkler finish.

## 2.2 PIPING SPECIALTIES

- A. Wet Pipe Sprinkler Alarm Valve: Check type valve with divided seat ring, rubber faced clapper to automatically actuate water motor alarm, with pressure retard chamber and variable pressure trim; with test and drain valve.
- B. Water Motor Alarm: Hydraulically operated impeller type alarm with aluminum alloy chrome plated gong and motor housing, nylon bearings, and inlet strainer.
- C. Water Flow Switch: Vane type switch for mounting horizontal or vertical, with two contacts; rated 10 amp at 125 volt AC and 2.5 amp at 24 volt DC.
- D. Fire Department Connections:
1. Type: Flush mounted wall type with brass finish.
  2. Outlets: Two-way with fire department thread size. Threaded dust-cap and chain of matching material and finish.
  3. Drain: 3/4 inch (19 mm) automatic drip, connected to drain.
  4. Label: "Sprinkler - Fire Department Connection"

## 2.3 BACKFLOW PREVENTERS

- A. Manufacturers:
1. Ames.
  2. Febco.
  3. Watts.
- B. Double Check Valve Assemblies: Comply with ASSE ASSE 1015 or AWWA C510; Bronze body with corrosion resistant internal parts and stainless steel springs; two independently operating check valves with intermediate atmospheric vent.

2.4 ELECTRICAL CHARACTERISTICS AND COMPONENTS

- A. Controls: Supervisory Switches.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install in accordance with NFPA 13.
- B. Install approved double check valve back-flow preventer assembly at sprinkler system water source connection.
- C. Locate fire department connection with sufficient clearance from walls, obstructions, or adjacent Siamese connectors to allow full swing of fire department wrench handle.
- D. Locate outside alarm-gong on building wall as indicated on Drawings.
- E. Place pipe runs to minimize obstruction to other work.
- F. Install piping in concealed spaces above finished ceilings.
- G. In areas with ceilings, center sprinklers in one direction only in ceiling tile with location in other direction variable, dependent upon spacing and coordination with ceiling elements.
- H. Install guards on sprinklers as indicated on Drawings.
- I. Hydrostatically test entire system.
- J. Require test be witnessed by Authority having jurisdiction.
- K. Test backflow preventer in accordance with ASSE 5015.

3.2 INTERFACE WITH OTHER PRODUCTS

- A. Verify signal devices are installed and connected to fire alarm system.

3.3 CLEANING

- A. Flush entire piping system of foreign matter.

3.4 PROTECTION OF INSTALLED CONSTRUCTION

- A. Apply masking tape or paper cover to protect concealed sprinklers, cover plates, and sprinkler escutcheons not receiving field paint finish. Remove after painting. Replace painted sprinklers with new.

END OF SECTION

SECTION 22 05 00

COMMON WORK RESULTS FOR PLUMBING

PART 1 GENERAL

1.1 SUMMARY

Applicable provisions of General Conditions, Special Conditions, and Special Instructions to Bidders govern work under this section and all of Division 22.

This section is in particular reference to and shall be considered a part of all Plumbing specifications sections following. It is intended that comments in this section be applicable to all parts of Division 22. Work described hereinafter shall be included as though written within each specific section of the specification.

The Contractor shall provide all items, articles, materials, operations, or methods listed, mentioned, or scheduled on the Drawings and/or herein, including all labor, materials, equipment, and incidentals necessary and required for their completion.

All work shall conform to requirements of all local construction codes, applicable sections of the National Fire Protection Association latest editions.

1.2 SCOPE

- A. Requirements specified in this section shall govern applicable portions of all plumbing sections.
- B. Where items specified in the specific plumbing sections conflict with requirements in this section, the former specific sections shall govern.
- C. The Contractor shall furnish all labor, plant, and materials, complete in connection with the installation of the plumbing systems in strict accordance with this specification and accompanying plans. The Contractor shall submit his bid based on performing all work hereinafter specified or indicated on applicable plans. The Contractor shall furnish and install all connections and appurtenances necessary and usually furnished in connection with such work and systems even though not specifically mentioned or shown on the plans.
- D. These requirements cover information, work, equipment and accessories listed under the following headings:
  - 1. References, Definitions, Procedures
  - 2. Permits and Fees
  - 3. Workmanship
- E. Work of Other Sections: Requirements given within this Section apply to the Work of all Sections of this Division.

- F. Prime and protective painting shall be provided under this Division where indicated on Drawings.

### 1.3 REFERENCES

#### A. References:

1. References to standards, codes, specifications and recommendations shall mean the latest edition of such publications adopted and published at date of invitation to submit Proposals.
2. References to technical societies, trade organizations and governmental agencies is made in plumbing work sections in accordance with the following abbreviations:
  - a. AGA American Gas Association
  - b. ANSI American National Standards Institute
  - c. ASME American Society of Mechanical Engineers
  - d. ASTM American Society for Testing and Materials
  - e. NFPA National Fire Protection Association

### 1.4 DEFINITIONS

#### A. Definitions of terms and expressions used in plumbing work are:

1. "Provide" shall mean "furnish and install" or "furnish labor and material required for installation of."
2. "Herein" shall mean the contents of a particular section where this term appears.
3. "Indicated" shall mean "indicated on contract drawings."
4. "Section" shall mean one of the portions of plumbing work sections indexed in Division 22.
5. "Concealed" where used in connection with painting of piping, and accessories, shall mean that they are hidden from sight as in chases, furred spaces, or hung ceilings.
6. "Exposed" where used in connection with painting of piping and accessories shall mean that they are not "concealed" as defined herein above.
7. "Piping" includes in addition to pipe, also fittings, valves, hangers and other accessories, which comprise a system.

#### B. Drawings and Instructions

1. Contract drawings for plumbing work are in part diagrammatic, intended to convey the scope of work and indicate general arrangement of piping. Plumbing trade shall follow these drawings in laying out their work, consult other trades and general construction drawings to familiarize themselves with all conditions affecting their work, and shall verify and coordinate spaces in which their work will be installed. The contract drawings shall be considered as a part of these specifications. It is intended that any Contractor making proposal to execute any work should study the drawings for his own particular trade, as well as all drawings of all other trades in order to fully understand the work he is expected to perform. As a qualification for bidding, the contractor shall visit the site and be responsible for determining all existing conditions in as far as it affects his work prior to submitting a proposal.

**1.5 DRAWINGS**

- A. General: The Drawings are schematic in nature and indicate approximate locations of the plumbing piping systems, except where specific locations are noted and dimensioned on the Drawings. All items are shown approximately to scale. The intent is to show how these items shall be integrated into the building. Locate all items by on-the-job measurements and in accordance with the Contract Documents. Cooperate with other trades to ensure project completion as indicated.
- B. Unless otherwise expressly agreed to in writing, all rights to the specifications and drawings prepared by Alderson & Associates, Inc. shall belong to Alderson & Associates, Inc. The sole exception is that the specifications and drawings may be used for construction of the project for which the specifications and drawings were prepared if all other contractual obligations have been complied with, including the payment of fees. Each page of the drawings, if prepared in whole or in part by Alderson & Associates, Inc., and all pages of specifications of Division 22 are covered by copyright and may not be reproduced, published or used in any way without the permission of Alderson & Associates, Inc.
- C. Location: Prior to locating plumbing items, obtain the Engineer's approval as to exact location. Locations shall not be determined by scaling drawings. Contractor shall be responsible for costs of redoing work of trades necessitated by failure to comply with this requirement.

**1.6 DISCREPANCIES**

- A. Clarification: Clarification shall be obtained before submitting a proposal for the Work under this Division as to discrepancies or omissions from the Contract Documents or questions as to the intent thereof.
- B. Contractor Agreement: Consideration will not be granted for misunderstanding of the amount of work to be performed. Tender of a proposal conveys full Contractor agreement of the items and conditions specified, shown, scheduled, or required by the nature of the project.
- C. The drawings intend that all piping be arranged as shown with necessary minor rearrangements to suit existing structural conditions and equipment. Some minor rearrangements are expected to best fit the structural conditions. It shall be the responsibility of the Contractor to make known his desires in such change, by shop drawings as required, to obtain agreement of the Engineer before proceeding with any change or variation. Changes required by job conditions or structural conditions of the building shall be at no cost to the Owner.

**1.7 PRODUCT SUBSTITUTION PROCEDURES**

- A. Engineer will consider requests for Substitutions. Engineer shall receive such requests a minimum of 10 days prior to scheduled bid date.

- B. Substitutions may be considered when a product becomes unavailable through no fault of Contractor.
- C. Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents.
- D. A request constitutes a representation that Bidder:
  - 1. Has investigated proposed product and has determined that it meets or exceeds quality level of specified product.
  - 2. Will provide same warranty for Substitution as for specified product.
  - 3. Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to Owner.
  - 4. Waives claims for additional costs or time extension which may subsequently become apparent.
  - 5. Will reimburse Owner and Engineer for review or redesign services associated with re-approval by authorities having jurisdiction.
- E. Substitutions will not be considered when they are indicated or implied on Shop Drawing or Product Data submittals, without separate written request, or when acceptance will require revision to Contract Documents.
- F. Substitution Submittal Procedure:
  - 1. Submit two copies of request for Substitution for consideration. Limit each request to one proposed Substitution.
  - 2. Submit Shop Drawings, Product Data, and certified test results attesting to proposed product equivalence. Burden of proof is on proposer.
  - 3. Engineer will notify Contractor in writing of decision to accept or reject request.

## 1.8 SUBMITTALS

- A. Submittal Preparation:
  - 1. Minimum of six copies are required, complete (all items submitted at one time), index to each Section of Specifications and include the following information and action taken.
    - a. Project Name
    - b. Date
    - c. Name and Address of Engineer
    - d. Name, Address and Telephone Number of Contractor or Sub-contractors.
    - e. Manufacturer's Name
    - f. Detailed drawing for fabricated items
    - g. Installation instructions
    - h. Other pertinent data
    - i. All required submittals and data, bound together, submitted at one time.
  - 2. Where literature is submitted covering a group or series of similar items, the applicable items must be clearly indicated on each copy with a highlighter pen, or other means of identification clearly legible.
  - 3. Data and shop drawings shall be coordinated and included in a single submission. Failure to submit shop drawings that meet the requirements of the Drawings and Specifications in ample time for review shall not entitle the Contractor to an

extension of contract time, and no claim for extension by reason of such Contractor default shall be allowed.

- B. Submittal Organization:
  - 1. Organize all required data in a 3-ring black (in color) binder of sufficient size with index tabs with number and appropriate title of specification section.
- C. Provide a cover sheet and an index sheet listing all items submitted.
- D. The second and third sheet shall be blank for stamping of submittals. All submittals are to be processed at same date; partial submittals will not and are not acceptable.
- E. The Engineer's review of submittals is only for confirmation of adherence to design of project and does not relieve the Contractor of final responsibility for furnishing all materials required for a complete working system and in complying with the Contract Documents in all respects.

#### 1.9 SHOP DRAWINGS, DESCRIPTIVE DATA

- A. As soon as practical and within thirty days after the official award of contract and before any materials are purchased, the Contractor shall submit to the Engineer, for review, six (6) copies of the complete list of all materials identified and referenced to specification paragraphs together with applicable shop drawings. In addition, the names and addresses of the manufacturers, their catalog data, numbers, and trade names shall be furnished. This data will be marked "Reviewed" by the Engineer, dated and distributed to the several parties involved, with two (2) copies returned to the Contractor. The data shall include the following:
  - 1. Materials as indicated in each Section.
  - 2. Indicate exact locations and elevations of pipes, obtained from field measurements, after consultation and agreement among trades involved.
- B. Verification of Dimensions:
  - 1. The Contractor shall be responsible for the coordination and proper relation of his work to the building structure and to the existing lighting, conduit, heaters and skylights. The Contractor shall verify all dimensions in the field and advise the Engineer of any discrepancy before performing the work. Adjustments to the work required in order to facilitate a coordinated installation shall be made at no additional cost to the Owner.
- C. Material other than that shown should be used in bids only when approved by the Engineer prior to bidding. In the event that the Contractor submits for approval any material that are not in conformity with the specifications, the Engineer reserves the right to reject this material, and the Contractor shall submit data on other material which meets the requirements of the specifications for approval.
- D. Submit such directions to Engineer prior to time of installation for use in review of the work.

**1.10 GENERAL INSTALLATION**

- A. Existing Services:
  - 1. Active Services: When encountered in work, protect, brace and support existing active gas piping and other services where required for proper execution of the work. If existing active services are encountered that require relocation, make request in writing for determination. Do not proceed with work until written directions are received. Do not prevent or disturb operation of active services that are to remain. Outages shall be kept to a minimum and allowed only as arranged with the Owner.
  - 2. Inactive Services: When encountered in work, remove, cap, or plug inactive services.
  - 3. Interruption of Services: Where work makes temporary shutdowns of services unavoidable, shut down at night or at such times as approved by Owner, which will cause the least interference with established operating routine. Arrange to work continuously, including overtime, if required, to assure that services will be shut down only during time actually required to make necessary connection to existing work.
  
- B. Material Design and Installation:
  - 1. Uniformity: Unless otherwise specified, material of same type or classification, used for same purpose shall be the product of same manufacturer.
  - 2. Design: Accessories not specifically described or identified by manufacturer's catalog numbers shall be designed in conformity with ASME, AIEE or other applicable technical standards, be suitable for maximum working pressure and shall have neat and finished appearance.
  - 3. Installation: Erect equipment in neat and workmanlike manner; align, level and adjust for satisfactory operation; install so that connecting and disconnecting of piping and accessories can be made readily, and so that all parts are easily accessible for inspection, operation, maintenance and repair. Minor deviation from indicated arrangements may be made, as approved.
  
- C. Protection of Materials:
  - 1. Responsibility for care and protection of plumbing work rests with the Contractor until it has been tested and accepted.
  - 2. After delivery, before and after installation, protect materials against theft, injury or damage from all causes.
  
- D. Completeness:
  - 1. The Contractor shall be responsible for the absolute completeness of his work, including all adjustments to obtain proper operation in all respects.
  - 2. Each system is intended to be complete and functional in performance. All such items as piping trim, accessories, and appurtenances required shall be installed at no extra cost.

**1.11 PERMITS AND FEES**

- A. All building permits and their required fees, and all inspection fees for all plumbing work shall be arranged and paid for by the Plumbing trade involved in the particular work for

which the permit is taken, and for the pertinent inspection fee for the work involved by the Contractor.

#### 1.12 INSPECTIONS

- A. Compliance: The Contractor is required to comply in every respect with all requirements of local inspection departments, local ordinances and codes, and utility company requirements.
- B. Certifications: Prior to final acceptance, the Contractor shall furnish without additional charge a certificate of acceptance from the inspection departments having jurisdiction over the work for any and all work installed under this Contract.
- C. Ordinances, Rules and Regulations:
  - 1. All installations shall comply with applicable codes; ordinances and regulations except where drawings require a higher degree of work as indicated on the plans or specified hereinafter.
- D. Installations shall comply with applicable requirements of the National Fire Protection Association, American Gas Association, Texas State Board of Insurance Underwriters, utility company, or other local, State or Federal agencies having jurisdiction. Compliance with these requirements shall be done at no additional cost to the Owner.
- E. Any changes to the contract required by the aforementioned requirements shall be submitted to the Engineer in writing for approval prior to execution.

#### 1.13 WORKMANSHIP

- A. All materials shall be installed in accordance with the approved recommendation of the manufacturer, and by workmen skilled in the trade involved shall accomplish the installation.

#### 1.14 FLAME SPREAD PROPERTIES OF MATERIALS

- A. Materials and adhesives incorporated in this project shall conform to ASTM Standard E84, "Test Method of Surface Burning Characteristics of Building Materials" and NFPA 90. The classification shall not exceed a flame spread rating of 25 for all materials, adhesives, finishes, etc., specified for each system, and shall not exceed a smoke developed rating of 50.

#### 1.15 ASBESTOS ABATEMENT

- A. In the event the Contractor encounters at the site material reasonably believed to be asbestos which has not been abated, the Contractor shall immediately stop work in the area affected and report the condition to the Owner. If in fact the material is asbestos and the asbestos has not been abated, the Contractor shall not resume the non-asbestos-related work in the affected area until the asbestos has been abated. The abatement action may be done in two ways, as the Owner may decide. The Owner may perform the abatement by its own forces, or the Owner may contract with a third party to perform the abatement.

**PART 2 PRODUCTS – NOT USED**

**PART 3 EXECUTION**

**3.1 SPACE REQUIREMENTS**

- A. General: Determine in advance of purchase that the materials proposed for installation will fit into the confines indicated, leaving adequate clearances for adjustment, repair or replacement.
- B. Clearance: Allow adequate space for clearance in accordance with the Code requirements and the requirements of the local inspection department.
- C. Responsibility: Since space requirements vary for each manufacturer, the responsibility for initial access and proper fit rests with the Contractor.
- D. Materials shall be installed in accordance with manufacturers' recommendations and best standard practice for the type of work involved.
- E. Conform to applicable technical societies' standards, also to codes and regulations of agencies having jurisdiction.

**3.2 TESTS**

- A. Following requirements are supplementary to tests specified for individual systems in plumbing work sections.
  - 1. Notice of Tests: Give written notice in ample time to all concerned of date when tests will be conducted.
  - 2. Acceptance Tests: Conduct pressure tests as specified for each system in presence of Engineer or other accredited representative of Owner, as well as representatives of agencies having jurisdiction. The Contractor shall correct all deficiencies resulting from test data and from deficiencies identified at times of site observations.
  - 3. Costs: Furnish labor, material, and instruments and bear other costs in connection with all tests

**3.3 GUARANTEES**

- A. All work, including materials, shall be guaranteed by the Contractor for a period of one (1) year after final acceptance of the work. All defects in labor and materials occurring during the one year after final acceptance of the work shall be immediately repaired or replaced by the Contractor at no additional cost to the owner.

**END OF SECTION**

SECTION 22 11 23

FACILITY NATURAL-GAS PIPING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Natural gas piping above grade.
  - 2. Unions.
  - 3. Valves.
  - 4. Pipe hangers and supports.

1.2 REFERENCES

- A. American National Standards Institute:
  - 1. ANSI Z21.15 - Manually Operated Gas Valves for Appliances, Appliance Connector Valves and Hose End Valves.
- B. American Society of Mechanical Engineers:
  - 1. ASME B16.3 - Malleable Iron Threaded Fittings.
  - 2. ASME B16.33 - Manually Operated Metallic Gas Valves for Use in Gas Piping Systems Up to 125 psig (sizes 1/2 - 2).
  - 3. ASME B31.9 - Building Services Piping.
- C. ASTM International:
  - 1. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
  - 2. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.
- D. Manufacturers Standardization Society of the Valve and Fittings Industry:
  - 1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
  - 2. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
  - 3. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.
  - 4. MSS SP 110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.
- E. National Fire Protection Association:
  - 1. NFPA 54 - National Fuel Gas Code.
- F. Underwriters Laboratories Inc.:
  - 1. UL 842 - Valves for Flammable Fluids.

**1.3 SYSTEM DESCRIPTION**

- A. Where more than one piping system material is specified, provide compatible system components and joints. Use non-conducting dielectric connections when joining dissimilar metals in systems.
- B. Provide unions at locations requiring servicing. Use unions downstream of valves and at equipment connections. Do not use direct welded or threaded connections to valves, equipment.
- C. Provide pipe hangers and supports in accordance with ASME B31.9, ASTM F708, MSS SP 58, MSS SP 69, and MSS SP 89.
- D. Use ball valves for shut-off and to isolate equipment or part of systems.

**1.4 SUBMITTALS**

- A. Product Data:
  - 1. Piping: Submit data on pipe materials, fittings, and accessories. Submit manufacturers catalog information.
  - 2. Valves: Submit manufacturers catalog information with valve data and ratings for each service.
  - 3. Hangers and Supports: Submit manufacturers catalog information including load capacity.
- B. Test Reports: Indicate results of gas piping system pressure test.

**1.5 CLOSEOUT SUBMITTALS**

- A. Project Record Documents: Record actual locations of valves, piping system, and system components.
- B. Operation and Maintenance Data: Submit for valve installation instructions and spare parts lists.

**1.6 QUALITY ASSURANCE**

- A. Perform natural gas Work in accordance with NFPA 54.
- B. Perform Work in accordance with ASME B31.9 code for installation of piping systems.
- C. Furnish shutoff valves complying with ASME B16.33 or ANSI Z21.15.

**1.7 QUALIFICATIONS**

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

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

#### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- B. Protect piping and fittings from soil and debris with temporary end caps and closures. Maintain in place until installation. Furnish temporary protective coating on cast iron and steel valves.

#### 1.9 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

#### 1.10 WARRANTY

- A. Furnish one year manufacturer warranty for valves excluding packing.

### PART 2 PRODUCTS

#### 2.1 NATURAL GAS PIPING, ABOVE GRADE

- A. Steel Pipe: ASTM A53/A53M Schedule 40 black.
  - 1. Fittings: ASME B16.3, malleable iron.
  - 2. Joints: Threaded for pipe 2 inch (50 mm) and smaller.

#### 2.2 UNIONS

- A. Unions for Pipe 2 inches (50 mm) and Smaller:
  - 1. Ferrous Piping: Class 150, malleable iron, threaded.
  - 2. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

#### 2.3 BALL VALVES

- A. Manufacturers:
  - 1. Crane Valve, North America.
  - 2. Hammond Valve.
  - 3. Milwaukee Valve Company
  - 4. NIBCO, Inc.
  - 5. Stockham Valves & Fittings.
- B. 1/4 inch (6 mm) to 1 inch (25 mm): MSS SP 110, Class 125, two piece, threaded ends, bronze body, chrome plated bronze ball, reinforced teflon seats, blow-out proof stem, lever handle, UL 842 listed for flammable liquids and LPG, full port.

- C. 1-1/4 inch (32 mm) to 3 inch (76 mm): MSS SP 110, Class 125, two piece, threaded ends, bronze body, chrome plated bronze ball, reinforced teflon seats, blow-out proof stem, lever handle, UL 842 listed for flammable liquids and LPG, conventional port.

## 2.4 PIPE HANGERS AND SUPPORTS

- A. Conform to NFPA 54, ASME 31.9, ASTM F708, MSS SP 58, MSS SP 69, and MSS SP 89.
- B. Hangers for Pipe Sizes 1/2 to 1-1/2 inch (15 to 40 mm): Malleable iron or Carbon steel, adjustable swivel, split ring.
- C. Wall Support for Pipe 3 inches (80 mm) and Smaller: Cast iron hook.

## PART 3 EXECUTION

### 3.1 PREPARATION

- A. Ream pipe ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt, on inside and outside, before assembly.
- C. Prepare piping connections to equipment with unions.

### 3.2 INSTALLATION - PIPE HANGERS AND SUPPORTS

- A. Install hangers and supports in accordance with ASME B31.9, ASTM F708 and MSS SP 89.
- B. Support horizontal piping hangers as scheduled.
- C. Install hangers to provide minimum 1/2 inch (13 mm) space between finished covering and adjacent work.
- D. Place hangers within 12 inches (300 mm) of each horizontal elbow.
- E. Install hangers to allow 1-1/2 inch (38 mm) minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
- F. Provide clearance in hangers and from structure and other equipment for access to valves and fittings.

### 3.3 INSTALLATION - ABOVE GROUND PIPING SYSTEMS

- A. Install natural gas piping in accordance with NFPA 54.
- B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

- C. Route piping in orderly manner and maintain gradient.
- D. Install piping to conserve building space and not interfere with use of space.
- E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- F. Sleeve pipe passing through partitions and walls.
- G. Install firestopping at fire rated construction perimeters and openings containing penetrating sleeves and piping.
- H. Provide clearance for access to valves and fittings.
- I. Provide access where valves and fittings are not exposed.
- J. Where pipe support members are welded to structural building framing, scrape, brush clean, weld, and apply one coat of zinc rich primer.
- K. Install valves with stems upright or horizontal, not inverted.
- L. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

3.4 FIELD QUALITY CONTROL

- A. Pressure test natural gas piping in accordance with NFPA 54.
- B. When pressure tests do not meet specified requirements, remove defective work, replace and retest.

END OF SECTION

SECTION 23 05 00

GENERAL MECHANICAL REQUIREMENTS

PART 1 GENERAL

1.1 SUMMARY

Applicable provisions of General Conditions, Special Conditions, and Special Instructions to Bidders in addition to the requirements of Division One specifications govern work under this section and all of Division 23.

This section is in particular reference to and shall be considered a part of all Mechanical specifications sections following. It is intended that comments in this section be applicable to all parts of Division 23. Work described hereinafter shall be included as though written within each specific section of the specification.

The Contractor shall provide all items, articles, materials, operations, or methods listed, mentioned, or scheduled on the Drawings and/or herein, including all labor, materials, equipment, and incidentals necessary and required for their completion.

All work shall conform to requirements of all local construction codes, applicable sections of the National Fire Protection Association, and the Public Health Agency.

1.2 SCOPE

- A. Requirements specified in this section shall govern applicable portions of all mechanical sections including paragraphs on related electrical work, whether so stated therein or not.
- B. Where items specified in the specific mechanical sections conflict with requirements in this section, the specific sections shall govern.
- C. The Contractor shall furnish all labor, plant, equipment, and materials, complete in connection with the installation of the heating and controls systems in strict accordance with this specification and accompanying plans. The Contractor shall submit his bid based on performing all work hereinafter specified or indicated on applicable plans. The Contractor shall furnish and install all connections and appurtenances necessary and usually furnished in connection with such work and systems even though not specifically mentioned or shown on the plans.
- D. These requirements cover information, work, equipment and accessories listed under the following headings:
  - 1. References, Definitions, Procedures
  - 2. Permits and Fees
  - 3. Inspections
  - 4. Workmanship

- E. Work of Other Sections: Requirements given within this Section apply to the Work of all Sections of this Division.

### 1.3 REFERENCES

#### A. References:

1. References to standards, codes, specifications and recommendations shall mean the latest edition of such publications adopted and published at date of invitation to submit Proposals.
2. References to technical societies, trade organizations and governmental agencies is made in mechanical work sections in accordance with the following abbreviations:
  - a. AGA American Gas Association
  - b. AIEE American Institute of Electrical Engineers
  - c. ANSI American National Standards Institute
  - d. ASME American Society of Mechanical Engineers
  - e. ASTM American Society for Testing and Materials
  - f. NFPA National Fire Protection Association
  - g. NEC National Electrical Code (NFPA Pamphlet No. 70)
  - h. NEMA National Electrical Manufactures Association
  - i. UL Underwriters' Laboratories, Inc.

### 1.4 DEFINITIONS

#### A. Definitions of terms and expressions used in mechanical work are:

1. "Provide" shall mean "furnish and install" or "furnish labor and material required for installation of."
2. "Herein" shall mean the contents of a particular section where this term appears.
3. "Indicated" shall mean "indicated on contract drawings."
4. "Section" shall mean one of the portions of mechanical work sections indexed in Division 23.

#### B. Drawings and Instructions

1. Contract drawings for mechanical work are in part diagrammatic, intended to convey the scope of work and indicate general arrangement of equipment, fixtures, interlocks, piping and approximate sizes and locations of equipment. Mechanical trades shall follow these drawings in laying out their work, consult other trades and general construction drawings to familiarize themselves with all conditions affecting their work, and shall verify and coordinate spaces in which their work will be installed. The contract drawings shall be considered as a part of these specifications. It is intended that any Contractor making proposal to execute any work should study the drawings for his own particular trade, as well as all drawings of all other trades in order to fully understand the work he is expected to perform. As a qualification for bidding, the contractor shall visit the site and be responsible for determining all existing conditions in as far as it affects his work prior to submitting a proposal.

**1.5 DRAWINGS**

- A. General: The Drawings are schematic in nature and indicate approximate locations of the heating systems, except where specific locations are noted and dimensioned on the Drawings. All items are shown approximately to scale. The intent is to show how these items shall be integrated into the building. Locate all items by on-the-job measurements and in accordance with the Contract Documents. Cooperate with other trades to ensure project completion as indicated.
- B. Unless otherwise expressly agreed to in writing, all rights to the specifications and drawings prepared by Alderson & Associates, Inc. shall belong to Alderson & Associates, Inc. The sole exception is that the specifications and drawings may be used for construction of the project for which the specifications and drawings were prepared if all other contractual obligations have been complied with, including the payment of fees. Each page of the drawings, if prepared in whole or in part by Alderson & Associates, Inc., and all pages of specifications of Division 23 are covered by copyright and may not be reproduced, published or used in any way without the permission of Alderson & Associates, Inc.

**1.6 DISCREPANCIES**

- A. Clarification: Clarification shall be obtained before submitting a proposal for the Work under this Division as to discrepancies or omissions from the Contract Documents or questions as to the intent thereof.
- B. Contractor Agreement: Consideration will not be granted for misunderstanding of the amount of work to be performed. Tender of a proposal conveys full Contractor agreement of the items and conditions specified, shown, scheduled, or required by the nature of the project.
- C. The drawings intend that all equipment be arranged as shown with necessary minor rearrangements to suit the equipment approved and to comply with the requirements of the various equipment manufacturers' recommendations. Some minor rearrangements are expected to best fit the structural conditions. It shall be the responsibility of the Contractor to make known his desires in such change, by shop drawings as required, to obtain agreement of the Engineer before proceeding with any change or variation. Changes required by job conditions, equipment employed, or structural conditions of the building shall be at no cost to the Owner or Engineer.

**1.7 SUBMITTALS - GENERAL**

- A. Submittal Preparation:
  - 1. Minimum of six (6) copies are required, complete (all items submitted at one time), index to each Section of Specifications and include the following information and action taken.
    - a. Project Name
    - b. Date
    - c. Name and Address of Engineer

- d. Name, Address and Telephone Number of Contractor or Sub-contractors.
  - e. Name, Address and Telephone number of major equipment manufacturer's local representatives.
  - f. Manufacturer's Name
  - g. Published ratings or capacity data
  - h. Detailed equipment drawing for fabricated items
  - i. Wiring diagrams
  - j. Installation instructions
  - k. Other pertinent data
  - l. All required submittals and data, bound together, submitted at one time.
2. Where literature is submitted covering a group or series of similar items, the applicable items must be clearly indicated on each copy with a highlighter pen, or other means of identification clearly legible.
  3. Data and shop drawings shall be coordinated and included in a single submission. Multiple submissions are not acceptable. Failure to submit shop drawings that meet the requirements of the Drawings and Specifications in ample time for review shall not entitle the Contractor to an extension of contract time, and no claim for extension by reason of such Contractor default shall be allowed.
- B. Submittal Organization:
1. Organize all required data in a 3-ring black (in color) binder of sufficient size with index tabs with number and appropriate title of specification section.
- C. Provide a cover sheet and an index sheet listing all items submitted.
- D. The second and third sheet shall be blank for stamping of submittals. All submittals are to be processed at same date; partial submittals are not acceptable and will not be reviewed.
- E. Show any revisions to equipment layout required by use of selected equipment. The Engineer shall receive submittals no later than thirty (30) working days from contract date with General Contractor and Owner. Allow two weeks (10 working days) for review process.
- F. The Engineer's review of submittals is only for confirmation of adherence to design of project and does not relieve the Contractor of final responsibility for furnishing all materials required for a complete working system and in complying with the Contract Documents in all respects.

#### 1.8 FABRICATION AND SHOP DRAWINGS, DESCRIPTIVE DATA

- A. As soon as practical and within thirty days after the official award of contract and before any materials and equipment are purchased, the Contractor shall submit to the Engineer, for review, six (6) copies of the complete list of all materials and equipment identified and referenced to specification paragraphs together with applicable fabrication and shop drawings. In addition, the names and addresses of the manufacturers, their catalog data, numbers, and trade names shall be furnished. Published performance data shall be furnished to indicate compliance with scheduled performance. This data will be marked "Reviewed" by the Engineer, dated and distributed to the several parties involved, with

three (3) copies returned to the Contractor. The data shall include the following:

1. Equipment and materials as indicated in each Section.
2. Automatic control system and sequence of control together with all data on components. In no case will wire-to-wire or terminal type of wiring diagrams for control system be included or checked as submittal; they shall be included as information only.
3. Wiring diagrams for electrically operated equipment furnished by mechanical trades.

**B. Verification of Dimensions:**

1. 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 verify all dimensions in the field and advise the Engineer of any discrepancy before performing the work. Adjustments to the work required in order to facilitate a coordinated installation shall be made at no additional cost to the Owner or Engineer.

**C. Equipment other than that shown should be used in bids only when approved by the Engineer prior to bidding. Those models and manufacturers identified in drawings and specifications were selected to provide minimum acceptable performance. These models are used in sake of brevity to establish a basis of quality, weights, performance, capacities, etc., required. Any such alternate proposals must include all necessary changes and additions to the work occasioned by such substitution including but not limited to supports, electrical work, connections, piping, etc. which shall be paid for by the Contractor. In the event that the Contractor submits for approval any material, equipment, etc., that are not in conformity with the specifications, the Engineer reserves the right to reject this equipment, and the Contractor shall submit data on other equipment which meets the requirements of the specifications for approval.**

**D. Installation Directions:**

1. Obtain manufacturer's printed installation directions to aid in properly executing work on equipment requiring such directions. Submit such directions to Engineer prior to time of installation for use in review of the work.

**E. Operating Instructions:**

1. Furnish manufacturer's printed operating and maintenance instruction for equipment and systems, which, in opinion of Engineer, require such instructions; see also requirements for Owners manuals at the end of this section.

**1.9 GENERAL INSTALLATION**

**A. Objectionable Noise and Vibration:**

1. Mechanical equipment shall operate without objectionable noise or vibration.
2. If such objectionable noise or vibration should be produced and transmitted to occupied portions of building apparatus, piping, or other parts of mechanical work, make necessary changes and additions, as approved, without extra cost to Owner.

- B. Equipment Design and Installation:
  - 1. Uniformity: Unless otherwise specified, equipment or material of same type or classification, used for same purpose shall be the product of same manufacturer.
  - 2. Design: Equipment and accessories not specifically described or identified by manufacturer's catalog numbers shall be designed in conformity with ASME, AIEE or other applicable technical standards, and shall have neat and finished appearance.
  - 3. Installation: Erect equipment in neat and workmanlike manner; align, level and adjust for satisfactory operation. Install pipe straight and parallel to building lines, with any required slopes. Install so that connecting and disconnecting of piping and accessories can be made readily, and so that all parts are easily accessible for inspection, operation, maintenance and repair. Minor deviation from indicated arrangements may be made, as approved.
  
- C. Protection of Equipment and Materials:
  - 1. Responsibility for care and protection of mechanical and electrical work rests with the Contractor until it has been tested and accepted.
  - 2. After delivery, before and after installation, protect equipment and materials against theft, injury or damage from all causes.
  
- D. Adjustments:
  - 1. It shall be the responsibility of the Contractor to adjust properly any and all equipment and devices and to run reasonable operating tests together with more specific tests indicated in the separate sections of the specifications. If for some reason any piece of equipment does not function satisfactorily after the first adjustments are made, the Contractor shall continue on the job until satisfactory corrections and adjustments have been made. The Contractor is responsible for the proper performance, functioning, and integration of all equipment. Where tests are required by the Engineer to ascertain equipment capacities in the installed condition, it shall be the responsibility of the Contractor to run approved tests, to provide all required instruments and apparatus and to submit certified statements of test results. All such instruments shall be in proper calibration and shall meet approval of the Engineer.
  
- E. Completeness:
  - 1. The Contractor shall be responsible for the absolute completeness of his work, including all adjustments to obtain proper operation in all respects.
  - 2. Each system is intended to be complete and functional in performance. All such items as piping trim, electrical work, controls, accessories, and appurtenances required shall be installed at no extra cost.

#### 1.10 PERMITS AND FEES

- A. All building permits and their required fees and all inspection fees for all mechanical work shall be arranged and paid for by the Mechanical trade involved in the particular work for which the permit is taken, and for the pertinent inspection fee for the work involved by the Contractor.

- B. The Mechanical Contractor shall assist the Owner and Engineer in the application process for any utility rebate that might apply, including scheduling of pre-inspection visits required by the utility, providing information and invoices, and any other requirements.

#### 1.11 INSPECTIONS

- A. Compliance: The Contractor is required to comply in every respect with all requirements of local inspection departments, local ordinances and codes.
- B. Certifications: Prior to final acceptance, the Contractor shall furnish without additional charge a certificate of acceptance from the inspection departments having jurisdiction over the work for any and all work installed under this Contract. Include with O & M Manuals.
- C. Ordinances, Rules and Regulations: All installations shall comply with applicable codes; ordinances and regulations except where drawings require a higher degree of work as indicated on the plans or specified hereinafter.
- D. Installations and equipment shall comply with applicable requirements of the National Fire Protection Association, American Gas Association, Texas State Board of Insurance Underwriters, or other local, State or Federal agencies having jurisdiction. Compliance with these requirements shall be done at no additional cost to the Owner.
- E. Any changes to the contract required by the aforementioned requirements shall be submitted to the Engineer in writing for approval prior to execution.

#### 1.12 WORKMANSHIP

- A. All materials and equipment shall be installed in accordance with the approved recommendation of the manufacturer, and workmen skilled in the trade involved shall accomplish the installation.

#### 1.13 FLAME SPREAD PROPERTIES OF MATERIALS

- A. Materials and adhesives incorporated in this project shall conform to ASTM Standard E84, "Test Method of Surface Burning Characteristics of Building Materials" and NFPA 90. The classification shall not exceed a flame spread rating of 25 for all materials, adhesives, finishes, etc., specified for each system, and shall not exceed a smoke developed rating of 50.

#### 1.14 ASBESTOS ABATEMENT

- A. In the event the Contractor encounters at the site material reasonably believed to be asbestos which has not been abated, the Contractor shall immediately stop work in the area affected and report the condition to the Owner. If in fact the material is asbestos and the asbestos has not been abated, the Contractor shall not resume the non-asbestos-related work in the affected area until the asbestos has been abated. The abatement action may be done in two ways, as the Owner may decide. The Owner may perform the abatement by its own forces, or the Owner may contract with a third party to perform

the abatement.

## PART 2 PRODUCTS – NOT USED

## PART 3 EXECUTION

### 3.1 SPACE REQUIREMENTS

- A. General: Determine in advance of purchase that the equipment and materials proposed for installation will fit into the confines indicated, leaving adequate clearances for adjustment, repair or replacement.
- B. Clearance: Allow adequate space for clearance in accordance with the Code requirements and the requirements of the local inspection department, and manufacturer's requirement.
- C. Responsibility: Since space requirements and equipment arrangement vary for each manufacturer, the responsibility for initial access and proper fit rests with the Contractor.
- D. Review: Final arrangements of equipment to be installed shall be subject to the Engineer's review.
- E. Equipment, Spaces and Clearances:
  - 1. All equipment and accessories shall be new and standard models of a type that has been in satisfactory use for a minimum of three (3) years. All major components of any given system shall be of the same manufacturer and shall have a manufacturer's nameplate stating address, catalog model number and capacity.
- F. Materials and equipment shall be installed in accordance with manufacturers' recommendations and best standard practice for the type of work involved.
- G. All equipment and materials shall be continuously protected, using temporary shelters, etc., from dirt, dust, moisture, damage, etc., and will not be accepted otherwise. All necessary supports, frames and foundations shall be provided for all equipment.
- H. The responsibility for the furnishing of the proper mechanical and electrical equipment rests entirely upon the Contractor who shall request advice and supervisory assistance from the representatives of specific manufacturers during the installation.
- I. It shall be the responsibility of the Contractor that the combination of proposed equipment will fit into the allotted space shown on the plan with adequate clearances for maintenance and servicing.
- J. Machinery Accessories:
  - 1. Equipment Supports: Where supports for machinery and other equipment are indicated or specified in mechanical work sections, perform as follows:
    - a. Design, Construction, Location

- 1) Design and construct supporting structures of strength to safely withstand stresses to which they may be subjected and to distribute properly the load and impact over the building areas.
- 2) Conform to applicable technical societies' standards, also to codes and regulations of agencies having jurisdiction.

### 3.2 RELATED ELECTRICAL PROVISIONS

- A. Electrical Contractor To Provide (coordinate with electrical contractor):
  1. Line Voltage and hook-up to all HVAC (Division 23) Equipment
  2. All Conduits for thermostats and sensors.
  3. Junction Boxes (Standard Two Gang) required for controls contractor, and coordination with controls contractor.
- B. Mechanical Contractor to Provide:
  1. All thermostats.
  2. All HVAC Equipment.
  3. All relays, contactors, and switches required to start/stop Mechanical Equipment other than switches shown on electrical drawings and required by Division 26.
  4. All control wiring.
- C. The Electrical plans are based on the equipment and devices scheduled shown on the drawings or as called for in the specifications. Should any mechanical equipment or associated devices be changed from those which are shown or noted, all electrical and/or mechanical changes shall be made at the expense of the trade or contractor initiating the change with no expense to the Owner, Engineer or their representatives.
- D. All Conduit and boxes for thermostats and/or sensors shall be provided by mechanical contractor.
- E. General Electrical Coordination:
  1. All electrical equipment, control components and circuits not specifically covered herein shall conform to the requirements in Division 26, Electrical.
  2. Mechanical contractor shall coordinate with Electrical trade to confirm that electrical service, including voltage, phase, overcurrent protection, conductors and terminations are compatible with equipment requirements. Any discrepancies shall be called to the attention of the Engineer during submittals.
  3. Mechanical contractor shall also coordinate carefully to ensure all electrical disconnects and accessories are covered appropriately and are correct voltage. Review electrical drawings and equipment wiring schedules.

### 3.3 MISCELLANEOUS

- A. Cleaning Equipment:
  1. Equipment shall be thoroughly cleaned of dirt, cuttings and other foreign substances.

**3.4 TESTS**

- A. Following requirements are supplementary to tests specified for individual equipment or systems in mechanical and electrical work sections.
- B. Notice of Tests: Give written notice in ample time to all concerned of date when tests will be conducted.
- C. Preliminary Tests: As soon as conditions permit, conduct preliminary or "turn-over" test of certain equipment as directed, to ascertain compliance with specified requirements. Make needed changes, adjustments or replacements as preliminary tests may indicate, prior to acceptance test.
- D. Acceptance Tests: Conduct performance and operating tests as specified for each system or equipment unit, in presence of Engineer or other accredited representative of Owner, as well as representatives of agencies having jurisdiction. The Contractor shall correct all deficiencies resulting from test data and from deficiencies identified at times of site observations.
- E. Costs: Furnish labor, material, and instruments and bear other costs in connection with all tests.

**3.5 GUARANTEES**

- A. All work, including mechanical, equipment, and materials, shall be guaranteed by the Contractor for a period of one (1) year after final acceptance of the work. All defects in labor and materials occurring during the one year after final acceptance of the work shall be immediately repaired or replaced by the Contractor at no additional cost to the Owner.
- B. See also individual sections for further requirements.

**3.6 OWNERS MANUALS**

- A. The Contractor shall turn over the following to the Owner at completion of contract.
  - 1. Operating instructions together with wiring diagrams.
  - 2. Approved drawings, equipment submittals, as-built control diagrams, etc.
  - 3. All equipment guarantees and warranties together with instructions shipped with equipment.
  - 4. Parts list of all major items of equipment.
  - 5. List of all local suppliers with contact information
  - 6. Certificates of acceptance by local inspection departments having jurisdiction.
  - 7. Provide "As-built" Mechanical Drawings in a format acceptable to the Owner. Unless otherwise instructed, provide a clean, marked-up set of prints showing as-installed conditions to the Engineer for processing.
  - 8. All above items shall be "punched" and bound in a loose-leaf notebook.

END OF SECTION

SECTION 23 55 00

FUEL-FIRED HEATERS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. High intensity infrared heaters.

1.2 REFERENCES

- A. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
  - 1. ASHRAE 90.1 - Energy Standard for Buildings except Low-Rise Residential Buildings.
- B. National Fire Protection Association:
  - 1. NFPA 54 - National Fuel Gas Code.
  - 2. NFPA 90B - Standard for the Installation of Warm Air Heating and Air Conditioning Systems.

1.3 SUBMITTALS

- A. Shop Drawings: Indicate assembly, required clearances, and locations and sizes of field connections.
- B. Product Data: Submit manufacturer's literature and data indicating rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.
- C. Manufacturer's Installation Instructions: Submit Indicate rigging and assembly.

1.4 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Record actual locations of thermostats or other products not mounted on unit.
- B. Operation and Maintenance Data: Submit manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listing.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years experience.

1.6 PRE-INSTALLATION MEETINGS

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

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Accept heaters and controls on site in factory packaging. Inspect for damage.

1.8 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.9 WARRANTY

- A. Furnish one year manufacturer warranty.

1.10 EXTRA MATERIALS

**PART 2 PRODUCTS**

2.1 HIGH INTENSITY INFRARED HEATERS

- A. Manufacturers:
  - 1. Enerco.
  - 2. Modine.
  - 3. Reverber-ray.
  - 4. Solaronics.
  - 5. Space Ray.
- B. Self-contained, packaged, factory assembled, factory wired unit consisting of cabinet, heat exchanger, burner, reflector and controls.
- C. Cabinet: Galvanized steel with baked enamel finish.
- D. Ceramic Emitter: Assembly of high temperature ceramic tiles with stainless steel housing and reflector.
- E. Gas Burner:
  - 1. Atmospheric type with adjustable combustion air supply.
  - 2. Gas valve provides 100 percent safety gas shut-off; 24-volt combining pressure regulation, safety pilot, manual set (On-Off), pilot filtration and automatic electric valve.
  - 3. Electronic pilot ignition, with electric spark igniter.
- F. Gas Burner Safety Controls: Thermo-couple sensor prevents opening of solenoid gas valve until pilot flame is proven and stops gas flow on ignition failure.
- G. Controls: Room thermostat, low voltage, to control burner operation.

**PART 3 EXECUTION**

**3.1 EXAMINATION**

- A. Verify space is ready for installation of units and openings are as indicated on shop drawings.

**3.2 INSTALLATION**

- A. Install units in accordance with NFPA 90B and NFPA 54.
- B. Installation - Natural Gas Piping:
  - 1. Connect natural gas piping in accordance with NFPA 54.
  - 2. Connect natural gas piping to unit, full size of unit gas train inlet. Arrange piping with clearances for burner service.
  - 3. Install the following piping accessories on natural gas piping connections.
    - a. Flexible stainless steel tubing.
    - b. Drip (dirt) leg.
    - c. Shutoff valve.
- C. Provide hangers and supports for suspended units. Support infrared radiant heaters in fixed position.
- D. Provide operating controls.
- E. Provide connection to electrical power systems.

**END OF SECTION**

SECTIONS 26 05 00

ELECTRICAL REQUIREMENTS FOR INCLUDED  
ELECTRICAL SECTIONS OF DIVISIONS 26 & 28

PART 1 GENERAL

1.1 SUMMARY

- A. Applicable provisions of General Conditions, Special Conditions, and Special Instructions to Bidders govern work under this section and all of electrical divisions.
- B. This section is in particular reference to and shall be considered a part of all Electrical specifications sections following. It is intended that comments in this section be applicable to all included electrical sections of Divisions 26 and 28. Work described hereinafter shall be included as though written within each specific section of the specification.
- C. The Contractor shall provide all items, articles, materials, operations, or methods listed, mentioned, or scheduled on the Drawings and/or herein, including all labor, materials, equipment, and incidentals necessary and required for their completion.
- D. All work shall conform to requirements of all local construction codes, applicable sections of the National Fire Protection Association, and the Public Health Agency.

1.2 SCOPE

- A. Requirements specified in this section shall govern applicable portions of all Electrical sections including related fire protection, plumbing and mechanical work, whether so stated therein or not.
- B. Where items specified in the specific Electrical sections conflict with requirements in this section, the former specific sections shall govern.
- C. The Contractor shall furnish all labor, plant, equipment, and materials, complete in connection with the installation of the Electrical systems in strict accordance with this specification and accompanying plans. The Contractor shall submit his bid based on performing all work hereinafter specified or indicated on applicable plans. The Contractor shall furnish and install all connections and appurtenances necessary and usually furnished in connection with such work and systems even though not specifically mentioned or shown on the plans.
- D. These requirements cover information, work, equipment and accessories listed under the following headings:
  - 1. References, Definitions, Procedures
  - 2. Permits and Fees
  - 3. Utility Connections and Inspections
  - 4. Workmanship
  - 5. Mechanical Provisions
  - 6. Electrical Provisions

- E. Work of Other Sections: Requirements given within this Section apply to the Work of all Sections of the electrical divisions.
- F. Electrical interlock apparatus and other electrical apparatus, which are not an integral part of equipment, are specified under this Division.

### 1.3 REFERENCES

- A. References to standards, codes, specifications and recommendations shall mean the latest edition of such publications adopted and published at a date of invitation to submit Proposals.
- B. References to technical societies, trade organizations and governmental agencies is made in Electrical specification sections in accordance with the following abbreviations:
  - 1. ANSI American National Standards Institute
  - 2. ASTM American Society for Testing and Materials
  - 3. CSD Commodity Standards Division U.S. Dept of Commerce
  - 4. IEEE Institute of Electrical and Electronic Engineers
  - 5. NFPA National Fire Protection Association
  - 6. NBS National Bureau of Standards
  - 7. NEC National Electrical Code (NFPA 70)
  - 8. NEMA National Electrical Manufacturers Association
  - 9. UL Underwriters' Laboratories, Inc.

### 1.4 DEFINITIONS

- A. Definitions of terms and expressions used in electrical work are:
  - 1. Approval: It is understood that approval must be obtained from the Engineer in writing before proceeding with the proposed work. Approval by the Engineer of any changes, submitted by the Contractor, will be considered as general only to aid the Contractor in expediting his work.
  - 2. Directed: Terms such as directed, requested, authorized, selected, approved, required, and permitted mean directed by the Engineer, requested by the Engineer, and similar phrases.
  - 3. Furnish: The term furnish means supply and deliver to the Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
  - 4. General: Basic Contract definitions are included in the Conditions of the Contract.
  - 5. Indicated: The term indicated refers to graphic representations, notes, or schedules on the Drawings, or other Paragraphs or Schedules in the Specifications, and similar requirements in the Contract Documents. Terms such as shown, noted, scheduled, and specified are used to help the reader locate the reference. There is no limitation on location.
  - 6. Install: The term install describes operations at the Project site including the actual unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
  - 7. This Contractor: This Contractor, engaged to execute the work included in this particular section only, even though he may be technically described as a

Subcontractor to the General Contractor or Managing Construction Contractor, referred to as "the Contractor". If this Contractor, engaged to execute said work, employs Sub-Contractors to perform various portions of the work included under this Section, he shall be held responsible for the execution of this work, in full conformity with Contract Document requirements. This Contractor shall cooperate at all times and shall be responsible for the satisfactory cooperation of his Subcontractors with the other Contractors on the job so that all of the various phases of the work may be properly coordinated without unnecessary delays or damage to any parts of the work of any Contractor.

8. Provide: Defined as requiring both the furnishing and installation of the item or facility indicated, complete in all respects and ready for operation unless otherwise specifically noted.

C. NEMA Classifications: (For complete definitions and listing see NEMA Standards)

1. Type 1 General Purpose, Indoor.
2. Type 2 Drip-proof, Non-corrosive, Indoor.
3. Type 3R Rain-proof, Outdoor.
4. Type 4 Watertight and dust-tight, non-corrosive, indoor and outdoor.
5. Type 4X Watertight and dust-tight, corrosion resistant, indoor and outdoor.
6. Type 12 Dust-tight, watertight, non-corrosive, indoor.

## 1.5 DRAWINGS

- A. Drawings and Instructions: Contract drawings for Electrical work are in part diagrammatic, intended to convey the scope of work and indicate general arrangement of equipment, fixtures, interlocks, conduit and approximate sizes and locations of equipment and outlets. Electrical trades shall follow these drawings in laying out their work, consult other trades and general construction drawings to familiarize themselves with all conditions affecting their work, and shall verify and coordinate spaces in which their work will be installed. The contract drawings shall be considered as a part of these specifications. It is intended that any Contractor making proposal to execute any work should study the drawings for his own particular trade, as well as all drawings of all other trades in order to fully understand the work he is expected to perform. As a qualification for bidding, the contractor shall visit the site and be responsible for determining all existing conditions in as far as it affects his work prior to submitting a proposal.
- B. General: The Drawings are schematic in nature and indicate approximate locations of the Electrical equipment, fixtures, conduit, etc., except where specific locations are noted and dimensioned on the Drawings. All items are shown approximately to scale. The intent is to show how these items shall be integrated into the building. Locate all items by on-the-job measurements and in accordance with the Contract Documents. Cooperate with other trades to ensure project completion as indicated.
- C. Unless otherwise expressly agreed to in writing, all rights to the Electrical specifications and drawings prepared by Alderson & Associates, Inc. shall belong to Alderson & Associates, Inc. The sole exception is that the specifications and drawings may be used for construction of the project for which the specifications and drawings were prepared if all other contractual obligations have been complied with, including the payment of fees. Each page of the drawings, if prepared in whole or in part by Alderson & Associates, Inc., and all pages of these specifications of Section are covered by copyright and may

not be reproduced, published or used in any way without the permission of Alderson & Associates, Inc.

- D. Location: Prior to locating Electrical equipment, outlets, devices, etc., obtain the Engineer's approval as to exact location. Locations shall not be determined by scaling drawings. Mounting heights shall be as directed by the Engineer or in accordance with the Texas Accessibility Standards and the A.D.A. Contractor shall be responsible for costs of redoing work of trades necessitated by failure to comply with this requirement.

#### 1.6 DISCREPANCIES

- A. Clarification: Clarification shall be obtained before submitting a proposal for the Work under the electrical divisions as to discrepancies or omissions from the Contract Documents or questions as to the intent thereof.
- B. Contractor Agreement: Consideration will not be granted for misunderstanding of the amount of work to be performed. Tender of a proposal conveys full Contractor agreement of the items and conditions specified, shown, scheduled, or required by the nature of the project.
- C. The drawings intend that all equipment and conduit be arranged as shown with necessary minor rearrangements to suit the equipment approved and to comply with the requirements of the various equipment manufacturers' recommendations. Some minor rearrangements are expected to best fit the structural conditions. It shall be the responsibility of the Contractor to make known his desires in such change, by shop drawings as required, to obtain agreement of the Engineer before proceeding with any change or variation. Changes required by job conditions, equipment employed, or structural conditions of the building shall be at no cost to the Owner.
- D. Perform all work in strict accordance with the requirements and recommendations stated in the codes and standards except when requirements are modified by the contract documents. Nothing in the Contract Documents shall be construed to permit work not conforming to these codes. When two or more codes or standards are applicable to the same work, then the stricter code or standard shall govern. The date of the code or standard is that in effect on the date of issue of the contract documents except when a particular publication date is specified. The Contractor shall be held responsible for verifying all State, Federal, NFPA, local codes and ordinances that may alter any part of the plans or specifications. The Contractor shall bear all costs for correcting the deficiencies. Where particular publication date is specified. The Contractor shall be held responsible for verifying all State, Federal, NFPA, local codes and ordinances that may alter any part of the plans or specifications. The Contractor shall bear all costs for correcting the deficiencies. Where local codes and ordinances are not in writing or on record but a local precedence has been set, the Owner shall pay for any additional cost incurred.

#### 1.7 PRODUCT SUBSTITUTION PROCEDURES

- A. Engineer will consider requests for Substitutions. Engineer shall receive such requests a minimum of 10 days prior to scheduled bid date.

- B. Substitutions may be considered when a product becomes unavailable through no fault of Contractor.
- C. Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents.
- D. A request constitutes a representation that Bidder:
  - 1. Has investigated proposed product and has determined that it meets or exceeds quality level of specified product.
  - 2. Will provide same warranty for Substitution as for specified product.
  - 3. Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to Owner.
  - 4. Waives claims for additional costs or time extension which may subsequently become apparent.
  - 5. Will reimburse Owner and Engineer for review or redesign services associated with re-approval by authorities having jurisdiction.
- E. Substitutions will not be considered when they are indicated or implied on Shop Drawing or Product Data submittals, without separate written request, or when acceptance will require revision to Contract Documents.
- F. Substitution Submittal Procedure:
  - 1. Submit two copies of request for Substitution for consideration. Limit each request to one proposed Substitution.
  - 2. Submit Shop Drawings, Product Data, and certified test results attesting to proposed product equivalence. Burden of proof is on proposer.
  - 3. Engineer will notify Contractor in writing of decision to accept or reject request.

## 1.8 SUBMITTALS

- A. Submittal Procedures: Requirements:
  - 1. Submittal Preparation:
    - a. Minimum of six copies are required, complete (all items submitted at one time), index to each Section of Specifications and include the following information and action taken.
      - 1. Project Name
      - 2. Date
      - 3. Name and Address of Engineer
      - 4. Name and Address of Engineer (See Division 1 of Specifications)
      - 5. Name, Address and Telephone Number of Contractor or Sub-contractors.
      - 6. Manufacturer's Name
      - 7. Published ratings or capacity data
      - 8. Detailed equipment drawing for fabricated items
      - 9. Wiring diagrams
      - 10. Installation instructions
      - 11. Other pertinent data
      - 12. All required submittals and data, bound together, submitted at one time.

- b. Where literature is submitted covering a group or series of similar items, the applicable items must be clearly indicated on each copy with a highlighter pen, or other means of identification clearly legible.
  - c. Data and shop drawings shall be coordinated and included in a single submission. Multiple submissions are not acceptable except where prior approval has been obtained from the Engineer. In such cases, a list of data to be submitted later shall be included with the first submission. Failure to submit shop drawings that meet the requirements of the Drawings and Specifications in ample time for review shall not entitle the Contractor to an extension of contract time, and no claim for extension by reason of such Contractor default shall be allowed.
- B. Submittal Organization: Organize all required data in a 3-ring binder of sufficient size (3 inch) with index tabs with number and appropriate title of specification section.
  - C. Provide a cover sheet and an index sheet listing all items submitted.
  - D. The second and third sheet shall be blank for stamping of submittals. All submittals are to be processed at same date; partial submittals will not and are not acceptable.
  - E. Show any revisions to equipment layout required by use of selected equipment. The Engineer shall receive submittals no later than thirty (30) working days from contract date with General Contractor and Owner.
  - F. The Engineer's review of submittals is only for confirmation of adherence to design of project and does not relieve the Contractor of final responsibility for furnishing all materials required for a complete working system and in complying with the Contract Documents in all respects.

#### 1.9 SHOP DRAWINGS, DESCRIPTIVE DATA

- A. As soon as practical and within thirty days after the official award of contract and before any materials and equipment are purchased, the Contractor shall submit to the Engineer, for review, five (5) copies of the complete list of all materials and equipment identified and referenced to specification paragraphs together with applicable shop drawings. In addition, the names and addresses of the manufacturers, their catalog data, numbers, and trade names shall be furnished. Published performance data shall be furnished to indicate compliance with scheduled performance. This data will be marked "Reviewed" by the Engineer, dated and distributed to the several parties involved, with two (2) copies returned to the Contractor. The data shall include the following:
  - 1. Equipment-room layouts drawn to 1/4" scale, including equipment and accessories, to show clearances for operating and servicing.
  - 2. Equipment and materials as indicated in each Section.
  - 3. Composite drawings of crowded locations where there is a possibility of conflict among trades.
- B. Verification of Dimensions: The Contractor shall be responsible for the coordination and proper relation of his work to the building structure and to the work of all trades. The Contractor shall verify all dimensions in the field and advise the Engineer of any

discrepancy before performing the work. Adjustments to the work required in order to facilitate a coordinated installation shall be made at no additional cost to the Owner.

- C. Equipment other than that shown should be used in bids only when approved by the Engineer prior to bidding. Those models and manufacturers identified in drawings and specifications were selected to provide minimum acceptable performance. These models are used in sake of brevity to establish a basis of quality, weights, performance, capacities, etc., required. Any such alternate proposals must include all necessary changes and additions to the work occasioned by such substitution including but not limited to foundations, supports, connections, piping, etc. which shall be paid for by the Contractor. In the event that the Contractor submits for approval any material, equipment, etc., that are not in conformity with the specifications, the Engineer reserves the right to reject this equipment, and the Contractor shall submit data on other equipment which meets the requirements of the specifications for approval.
- D. Installation Directions: Obtain manufacturer's printed installation directions to aid in properly executing work on equipment requiring such directions.
- E. Submit such directions to Engineer prior to time of installation for use in review of the work.
- F. Operating Instructions, Charts: Furnish manufacturer's printed operating and maintenance instruction for equipment and systems, which, in opinion of Engineer, require such instructions; obtain receipt for it.
- G. When so specified or instructed, mount operating instructions in approved frame with glass over; locate where directed.

#### 1.10 GENERAL INSTALLATION

- A. Lines and Grades:
  - 1. Construct work in conformity with lines and grades as indicated, using axis lines and bench marks provided under General Construction; verify such axis lines and bench marks.
  - 2. Axis lines within building will be so spaced on each floor level that mechanical work may be laid out with tape measure having length of 50 feet maximum.
  - 3. Bench marks outside building will be at accessible points on building walls, from which lines and grades required for installation of mechanical and electrical work may be set.
- B. Cutting and Patching
  - 1. Notify the General Contractor sufficiently ahead of construction of any floors, walls, ceiling, roof, etc., of any openings that will be required for his work. The Contractor shall see that all sleeves required for his work are set at proper times so as to avoid delay of the job. All necessary cutting of walls, floors, partitions, ceilings, etc., as required for the proper installation of the work under this Contract shall be done at the Subcontractor's expense in a neat and workmanlike manner, and as approved by the Engineer. No joists, beams, girders or columns shall be cut by any Contractor without first obtaining written permission of the Engineer. The General Contractor shall provide patching of openings and/or alterations. All

openings in fire walls and floors shall be completely sealed after installation for a completely air-tight installation. Sealing material shall be non-combustible and UL approved. The installed sealing assembly shall not cause the fire rating of the penetrated structure to be decreased. All openings in exterior walls shall be sealed watertight. Seal voids around conduits penetrating fire-rated assemblies and partitions using fire stopping materials and methods in accordance with NFPA and local codes.

**C. Existing Services:**

1. **Active Services:** When encountered in work, protect, brace and support existing active sewers, gas, piping and other services where required for proper execution of the work. If existing active services are encountered that require relocation, make request in writing for determination. Do not proceed with work until written directions are received. Do not prevent or disturb operation of active services that are to remain. Outages shall be kept to a minimum and allowed only as arranged with the Engineer.
2. **Inactive Services:** When encountered in work, remove, cap, or plug inactive services.
3. **Interruption of Services:** Where work makes temporary shutdowns of services unavoidable, shut down at night or at such times as approved by Owner, which will cause the least interference with established operating routine. Arrange to work continuously, including overtime, if required, to assure that services will be shut down only during time actually required to make necessary connection to existing work.

**D. Manufacturer's Instructions:**

1. All equipment and devices shall be installed in accordance with the drawings and specifications, manufacturer's instructions and applicable codes. Where specifications call for installation of a product to be in accordance with manufacturer's instructions and/or where manufacturer's instructions are required for installation of a product, it shall be the contractor's responsibility to obtain the necessary applicable manufacturer's instructions and install the product in accordance with the manufacturer's instructions. It shall be the Contractor's responsibility to install all equipment, materials, and devices shown on the plans and as called out in these specifications even if manufacturer's instructions are absolutely unattainable.

**E. Related Work:**

1. The various specification sections for this division may or may not include related work listings.
2. All related work shall be coordinated and provided by the Electrical Contractor regardless whether specifically identified or not.

**F. Electrical Wiring and Equipment for Mechanical Systems**

1. **Electrical Contractor To Provide:**
  - a. Line Voltage and hook-up to all HVAC Equipment
  - b. All conduits into accessible attic space for thermostats and sensors.
  - c. All lighting contractors, mechanically held with control relay, required coil voltage coordinated with controls contractor.
  - d. Junction Boxes (Standard Two Gang) required for controls contactor, and

- coordination with controls contractor. One TVSS power outlet at each energy management control panel located at project controls contractor.
- e. A weatherproof outlet within 25 feet of each piece of mechanical equipment mounted either on the roof or on the ground. This outlet shall be connected to the nearest 120/208 panelboard with a GFCI circuit breaker.
2. Mechanical Contractor to Provide:
    - a. All motor starters (with heaters as required).
    - b. All thermostats.
    - c. All HVAC Equipment.
    - d. All relays, contactors, and switches required to start/stop Mechanical Equipment other than switches shown on and required by Division 26.
  3. Controls Contractor to Provide:
    - a. All required relays
    - b. All Sensors
    - c. All conduit required above ceiling.
    - d. All control wiring.
  4. The Electrical plans are based on the equipment and devices scheduled shown on the drawings or as called for in the specifications. Should any mechanical equipment or device associated devices be changed or accepted from those which are shown or noted, all electrical and/or mechanical changes shall be made at the expense of the trade or contractor initiating the change with no expense to the Owner, Engineer, Engineer or their representatives.
  5. All Conduit and boxes for thermostats and/or sensors shall be provided by this contractor. A thermostat or sensor junction box and 1/2" conduit to accessible attic and/or to corridor shall be provided for each room served with HVAC equipment. Coordinate with the mechanical drawings for exact locations and requirements. All control conduits required in attic, clear spaces, or on roof shall be by the Mechanical or Controls Contractor. Details on Electrical drawings showing HVAC/Mechanical/Control Equipment providing of various relays devices, wiring and other equipment shall be provided by this Contractor a directed and as required per drawing.
- G. Objectionable Noise and Vibration:
1. Electrical equipment shall operate without objectionable noise or vibration.
  2. If such objectionable noise or vibration should be produced and transmitted to occupied portions of building or other parts of Electrical work, make necessary changes and additions, as approved, without extra cost to Owner.
- H. Equipment Design and Installation:
1. Uniformity: Unless otherwise specified, equipment or material of same type or classification, used for same purpose shall be the product of same manufacturer.
  2. Design: Equipment and accessories not specifically described or identified by manufacturer's catalog numbers shall be designed in conformity with ASME, AIEE or other applicable technical standards, and shall have neat and finished appearance.
  3. Installation: Erect equipment in neat and workmanlike manner; align, level and adjust for satisfactory operation; and so that all parts are easily accessible for inspection, operation, maintenance and repair. Minor deviation from indicated arrangements may be made, as approved.

- I. Protection of Equipment and Materials:
  - 1. Responsibility for care and protection of work rests with the Contractor until it has been tested and accepted.
  - 2. After delivery, before and after installation, protect equipment and materials against theft, injury or damage from all causes.
  
- J. Installation:
  - 1. Cooperation with trades of adjacent, related or affected materials or operations, and or trades performing continuations of this work under subsequent contracts is considered a part of this work in order to effect timely and accurate placing of work and to bring together, in proper and correct sequence, the work of such trades, including trade in general contractor allowance and Division 26.
  - 2. The Electrical Contractor shall coordinate installation of the electrical system with the General Contractor, Mechanical, Plumbing, and Communications Contractors to insure a complete working system for the Owner.
  - 3. Where required, all conduit and boxes for all systems, except mechanical controls specified otherwise, shall be provided by the Electrical Contractor, including systems in the Electrical divisions, any and all allowances shall be included. Normally low voltage wiring shall run open in accessible attic space. Coordinate with, and verify with these specifications to provide required conduit and boxes at locations and heights required.
  - 4. All wiring shall be enclosed in conduit or raceway in all exposed areas such as gymnasium, shops, stages, or field houses.
  - 5. Workmen skilled in their trade must perform Work. The installation must be complete whether the work is concealed or exposed.
  - 6. Conceal electrical work in walls, floors, chases, under floors, underground and above ceilings. Branch circuits may be installed in the slab. Install in slab as directed by Structural Engineer. Coordinate the actual electrical outlets and equipment with building features and mechanical equipment as indicated on Engineering, structural and mechanical drawings. Review with the Engineer any proposed changes in outlet or equipment location. Relocation of outlets before installation, of up to 3 feet from the position indicated, may be directed without additional cost. Remove and relocate outlets placed in an unsuitable location when so requested by the Engineer.
  - 7. If structural sheets do not address conduits in the slab, the Contractor must get written approval from Structural Engineer prior to installation.
  
- K. Project Record Documents
  - 1. The Contractor shall keep a set of plans on the job, noting daily all changes made in connection with the final installation including exact dimensioned locations of all new and existing switchgear, devices, fixtures, equipment and new or existing site utilities and lights.
  - 2. Upon submitting his request for final payment, he shall turn over to the Engineer, record document submittals as outlined in Division 1 - General Requirements of the Specifications.
  - 3. In addition to the above, the Contractor shall accumulate during the job's progress the following data, in duplication. Two (2) each prepared in 3-ring black in color binder neat in appearance of sufficient size and turned over to the Engineer for checking and subsequent delivery to the Owner:

- a. All warranties, guarantees and manufacturer's directions on equipment and material covered by the Contract.
  - b. All shop drawings.
  - c. Set of operating instructions. Operating instructions shall also include recommended maintenance and seasonal changeover procedures.
  - d. Any and all other data and/or plans required during construction.
  - e. Repair parts lists of all major items and equipment including name, address and telephone number of local supplier or agent.
  - f. The first page, or pages, shall have the names, addresses, and telephone numbers of the following:
    - i. General Contractor and all sub-contractors.
    - ii. Major Equipment Suppliers
  - g. Submit Megger Reading Log copies in accordance with the specifications.
  - h. Submit ground tests methods and results in accordance with the specifications.
  - i. Submit testing of Electrical System results in accordance with the specifications.
  - j. Submit conductor insulation test results in accordance with the specifications.
  - k. Submit surge suppression - switchgear mounted warranty in accordance with the specifications.
- L. Final Acceptance Review
- 1. It shall be the duty of this Contractor to make a careful inspection trip of the entire project, to ensure that the work on the project is ready for final acceptance before calling upon the Engineer to make a final observation visit.
  - 2. To avoid delay of final acceptance of the work, the Contractor shall have all necessary bonds, warranties, receipts, affidavits, etc., called for in the various articles of these specifications, prepared and signed in advance, together with a letter of transmittal, listing each paper included, and shall deliver the same to the Engineer at or before the time of said final visit. The Contractor is cautioned to check over each bond, receipt, etc., before preparing for submission to verify that the terms check with the requirements of the specifications.
  - 3. The following will be required at time of final completion:
    - a. Final clean-up completed.
    - b. All systems are fully operational, all material and devices installed and tested.
    - c. Project Record Documents
- M. Warranty
- 1. This Contractor shall warranty his work against defective materials and workmanship for a period of one year from date of acceptance of the job.
  - 2. Neither the final payment nor any provisions in Contract Documents shall relieve this Contractor, or the Contractor, of the responsibility for faulty materials or workmanship.
  - 3. He shall remedy any defects due thereto, and pay for any damage to other work resulting therefrom, which shall appear within a period of one year from date of substantial completion.
  - 4. The Owner shall give notice of observed defects with reasonable promptness.
  - 5. This Warranty shall not be construed to include the normal maintenance of the

various components of the system covered by these specifications.

- N. Training
  - 1. Upon completion of the work and at a time designated by the Engineer, provide a formal training session for the Owner's operating personnel to include location, operation, and maintenance of all electrical equipment and systems.
  - 2. See other sections in Division 26 for time requirements.
- O. Adjustments:
  - 1. It shall be the responsibility of the Contractor to adjust properly any and all equipment and devices and to run reasonable operating tests together with more specific tests indicated in the separate sections of the specifications. If for some reason any piece of equipment does not function satisfactorily after the first adjustments are made, the Contractor shall continue on the job until satisfactory corrections and adjustments have been made. The Contractor is responsible for the proper performance, functioning, integration, and balance of all equipment. Where tests are required by the Engineer to ascertain equipment capacities in the installed condition, it shall be the responsibility of the Contractor to run approved tests, to provide all required instruments and apparatus and to submit certified statements of test results. All such instruments shall be in proper calibration and shall meet approval of the Engineer.
- P. Completeness:
  - 1. The Contractor shall be responsible for the absolute completeness of his work, including all adjustments and all final balancing to obtain proper operation in all respects.
  - 2. Each system is intended to be complete and functional in performance. All such items as trim, electrical work, and appurtenances required shall be installed at no extra cost.
  - 3. The Contractor shall take such precautions as may be necessary to properly protect his apparatus from damage. This shall include the creation of all required temporary shelters to adequately protect any apparatus above the floor of the construction and the covering of apparatus in the completed building with tarpaulins or other protective covering. Failure to comply with the above to the satisfaction of the Owner's inspector will be sufficient cause for the rejection of the equipment in question and its complete replacement by this Contractor.

#### 1.11 ELECTRICAL TESTS

- A. During the progress of the work and upon completion, tests shall be made as specified herein and as required by authorities having jurisdiction; including inspectors, Owner, or Engineer. Tests shall be conducted by the Contractor as part of the work of the electrical divisions and shall include the services of qualified personnel as well as all equipment, apparatus and services required. Each wiring system with devices connected must test free from short circuit and ground faults and must have an insulation resistance between conductors and ground in accordance with ANSI and IEEE standards.
- B. Prior to the execution of testing, the Contractor shall submit proposed test procedures recording forms, list of personnel and test equipment for the Engineer's review.

- C. The tests shall include, but not be limited to, the following:
  - 1. Branch Circuit Test
  - 2. Fire Alarm Test
- D. Branch Circuit Test
  - 1. Operate all lighting and receptacle circuits with associated switching and controls.
- E. Fire Alarm And Communication System Test
  - 1. Demonstration and operation test of each device and all interlocks and controls of the fire alarm and communication system, as required by and to the approval of the authorities having jurisdiction.
- F. Warranty Requirements
  - 1. The foregoing tests shall in no way relieve the Contractor of the warranty requirements.

#### 1.12 PERMITS AND FEES

- A. All building permits and their required fees, extension of utilities together with applicable meters, and all inspection fees for all Electrical work shall be arranged and paid for by the Electrical trade involved in the particular work for which the permit is taken, and for the pertinent inspection fee for the work involved by the Contractor.

#### 1.13 UTILITY CONNECTIONS AND INSPECTIONS

- A. Extensions: The Contractor shall provide or obtain and pay for all utility connections, utility extensions, and/or relocations and shall pay all costs and inspection fees for all work included therein.
- B. Compliance: The Contractor is required to comply in every respect with all requirements of local inspection departments, local ordinances and codes, and utility company requirements.
- C. Utilities: The Contractor shall check with the various utility companies whose services are required for this project and shall provide, complete in all respects, the required utility relocations, extensions, modifications, and/or changes.
- D. Certifications: Prior to final acceptance, the Contractor shall furnish without additional charge a certificate of acceptance from the inspection departments having jurisdiction over the work for any and all work installed under this Contract.
- E. Utility Locations and Elevations: Locations and elevations of the various utilities included within the scope of this work have been obtained from substantially reliable sources and are offered as a general guide only, without guarantee as to accuracy. The Contractor shall examine the site, shall verify to his own satisfaction the locations, elevations, and availability of all utilities and services required, and shall adequately inform himself as to their relation to the work. The submission of bids shall be deemed evidence thereof.

- F. Ordinances, rules and regulations: All installations shall comply with applicable code, ordinances and regulations except where the drawings require a higher degree of work as indicated on the plans or specified hereinafter. All installations shall comply with applicable codes, ordinances and regulations except where drawings required a higher degree of work as indicated on the plans or specified hereinafter.
- G. Installations and equipment shall comply with applicable requirements of the National Fire Protection Association, Underwriters Laboratories, National Electrical Code, utility company, or other local, State or Federal agencies having jurisdiction. Compliance with these requirements shall be done at no additional cost to the Owner.
- H. Any changes to the contract required by the aforementioned requirements shall be submitted to the Engineer in writing for approval prior to execution.

#### 1.14 QUALITY ASSURANCE

- A. Provide complete installations of and verify that all systems, comply with NFPA 70, latest edition.
- B. The more stringent of the N.E.C. or specifications shall apply to this project. All materials furnished under this Contract shall be new, free from defects of any kind, of the quality and design hereinafter specified, and shall conform to the standards of Underwriter's Laboratories Inc., except for equipment which U.L. does not list or provide label service.
- C. Submit a bid on the basis of a complete installation including all labor, material, delivery, insurance, permits, inspection fees and tests required even though each and every item necessary is not specifically mentioned or shown. In case of any conflict between the specifications, plans and ordinances, the ordinances shall govern. In case of any conflict between the specifications and plans, the Engineer shall make the final decision.
- D. Refer to Division 1 - General Requirements: All materials and equipment shall be installed in accordance with the approved recommendation of the manufacturer and workmen skilled in the trade involved shall accomplish the installation.

#### 1.15 CONTRACTOR'S RESPONSIBILITY

- A. Erect barricades, protective fencing, and signs as required to prevent injury to personnel on site.
- B. Make permanent connection to new utilities or existing lines. Determine depth and location, and bid accordingly.
- C. Relocate and repair any existing lines cut by general construction work.
- D. Pay all costs in connection with metering. Plans do not show exact location and elevations of lines. Deviate from plans as required to conform to the general construction, and provide proper grading and installation.
- E. Maintain all utility services during construction to existing portions of job that remain.

- F. Procure and pay for all necessary permits or licenses to carry out the work.
- G. Obtain and pay for all the necessary certificates of approval, which must be delivered to the Engineer before final acceptance of the work.
- H. Periodically remove rubbish, clean or repair all surfaces marred by the work required under this contract.
- I. Protect work from damage by other trades.
- J. Where job conditions require changes in indicated locations and arrangement, make such changes without extra cost to Owner.
- K. Exposed piping and/or other materials will not be permitted in the finished job.
- L. Provide required hook-up to line voltage at all electromagnetic door holder/release, fire/smoke dampers, and smoke dampers. See Mechanical drawings for all locations of required devices. Provide required relays and wiring to fire alarm panels and coordinate with other specified work.
- M. Accomplish all demolition and remodeling work involving his trade in a manner and completeness to provide the appearance of new construction work.
- N. Replace any usable equipment and/or structure damaged during demolition and remodel work.

#### 1.16 FLAME SPREAD PROPERTIES OF MATERIALS

- A. Materials and adhesives incorporated in this project shall conform to ASTM Standard E84, "Test Method of Surface Burning Characteristics of Building Materials" and NFPA 90. The classification shall not exceed a flame spread rating of 25 for all materials, adhesives, finishes, etc., specified for each system, and shall not exceed a smoke developed rating of 50.

#### 1.17 ASBESTOS ABATEMENT

- A. In the event the Contractor encounters at the site material reasonably believed to be asbestos which has not been abated, the Contractor shall immediately stop work in the area affected and report the condition to the Owner. If in fact the material is asbestos and the asbestos has not been abated, the Contractor shall not resume the non-asbestos-related work in the affected area until the asbestos has been abated. The abatement action may be done in two ways, as the Owner may decide. The Owner may perform the abatement by its own forces, or the Owner may contract with a third party to perform the abatement.

#### PART 2 PRODUCTS – NOT USED

#### PART 3 EXECUTION

**3.1 GENERAL**

- A. Equipment, Spaces and Clearances: All equipment and accessories shall be new and standard models of a type that has been in satisfactory use for two (2) years. All major components of any given system shall be of the same manufacturer and shall have a manufacturer's nameplate stating address, catalog model number and capacity.
- B. Materials and equipment shall be installed in accordance with manufacturers' recommendations and best standard practice for the type of work involved.
- C. All equipment shall be continuously protected, using temporary shelters, etc., from dirt, dust, moisture, damage, etc., and will not be accepted otherwise. All necessary supports, frames and foundations shall be provided for all equipment.
- D. The responsibility for the furnishing of the proper Electrical equipment rests entirely upon the Contractor who shall request advice and supervisory assistance from the representatives of specific manufacturers during the installation.
- E. It shall be the responsibility of the Contractor that the combination of proposed Electrical equipment will fit into the allotted space shown on the plan with adequate clearances for maintenance and servicing.
- F. Any apparatus, which is too large to permit access through stairways, doorways, shaft, etc., shall be delivered to the job and set in place prior to constructing the mechanical room enclosures.
- G. Design and construct supporting structures of strength to safely withstand stresses to which they may be subjected and to distribute properly the load and impact over the building areas.
- H. Conform to applicable technical societies' standards, also to codes and regulations of agencies having jurisdiction.
- I. Submit detailed shop drawings of all supports; obtain approval before fabricating or constructing.

**3.2 SPACE REQUIREMENTS**

- A. General:
  - 1. Determine in advance of purchase that the equipment and materials proposed for installation will fit into the confines indicated, leaving adequate clearances for adjustment, repair or replacement.
- B. Clearance:
  - 1. Allow adequate space for clearance in accordance with the Code requirements and the requirements of the local inspection department.
- C. Responsibility:

1. Since space requirements and equipment arrangement vary for each manufacturer, the responsibility for initial access and proper fit rests with the Contractor.

D. Review:

1. Final arrangements of equipment to be installed shall be subject to the Engineer's review.

### 3.3 RELATED ELECTRICAL PROVISIONS

- A. Such items as electric control, motors, relays, thermostats, terminal or limiting switches on equipment, etc., shall be furnished as part of the equipment involved. All of these electrical controls, interlocks, and devices shall be installed and wired into the system to conform to Division 26. They shall be complete with all required conduit, condulets, boxes, wire, grounds, power disconnect switches, etc. The electrical trades doing Division 26 work shall provide all power wiring of 115 volt or higher including interlocks. All temperature control wiring shall be the responsibility of the mechanical trades, who shall furnish all wiring and diagrams.

B. Cleaning Electrical Equipment:

1. Equipment shall be thoroughly cleaned of dirt, cuttings and other foreign substances.

### 3.4 GUARANTEES

- A. All work, equipment, and materials, shall be guaranteed by the Electrical Contractor for a period of one (1) year after final acceptance of the work. All defects in labor and materials occurring during the one year after final acceptance of the work shall be immediately repaired or replaced by the Contractor at no additional cost to the owner.

END OF SECTION

SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes building wire and cable; nonmetallic-sheathed cable; direct burial cable; service entrance cable; armored cable; metal clad cable; and wiring connectors and connections.
- B. Related Sections:
  - 1. Section 26 05 53 - Identification for Electrical Systems: Product requirements for wire identification.

1.2 REFERENCES

- A. International Electrical Testing Association:
  - 1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
- B. National Fire Protection Association:
  - 1. NFPA 70 - National Electrical Code.
  - 2. NFPA 262 - Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces.
- C. Underwriters Laboratories, Inc.:
  - 1. UL 1277 - Standard for Safety for Electrical Power and Control Tray Cables with Optional Optical-Fiber Members.

1.3 SYSTEM DESCRIPTION

- A. Product Requirements: Provide products as follows:
  - 1. Solid conductor for feeders and branch circuits 10 AWG and smaller.
  - 2. Stranded conductors for control circuits.
  - 3. Conductor not smaller than 12 AWG for power and lighting circuits.
  - 4. Conductor not smaller than 14 AWG for control circuits.
  - 5. Increase wire size in branch circuits to limit voltage drop to a maximum of 3 percent.
- B. Wiring Methods: Provide the following wiring methods:
  - 1. Concealed Dry Interior Locations: Use only building wire, Type THHN/THWN insulation, in raceway.
  - 2. Exposed Dry Interior Locations: Use only building wire, Type THHN/THWN insulation, in raceway.
  - 3. Wet or Damp Interior Locations: Use only building wire, Type XHHW insulation, in raceway.
  - 4. Exterior Locations: Use only building wire, Type XHHW insulation, in raceway.

1.4 DESIGN REQUIREMENTS

- A. Conductor sizes are based on copper.

1.5 SUBMITTALS

- A. Product Data: Submit for building wire and each cable assembly type.
- B. Design Data: Indicate voltage drop and ampacity calculations for aluminum conductors substituted for copper conductors.
- C. Test Reports: Indicate procedures and values obtained.

1.6 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Record actual locations of components and circuits.

1.7 QUALIFICATIONS

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

1.8 FIELD MEASUREMENTS

- A. Verify field measurements are as indicated on Drawings.

1.9 COORDINATION

- A. Where wire and cable destination is indicated and routing is not shown, determine routing and lengths required.

PART 2 PRODUCTS

2.1 BUILDING WIRE

- A. Manufacturers:
  - 1. AETNA
  - 2. American Insulated Wire Corp.
  - 3. Colonial Wire
  - 4. Encore Wire
  - 5. General Cable Co.
  - 6. Republic Wire
  - 7. Rome Cable
  - 8. Service Wire Co.
  - 9. Southwire
  - 10. Superior Essex
- B. Product Description: Single conductor insulated wire.
- C. Conductor: Copper.

- D. Insulation Voltage Rating: 600 volts.
- E. Insulation Temperature Rating: 75 degrees C.
- F. Insulation Material: Thermoplastic.

## 2.2 TERMINATIONS

- A. Terminal Lugs for Wires 6 AWG and Smaller: Solderless, compression type copper.
- B. Lugs for Wires 4 AWG and Larger: Color keyed compression type copper, with insulating sealing collars.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify interior of building has been protected from weather.
- B. Verify mechanical work likely to damage wire and cable has been completed.
- C. Verify raceway installation is complete and supported.

### 3.2 PREPARATION

- A. Completely and thoroughly swab raceway before installing wire.

### 3.3 EXISTING WORK

- A. Remove exposed abandoned wire and cable, including abandoned wire and cable above accessible ceiling finishes. Patch surfaces where removed cables pass through building finishes.
- B. Disconnect abandoned circuits and remove circuit wire and cable. Remove abandoned boxes when wire and cable servicing boxes is abandoned and removed. Install blank cover for abandoned boxes not removed.
- C. Provide access to existing wiring connections remaining active and requiring access. Modify installation or install access panel.
- D. Extend existing circuits using materials and methods compatible with existing electrical installations, or as specified.
- E. Clean and repair existing wire and cable remaining or wire and cable to be reinstalled.

### 3.4 INSTALLATION

- A. Route wire and cable to meet Project conditions.
- B. Neatly train and lace wiring inside boxes, equipment, and panelboards.

- C. Identify and color code wire and cable under provisions of Section 26 05 53. Identify each conductor with its circuit number or other designation indicated.
- D. Minimum Conductor Size – Building Wire in Raceway:
  - 1. Minimum #14 AWG for control circuits.
  - 2. Minimum #10 AWG for power homeruns.
  - 3. Minimum #10 AWG for special outlets, dedicated outlets and junction boxed hard wire connections for equipment.
  - 4. Minimum #10 AWG for 20 ampere 120-277 volt branch circuits. The backbone of all 20 ampere lighting and power branch circuits shall be #10 AWG. Drops to individual receptacles and light fixtures may be #12 AWG.
- E. Special Techniques - Building Wire in Raceway:
  - 1. Pull conductors into raceway at same time.
  - 2. Install building wire 4 AWG and larger with pulling equipment and lubricant.
- F. Special Techniques - Cable:
  - 1. Protect exposed cable from damage.
  - 2. Support cables above accessible ceiling, using spring metal clips to support cables from structure. Do not rest cable on ceiling panels.
  - 3. Use suitable cable fittings and connectors.
- G. Special Techniques - Wiring Connections:
  - 1. Clean conductor surfaces before installing lugs and connectors.
  - 2. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.
  - 3. Tape uninsulated conductors and connectors with electrical tape to 150 percent of insulation rating of conductor.
  - 4. Install split bolt connectors for copper conductor splices and taps, 6 AWG and larger.
  - 5. Install solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.
  - 6. Install insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.
- H. Install stranded conductors for branch circuits 10 AWG and smaller. Install crimp on fork terminals for device terminations. Do not place bare stranded conductors directly under screws.
- I. Install terminal lugs on ends of 600 volt wires unless lugs are furnished on connected device, such as circuit breakers.
- J. Size lugs in accordance with manufacturer's recommendations terminating wire sizes. Install 2-hole type lugs to connect wires 4 AWG and larger to copper bus bars.
- K. For terminal lugs fastened together such as on motors, transformers, and other apparatus, or when space between studs is small enough that lugs can turn and touch each other, insulate for dielectric strength of 2-1/2 times normal potential of circuit.

3.5 WIRE COLOR

- A. Phase Conductors, including Switch Legs – Color code conductors as indicated in the Wire Color Code Table below, per City of San Antonio standards:
1. For wire sizes 10 AWG and smaller, install wire with insulation color per the table.
  2. For wire sizes 8 AWG and larger, identify wire with colored tape at terminals, splices and boxes, with color per the table.
- B. Neutral Conductors - Color code conductors as indicated in the Wire Color Code Table below. When two or more neutrals are located in one conduit, individually identify each with proper circuit number.
1. For wire sizes 10 AWG and smaller, install wire with insulation color per the table.
  2. For wire sizes 8 AWG and larger, identify wire with colored tape at terminals, splices and boxes, with color per the table.
- C. Ground Conductors – Color code conductors as indicated in the Wire Color Code Table below.
1. For wire sizes 10 AWG and smaller, install wire with insulation table per table.
  2. For wire sizes 8 AWG and larger, identify with colored tape at terminals, splices and boxes, with color code per the table.

| WIRE COLOR CODE TABLE |  |  |  |  |
|-----------------------|--|--|--|--|
| Phase Conductor       | 480Y/277<br>3 Phase                          | 208Y/120<br>3 Phase                          | 120/240V<br>1 Phase                          | 240/120V,<br>Delta, 3 Phase                  |
| A or L1               | Purple                                       | Black  | Black  | Black  |
| B or L2               | Brown  | Red  | Red  | Orange<br>(High Leg)                         |
| C or L3               | Yellow                                       | Blue   | NA   | Blue   |
| Neutral               | Gray   | White  | White  | White  |
| Ground                | Green  | Green  | Green  | Green  |
| Isolated<br>Ground    | ---  | Green with<br>Yellow Tracer                  | Green with<br>Yellow Tracer                  | Green with<br>Yellow Tracer                  |
| Switch Leg            | Same Color as<br>Branch Circuit<br>Conductor |

END OF SECTION

SECTION 26 05 33

RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes conduit and tubing, surface raceways, wireways, outlet boxes, pull and junction boxes, and handholes.
- B. Related Sections:
  - 1. Section 26 05 53 - Identification for Electrical Systems.

1.2 REFERENCES

- A. American National Standards Institute:
  - 1. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.
  - 2. ANSI C80.3 - Specification for Electrical Metallic Tubing, Zinc Coated.
  - 3. ANSI C80.5 - Aluminum Rigid Conduit - (ARC).
- B. National Electrical Manufacturers Association:
  - 1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
  - 2. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
  - 3. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
  - 4. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers, and Box Supports.
  - 5. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
  - 6. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Tubing and Conduit.
  - 7. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.

1.3 SYSTEM DESCRIPTION

- A. Raceway and boxes located as indicated on Drawings, and at other locations required for splices, taps, wire pulling, equipment connections, and compliance with regulatory requirements. Raceway and boxes are shown in approximate locations unless dimensioned. Provide raceway to complete wiring system.
- B. Outdoor Locations, Above Grade: Provide rigid steel conduit. Provide cast metal or nonmetallic outlet, pull, and junction boxes.
- C. Wet and Damp Locations: Provide rigid steel conduit. Provide cast metal or nonmetallic outlet, junction, and pull boxes. Provide flush mounting outlet box in finished areas.

- D. Concealed Dry Locations: Provide electrical metallic tubing. Provide sheet-metal boxes. Provide flush mounting outlet box in finished areas. Provide hinged enclosure for large pull boxes.
- E. Exposed Dry Locations: Provide rigid steel conduit electrical metallic tubing. Provide sheet-metal boxes. Provide flush mounting outlet box in finished areas. Provide hinged enclosure for large pull boxes.

#### 1.4 DESIGN REQUIREMENTS

- A. Minimum Raceway Size: 1/2 inch (13 mm) unless otherwise specified.

#### 1.5 SUBMITTALS

- A. Product Data: Submit for the following:
  - 1. Flexible metal conduit.
  - 2. Liquidtight flexible metal conduit.
  - 3. Electrical Metallic Conduit.
  - 4. Raceway fittings.
  - 5. Conduit bodies.
  - 6. Pull and junction boxes.
- B. Manufacturer's Installation Instructions: Submit application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

#### 1.6 CLOSEOUT SUBMITTALS

- A. Project Record Documents:
  - 1. Record actual routing of conduits larger than 2 inch (DN50).
  - 2. Record actual locations and mounting heights of outlet, pull, and junction boxes.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.
- B. Protect PVC conduit from sunlight.

#### 1.8 COORDINATION

- A. Coordinate mounting heights, orientation and locations of outlets mounted above counters, benches, and backsplashes.

## PART 2 PRODUCTS

### 2.1 FLEXIBLE METAL CONDUIT

A. Manufacturers:

1. AFC Cable
2. Alflex
3. Allied Tube & Conduit
4. Anamet Electrical
5. Electri-Flex
6. Manhattan/CDT
7. Maverick Tube
8. O-Z Gedney
9. Wheatland Tube
10. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description: Interlocked steel construction.

C. Fittings: NEMA FB 1.

### 2.2 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

A. Manufacturers:

1. AFC Cable
2. Alflex
3. Allied Tube & Conduit
4. Anamet Electrical
5. Electri-Flex
6. Manhattan/CDT
7. Maverick Tube
8. O-Z Gedney
9. Wheatland Tube
10. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description: Interlocked steel construction with PVC jacket.

C. Fittings: NEMA FB 1.

### 2.3 ELECTRICAL METALLIC TUBING (EMT)

A. Manufacturers:

1. AFC Cable
2. Alflex
3. Allied Tube & Conduit
4. Anamet Electrical
5. Electri-Flex
6. Manhattan/CDT
7. Maverick Tube
8. O-Z Gedney

9. Wheatland Tube
10. Substitutions: Section 01 60 00 - Product Requirements.

- B. Product Description: ANSI C80.3; galvanized tubing.
- C. Fittings and Conduit Bodies: NEMA FB 1; steel, compression set screw type.

#### 2.4 CONDUIT REQUIREMENTS

- A. Minimum size shall be  $\frac{3}{4}$  inch unless otherwise noted in the electrical specifications or the electrical drawings.
- B. Interior dry locations:
  1. Concealed shall be electrical metallic tubing.
  2. Exposed above 10' AFF in mechanical rooms or in areas not subject to physical damage shall be electrical metallic tubing.
  3. Exposed below 10' AFF in mechanical rooms or in area subject to physical damage shall be rigid metal conduit.
- C. Equipment connections shall be liquid tight flexible metal conduit for exterior equipment (5'-0" maximum length).

#### 2.5 OUTLET BOXES

- A. Manufacturers:
  1. Cooper
  2. Appleton
  3. Erickson
  4. Haffman
  5. Hubbell
  6. O-Z/Gedney
  7. Thomas & Betts
  8. Walker
  9. The Wiremold Co.

#### 2.6 PULL AND JUNCTION BOXES

- A. Manufacturers:
  1. Carlon Electrical Products.
  2. Hubbell Wiring Devices
  3. Thomas & Betts Corp.
  4. Walker Systems Inc.
  5. The Wiremold Co.
  6. Substitutions: Section 01 60 00 - Product Requirements.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify outlet locations and routing and termination locations of raceway prior to rough-in.

### 3.2 EXISTING WORK

- A. Remove exposed abandoned raceway, including abandoned raceway above accessible ceiling finishes. Cut raceway flush with walls and floors, and patch surfaces.
- B. Remove concealed abandoned raceway to its source.
- C. Disconnect abandoned outlets and remove devices. Remove abandoned outlets when raceway is abandoned and removed. Install blank cover for abandoned outlets not removed.
- D. Maintain access to existing boxes and other installations remaining active and requiring access. Modify installation or provide access panel.
- E. Extend existing raceway and box installations using materials and methods compatible with existing electrical installations, or as specified.
- F. Clean and repair existing raceway and boxes to remain or to be reinstalled.

### 3.3 INSTALLATION

- A. Ground and bond raceway and boxes in accordance with NEC.
- B. Fasten raceway and box supports to structure and finishes in accordance with NEC.
- C. Identify raceway and boxes in accordance with NEC.
- D. Arrange raceway and boxes to maintain headroom and present neat appearance.

### 3.4 INSTALLATION - RACEWAY

- A. Raceway routing is shown in approximate locations unless dimensioned. Route to complete wiring system.
- B. Arrange raceway supports to prevent misalignment during wiring installation.
- C. Support raceway using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.
- D. Group related raceway; support using conduit rack.
- E. Do not support raceway with wire or perforated pipe straps. Remove wire used for temporary supports

- F. Do not attach raceway to ceiling support wires or other piping systems.
- G. Route exposed raceway parallel and perpendicular to walls.
- H. Route raceway installed above accessible ceilings parallel and perpendicular to walls.
- I. Maintain clearance between raceway and piping for maintenance purposes.
- J. Cut conduit square using saw or pipe cutter; de-burr cut ends.
- K. Bring conduit to shoulder of fittings; fasten securely.
- L. Install no more than equivalent of three 90 degree bends between boxes. Install conduit bodies to make sharp changes in direction, as around beams. Install factory elbows for bends in metal conduit larger than 2 inch (50 mm) size.
- M. Install fittings to accommodate expansion and deflection where raceway crosses seismic control and expansion joints.
- N. Install suitable pull string or cord in each empty raceway except sleeves and nipples.
- O. Install suitable caps to protect installed conduit against entrance of dirt and moisture.
- P. Close ends and unused openings in wireway.

### 3.5 INSTALLATION - BOXES

- A. Install wall mounted boxes at elevations to accommodate mounting heights specified in section for outlet device.
- B. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.
- C. Do not fasten boxes to ceiling support wires or other piping systems.
- D. Support boxes independently of conduit.
- E. Install gang box where more than one device is mounted together. Do not use sectional box.

### 3.6 CLEANING

- A. Clean interior of boxes to remove dust, debris, and other material.
- B. Clean exposed surfaces and restore finish.

END OF SECTION

SECTION 26 05 53

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Nameplates.
  - 2. Labels.
  - 3. Wire markers.
  - 4. Lockout Devices.

1.2 SUBMITTALS

- A. Product Data:
  - 1. Submit manufacturer's catalog literature for each product required.
  - 2. Submit electrical identification schedule including list of wording, symbols, letter size, color coding, tag number, location, and function.
- B. Manufacturer's Installation Instructions: Indicate installation instructions, special procedures, and installation.

1.3 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Record actual locations of tagged devices; include tag numbers.

1.4 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.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Accept identification products on site in original containers. Inspect for damage.
- B. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
- C. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

## 1.6 ENVIRONMENTAL REQUIREMENTS

- A. Install nameplates only when ambient temperature and humidity conditions for adhesive are within range recommended by manufacturer.

## PART 2 PRODUCTS

### 2.1 NAMEPLATES

- A. Product Description: Laminated three-layer plastic with engraved black letters on white contrasting background color.
- B. Letter Size:
  - 1. 1/8 inch (3 mm) high letters for identifying individual equipment and loads.
  - 2. 1/4 inch (6 mm) high letters for identifying grouped equipment and loads.
- C. Minimum nameplate thickness: 1/8 inch (3 mm).

### 2.2 WIRE MARKERS

- A. Description: Split sleeve or tubing type wire markers.
- B. Legend:
  - 1. Power and Lighting Circuits: Branch circuit or feeder number.
  - 2. Control Circuits: Control wire number as indicated on schematic and interconnection diagrams.

### 2.3 LOCKOUT DEVICES

- A. Anodized aluminum hasp with erasable label surface; size minimum 7-1/4 x 3 inches (184 x 75 mm).

## PART 3 EXECUTION

### 3.1 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.

### 3.2 EXISTING WORK

- A. Install identification on existing equipment to remain in accordance with this section.
- B. Install identification on unmarked existing equipment.
- C. Replace lost nameplates.
- D. Re-stencil existing equipment.

3.3 INSTALLATION

- A. Install identifying devices after completion of painting.
- B. Nameplate Installation:
  - 1. Install nameplate parallel to equipment lines.
  - 2. Install nameplate for each electrical distribution and control equipment enclosure with corrosive-resistant mechanical fasteners, or adhesive.
  - 3. Install nameplates for each control panel and major control components located outside panel with corrosive-resistant mechanical fasteners, or adhesive.
  - 4. Secure nameplate to equipment front using screws.
  - 5. Secure nameplate to inside surface of door on recessed panelboard in finished locations.
  - 6. Install nameplates for the following:
    - a. Switchboards.
    - b. Panelboards.
    - c. Transformers.
    - d. Service Disconnects.
  - 7. Name plate requirements as indicated in table below:

| EQUIPMENT  | SIZE LETTERING                        | INFORMATION   |
|--|---------------------------------------|---|
| <p>LOW-VOLTAGE SWITCHBOARDS</p> <p>Name/Ratings</p> <p>Devices</p> | <p>1/4" / 1/8"</p> <p>1/8"</p>        | <p>Switchboard designation/ampere rating and voltage characteristics<br/> <u>EX:</u> SWBD 1</p> <p>Load served<br/> <u>EX:</u> Transformer for Panel 1LB3</p> |
| <p>PANELBOARDS</p> <p>Name/Ratings</p>                             | <p>1/4" / 1/8"</p> <p>1/4" / 1/8"</p> | <p>Panelboard designation/mpere rating and voltage characteristics<br/> <u>EX:</u> 1LB3</p>   |
| <p>TRANSFORMERS</p>  | <p>1/8"</p>                           | <p>Load served and circuit number<br/> <u>EX:</u> PANEL 1LB3<br/>                     CKT SWBD1-1</p>   |
|  |                                       |   |

| EQUIPMENT                   | SIZE LETTERING | INFORMATION  |
|-----------------------------|----------------|--|
| SAFETY SWITCHES             | 1/8"           | Load served and circuit number<br><u>EX:</u> ELEVATOR NO. 1<br>CKT 1LB3 – 37,39,41 |
| MOTOR STARTERS              | 1/8"           | Load served and circuit number<br><u>EX:</u> AHU-1<br>CKT 1LB3 – 38, 40, 42        |
| MOTOR CONTROL DEVICES       | 1/8"           | Load served<br><u>EX:</u> AHU-2  |
| TIME SWITCHES OR CONTACTORS | 1/8"           | Load served<br><u>EX:</u> Exterior Lights  |

- C. Label Installation:
1. Install label parallel to equipment lines.
  2. Install label for identification of individual control device stations,
  3. Install labels for permanent adhesion and seal with clear lacquer.
- D. Wire Marker Installation:
1. Install wire marker for each conductor at panelboard gutters; pull boxes, outlet and each load connection.
  2. Mark data cabling at each end. Install additional marking at accessible locations along the cable run.
  3. Install labels at data outlets identifying patch panel and port designation as indicated on Drawings.

END OF SECTION

SECTION 28 31 00

FIRE ALARM SYSTEM

PART 1 - GENERAL REQUIREMENTS

1.1 DESCRIPTION

- A. This section of the specification includes the furnishing, installation, connection and testing of the microprocessor controlled, intelligent reporting fire alarm equipment required to form a complete, operative, coordinated system. It shall include, but not be limited to, alarm initiating devices, alarm notification appliances, Fire Alarm Control Panel (FACP), auxiliary control devices, annunciator, Ethernet and/or digital alarm communications to central stations and wiring as shown on the drawings and specified herein.
- B. The fire alarm system shall comply with requirements of NFPA Standard No. 72 for Local Protected Premises Signaling Systems except as modified and supplemented by this specification. The system field wiring shall be supervised either electrically or by software-directed polling of field devices.
  - 1. The Secondary Power Source of the fire alarm control panel will be capable of providing at least 24 hours of backup power with the ability to sustain 5 minutes in alarm at the end of the backup period.

1.2 SCOPE

- A. An intelligent, microprocessor – controlled, fire alarm detection system shall be installed in accordance to the project specifications and drawings.
- B. The features and capacities described in this specification are a requirement for this project and shall be furnished by the successful contractor. The system as described shall be installed, programmed, tested, and delivered to the owner in fully operational condition. The system shall include all required hardware, software, raceways and interconnecting wiring to accomplish the requirements of this specification and the contract drawings, whether or not specifically itemized herein. The system shall consist of, but not be limited to, the following:
  - 1. Fire Alarm Control Panel (FACP).
  - 2. Remote Annunciator Panel(s) with LCD Alphanumeric Display.
  - 3. Addressable Manual Dual Action Fire Alarm Pull Boxes.
  - 4. Addressable Analog Smoke Detectors.
  - 5. Addressable Area Heat Detectors.
  - 6. Addressable Intelligent Interface Modules.
  - 7. Audible and Visual Notification Appliances.
- C. Non-addressable alarm initiating, supervisory and status monitored devices shall be integrated into the fire alarm system, as applicable, via the addressable intelligent interface module:
  - 1. Sprinkler Water Flow Alarm (alarm initiating).
  - 2. Sprinkler Valve Tamper Switch (supervisory).

3. Security Interface.
- D. Audible/visual notification appliances and communicating devices to be controlled by the FACP:
  1. Horns.
  2. Strobe Lights.
  3. Combination Horn/Strobes.
- E. Devices to be controlled by the FACP, remote system programmable addressable relays and/or intelligent addressable interface module relays:
  1. Connections to the Appropriate Receiving Agency for Manual Station Alarm, Sprinkler Alarm, Smoke Alarm, Interfaced Suppression System Alarm, Supervisory and System Trouble Conditions.
- F. Fire Alarm Control Panel 120V Circuit:
  1. Fire Alarm Contractor shall include the scope of work to finish and install the 120V circuit to the FACP as shown on the drawings. This work is to be performed by a licensed electrical contractor.

### 1.3 RELATED DOCUMENTS/WORK AND EXISTING CONDITIONS

- A. Related Documents:
  1. Prior to the commencement of work, the contractor shall obtain all permits necessary for installation of the work. All permit costs and inspection fees shall be included as part of the required work.
  2. Local requirements shall be adhered to with regard to submitting specifications, wiring diagrams, shop drawings and plans. Responsibility for furnishing the quantities of copies on paper, as directed by such requirements, shall be included as part of the work of this section.
  3. Prior to commencement and after completion of work, the contractor shall notify all authorities having jurisdiction.
  4. The contractor shall submit a letter of approval of the installation, from the local code authority, before requesting final acceptance of the system.
- B. Related Work:
  1. The contractor shall coordinate work in this section with all related trades. Work and/or equipment provided in other sections and related to the fire alarm system shall include, but not be limited to:
    - a. Sprinkler water flow alarm and valve tamper switches to be provided and installed by the fire protection sprinkler contractor. They shall be wired and connected to the fire alarm system by the contractor.
    - b. Coordinate with all other trade contractors for the mounting of and/or interfacing with any and all other fire alarm system related devices.
- C. Existing Conditions
  1. The Contractor shall visit the site to determine and verify all existing conditions. Existing conditions that would, in the contractor's opinion, prohibit or greatly delay construction progress shall be brought to the Engineer's attention in writing.

2. No additional compensation shall be permitted for variations due to field conditions that would affect the installation of the fire alarm system.

#### 1.4 REFERENCES - APPLICABLE LISTINGS, CODES, STANDARDS, DOCUMENTS

##### A. Standards and Codes:

1. All equipment shall be installed and comply with the current adopted provisions of the following codes and standards.
2. All equipment shall be Underwriters' Laboratories (UL), Inc. listed for its intended use. As a minimum, the following standards shall apply:
  - a. UL 268 and 268A - Smoke Detectors for Fire Protective Signaling Systems - Detectors Duct Application.
  - b. UL 346 - Water-Flow Indicators for Fire Protective Signaling Systems.
  - c. UL 464 - Audible Signaling Appliances.
  - d. UL 864 - Control Units for Fire Protective Signaling Systems.
  - e. UL 1481 - Power Supplies for Fire Protective Signaling Systems.
  - f. UL 1971 - Signaling Devices for the Hearing-Impaired.
3. National Fire Protection Association (NFPA) standards (latest applicable edition).
  - a. NFPA No. 13 - Sprinkler Alarm and Supervision.
  - b. NFPA No. 70 - National Electrical Code.
  - c. NFPA No. 72 - National Fire Alarm Code.
  - d. NFPA No. 101 - Life Safety Code.
4. All wiring shall be installed in compliance with NFPA Standard 70 (National Electrical Code - Article 760). Codes shall be implicitly followed, in particular with regard to material type and quality, circuitry extensions from and connections to outlet and junction boxes, panel boards and similar appurtenances.
5. The fire alarm system and its installation shall comply with all applicable requirements of The Americans with Disabilities Act.
6. The fire alarm system and its installation shall comply with all other local codes and authorities having jurisdiction.

#### 1.5 DEFINITIONS

- A. **Initiating Device:** A system component that originates transmission of a change of state condition, such as a smoke detector, manual fire alarm box, supervisory switch, etc.
- B. **Initiating Device Circuit:** A circuit to which automatic or manual initiating devices are connected where the signal received does not identify the individual device operated. Typically known as a "Zone" for conventionally wired systems or circuits.
- C. **Notification Appliance:** A fire alarm system component such as a bell, horn, speaker, strobe, etc., that provides an audible or visual output or both.
- D. **Notification Appliance Circuit:** A circuit or path directly connected to a notification appliance.
- E. **Signaling Line Circuit:** A circuit or path between any combination of circuit interfaces, control units, or transmitters over which multiple system input or output signals or both

are carried. (When used with addressable analog initiating devices, these SLC circuits are also known as "Addressable Loops")

**Note:** Both Signaling Line Circuits and Initiating Device Circuits operate initiating devices; however, they provide different communication capabilities. Code requirements differ greatly for performance and capacities. Refer to NFPA 72.

## 1.6 SYSTEM DESCRIPTION

- A. The system shall operate as a protected premise fire alarm control system.
- B. Sensor "dirty" and "excessively dirty" trouble conditions shall report automatically.
- C. Devices shall be listed by UL for sensitivity testing by means of the portable programmer/tester or by readout from the control panel. Each addressable device address shall be set electronically, devices requiring dipswitch settings, rotary switch settings, staples or jumper settings are not acceptable.
- D. Smoke detectors shall alarm at their programmed sensitivity settings and shall not revert to a common default setting when their operating system segment is in the fail safe degrade mode.
- E. System individually identifies each addressable initiating device and other addressable monitor functions using multiplexing interfacing techniques.
- F. Life safety alarm function programs shall perform automatically upon system alarm actuation. In addition, control points may be operated manually at any time by the attendant through appropriate keyboard commands. The system FCS shall also provide integral programmable function control switches to allow personnel to manually operate specific pre-programmed control output functions, as required.

## 1.7 QUALITY ASSURANCE

- A. It is the intent of these specifications to provide a complete fire alarm system that complies in all respects with the requirements of all-applicable codes and standards. Equipment, materials, software, installation practices, etc. that do not meet these requirements or do not meet the performance standards herein specified shall not be acceptable.
- B. The equipment furnished under this specification shall be that of the specified manufacturer as an acceptable approved manufacturer. All information herein is intended to establish minimum standards of performance, quality and construction, and is based upon addressable analog equipment manufactured in the United States.
- C. Before commencing work the fire protection contractor shall submit data showing that the manufacturer has successfully installed fire alarm systems of the same scope, type and design as specified. The contractor shall also include the names and locations of at least three installations where such systems have performed satisfactorily for the preceding 18 months.

1. The Contractor shall submit three copies of all required Licenses and Bonds as required in the State of Texas.
  2. The installing contractor shall employ on staff (full time 40hrs per week) a minimum of one NICET level 3 Fire Alarm Planner and (2) NICET II technicians and a professional engineer, registered in the State of Texas.
- D. Provide the services of a representative or technician from the manufacturer of the system. The representative or technician is to be certified and experienced in the installation and operation of the type of system provided. The representative shall be licensed in the State of Texas, if required by law. The fire alarm contractor shall supervise installation, software programming, software documentation, adjustments, preliminary testing, final testing and certification of the system. The fire alarm contractor shall also be required to provide operational instruction to the owner's personnel. Instruction shall include system operation, maintenance, programming and arm/disarm procedures.
- E. All fire alarm system equipment furnished under this specification shall be UL listed, under the appropriate category, as the product of a single manufacturer. All control equipment shall be listed under UL as a single control unit. The manufacturer shall have been engaged in the production of this type of equipment for at least ten (10) years and have a fully equipped service organization capable of responding within 8 hours from the initial contact for warranty or regular service work. Emergency and/or off hours calls shall be responded to within 8 hours of initial contact seven days a week.
- F. With bid submittal, the contractor shall state what, if any, specific points of the proposed system's operation or the equipment's quality differ in any way from this specification by submission of a complete technical proposal to include supporting literature and drawings. Only those departures from these specifications, submitted in writing at the time of bid, shall be considered by the Engineer during the submittal review phase. Failure to submit all departures from these specifications at the time of bid shall be cause for summary rejection of any submittal documents where additional departures are discovered.

## 1.8 DRAWINGS

- A. Drawings and Instructions: Contract drawings for Fire Alarm work are basis of design documents, and in part diagrammatic, intended to convey the scope of work and indicate general arrangement of equipment, interlocks, conduit and approximate sizes and locations of equipment and devices. Fire Alarm trades shall follow these drawings in laying out their work, consult other trades and existing conditions to familiarize themselves with all conditions affecting their work, and shall verify and coordinate spaces in which their work will be installed. The contract drawings shall be considered as a part of these specifications. It is intended that any Contractor making proposal to execute any work should study the drawings for his own particular trade, as well as all drawings of all other trades in order to fully understand the work he is expected to perform. As a qualification for bidding, the contractor shall visit the site and be responsible for determining all existing conditions in as far as it affects his work prior to submitting a proposal.

- B. General: The Drawings are schematic in nature and indicate approximate locations of the Fire Alarm equipment, devices, conduit, etc., except where specific locations are noted and dimensioned on the Drawings. All items are shown approximately to scale. The intent is to show how these items shall be integrated into the building. Locate all items by on-the-job measurements and in accordance with the Contract Documents. Cooperate with other trades to ensure project completion as indicated.
- C. Unless otherwise expressly agreed to in writing, all rights to the Fire Alarm specifications and drawings prepared by Alderson & Associates, Inc. shall belong to Alderson & Associates, Inc. The sole exception is that the specifications and drawings may be used for construction of the project for which the specifications and drawings were prepared if all other contractual obligations have been complied with, including the payment of fees. Each page of the drawings, if prepared in whole or in part by Alderson & Associates, Inc., and all pages of these specifications of Section are covered by copyright and may not be reproduced, published or used in any way without the permission of Alderson & Associates, Inc.
- D. Location: Prior to locating Fire Alarm equipment, devices, etc., obtain the Engineer's approval as to exact location. Locations shall not be determined by scaling drawings. Mounting heights shall be as directed by the Engineer or in accordance with the A.D.A and Texas Accessibility Standards. Contractor shall be responsible for costs of redoing work of trades necessitated by failure to comply with this requirement.

#### 1.9 DISCREPANCIES

- A. Clarification: Clarification shall be obtained before submitting a proposal for the Work under the fire alarm divisions as to discrepancies or omissions from the Contract Documents or questions as to the intent thereof.
- B. Contractor Agreement: Consideration will not be granted for misunderstanding of the amount of work to be performed. Tender of a proposal conveys full Contractor agreement of the items and conditions specified, shown, scheduled, or required by the nature of the project.
- C. The drawings intend that all equipment and devices be arranged as shown with necessary minor rearrangements to suit the equipment approved and to comply with the requirements of the various equipment manufacturers' recommendations. Some minor rearrangements are expected to best fit the structural conditions. It shall be the responsibility of the Contractor to make known his desires in such change, by shop drawings as required, to obtain agreement of the Engineer before proceeding with any change or variation. Changes required by job conditions, equipment employed, or structural conditions of the building shall be at no cost to the Owner.
- D. Perform all work in strict accordance with the requirements and recommendations stated in the codes and standards except when requirements are modified by the contract documents. Nothing in the Contract Documents shall be construed to permit work not conforming to these codes. When two or more codes or standards are applicable to the same work, then the stricter code or standard shall govern. The date of the code or standard is that in effect on the date of issue of the contract documents except when a particular publication date is specified. The Contractor shall be held responsible for

verifying all State, Federal, NFPA, local codes and ordinances that may alter any part of the plans or specifications. The Contractor shall bear all costs for correcting the deficiencies. Where particular publication date is specified. The Contractor shall be held responsible for verifying all State, Federal, NFPA, local codes and ordinances that may alter any part of the plans or specifications. The Contractor shall bear all costs for correcting the deficiencies. Where local codes and ordinances are not in writing or on record but a local precedence has been set, the Owner shall pay for any additional cost incurred.

#### 1.10 SUBMITTALS

- A. Submittal Procedures:
  - 1. Submittal Preparation:
    - a. Minimum of six copies are required, complete (all items submitted at one time), index to each Section of Specifications and include the following information and action taken.
      - 1. Project Name
      - 2. Date
      - 3. Name and Address of Engineer
      - 4. Name, Address and Telephone Number of Contractor or Sub-contractors.
      - 5. Manufacturer's Name
      - 6. Published ratings or capacity data
      - 7. Detailed equipment drawing for fabricated items
      - 8. Wiring diagrams
      - 9. Installation instructions
      - 10. Other pertinent data
      - 11. All required submittals and data, bound together, submitted at one time.
    - b. Where literature is submitted covering a group or series of similar items, the applicable items must be clearly indicated on each copy with a highlighter pen, or other means of identification clearly legible.
    - c. Data and shop drawings shall be coordinated and included in a single submission. Multiple submissions are not acceptable except where prior approval has been obtained from the Engineer. In such cases, a list of data to be submitted later shall be included with the first submission. Failure to submit shop drawings that meet the requirements of the Drawings and Specifications in ample time for review shall not entitle the Contractor to an extension of contract time, and no claim for extension by reason of such Contractor default shall be allowed.
- B. Submittal Organization: Organize all required data in a 3-ring binder of sufficient size with index tabs with number and appropriate title of specification section.
- C. Provide a cover sheet and an index sheet listing all items submitted.
- D. Show any revisions to equipment layout required by use of selected equipment. The Engineer shall receive submittals no later than thirty (30) working days from contract date with General Contractor and Owner.

- E. The Engineer's review of submittals is only for confirmation of adherence to design of project and does not relieve the Contractor of final responsibility for furnishing all materials required for a complete working system and in complying with the Contract Documents in all respects.
- F. The complete submittal shall include, but not be limited to, all of the following material:
1. Power Calculations
    - a. Battery capacity calculations shall be a minimum of 125% of the calculated requirement.
    - b. Supervisory power requirements for all equipment.
    - c. Alarm power requirements for all equipment.
    - d. Power supply rating justification showing power requirements for each of the system power supplies. Power supplies shall be sized to furnish the total connected load in a worst case condition plus 25% spare capacity.
    - e. Voltage-drop calculations for wiring runs demonstrating worst case condition.
  2. Complete manufacturers catalog data including supervisory power usage, alarm power usage, physical dimensions, finish and mounting requirements.
  3. Provide the address, telephone number, and contact person(s) of the manufacturer's local service facility for normal and off-hour warranty issues.
  4. Obtain manufacturers printed installation directions to aid in properly executing work.
  5. Provide a fire alarm system function matrix. Matrix shall illustrate alarm output events in association with initiating devices input events. Matrix shall represent a summary of the installed system alarm, supervisory and trouble functions. Include any and all departures, exceptions, variances or substitutions from these specifications and/or drawings at the time of bid. Failure to provide this requirement shall be cause for summary rejection of submittal documents where additional departures are discovered. (See Appendix-A NFPA-72 for minimum matrix requirements.
  6. For each system control panel and/or transponder panel, provide panel ampere loading during both normal and alarm modes, with time calculations to substantiate compliance with battery back-up power requirements (battery Ampere-Hour capacity), described elsewhere in these specifications.
  7. For each system control panel and/or transponder panel, provide written schedule of active and spare addresses provided on each addressable circuit to substantiate compliance with circuit usage/spare requirements, described elsewhere in these specifications.
  8. For each system control panel and system transponder notification appliance circuit provide a written schedule of spare capability in amperes available for future possible use.
  9. Provide manufacturer's printed product data, catalog pages and descriptions of any special installation requirements and/or procedures. Drawings depicting any special physical installation requirements shall show physical plans, elevations, all dimensions, conduit entry, minimum access clearances and any other details required.
  10. Provide shop drawings as follows:
    - a. Drawing or catalog page showing actual dimensions of the main FACP.

- b. Drawing(s) or catalog page(s) showing actual dimensions of any additional system control panels, amplifier cabinets and/or battery cabinets.
  - c. Drawing or catalog page showing actual dimensions of the remote annunciator(s).
  - d. Single line riser diagram showing, all equipment, all connections and number and size of all conductors and conduits.
11. The fire protection contractor shall provide copies of certification for service technician's formal training by the system manufacture. As a minimum, certification documents shall indicate training dates, systems qualified, name of individual certified and current status.

## **PART 2 - SYSTEM OPERATION**

### **2.1 BASIC SYSTEM EQUIPMENT, CIRCUITING, ADDRESSING AND OPERATING CAPABILITIES**

#### **A. General**

1. The FACP, remote control transponder panels shall communicate via an RS-485 Carrier Sense, Multiple Access, Collision Detect protocol, also known as CSMA/CD or an ETHERNET type topology.
2. System power supplies, including necessary transformers rectifiers, regulators, filters and surge protection required for system operation, with the capacity to power the system in a worst case condition with all devices in alarm and all local indicating appliances active without exceeding the listed ratings. All system devices shall display normal and alarm conditions consistently whether operating from normal power or reserve (standby) power.
  - a. Systems not displaying an alarm indication at each detector when in a standby power mode shall include an addressable remote LED indicator to perform this required function.
  - b. System primary power: Primary power for the FACP and the secondary power battery chargers shall be obtained from a dedicated power circuit. Circuit breakers shall be fitted with a suitable guard, requiring removal of a screw to open, and used only for fire alarm. Each circuit used for fire alarm purposes shall be permanently labeled for function.
  - c. Secondary power supply: Provide sealed gelled electrolyte batteries as the secondary power supply for all fire alarm functions. The battery supply shall be calculated to operate loads in a supervisory mode for twenty four (24) hours power applied, and after that time, operate in alarm mode for fifteen (15) minutes. Batteries shall be sized at 125% of the calculated size to compensate for deterioration and aging during the battery life cycle. Battery calculations shall be submitted to justify the battery size.
3. Provide battery-charging circuitry for each standby battery bank in the system. The charger shall be automatic in design, adjusting the charge rate to the condition of the batteries. All system battery charge rates and terminal voltages shall be read using the fire alarm control panel LCD display in the service mode, indicating directly in volts and amps. Meters reading in percentage are not acceptable.

4. The system 16 bit core processor shall incorporate an internal operating system to process incoming alarm signals and issue output commands required as a result of the alarm reception, by system programming or by manual commands. All system processors shall be supervised by individual watchdog circuitry furnishing automatic restart after loss of activity. Systems with single watchdog circuits for all processors shall not be acceptable unless supplied with a "hot" standby CPU. Digital communication capabilities required for the control panel to communicate with remote annunciators, input/output drivers and displays shall be provided.
5. Manual addressable fire pull boxes shall be dual action and listed by Underwriters' Laboratories, Inc. The intelligent manual fire station shall operate on any addressable detection circuit. It shall be red in color. Manual fire stations shall be individually annunciated on the control panel. Mounting height shall be 48" inches to the manual station actuation handle from the finished floor.
6. Intelligent/analog smoke detectors shall be photoelectric and listed by Underwriters' Laboratories, Inc. The detector shall contain a long life light emitting diode (LED) as its light source, and photo diode as a light receiver. An automatic gain control circuit shall be compensating for detector aging and dirt accumulation. The smoke detector shall be a plug-in twist/lock unit that allows for easy connection to its mounting base. Each smoke detector, when activated, shall have a flashing tri-color LED alarm indicator that shall indicate red for alarm, yellow for trouble and green for normal operational mode. Application Specific Detection environmental settings shall be programmed as directed by the engineer. System programming shall provide multiple out-put functions from a single initiating multi-criteria smoke detector. This capability shall mean a separate alarm event output for smoke alarm and a separate alarm output function for thermal alarm from a single analog initiating address device. Systems not capable of providing this design requirement shall provide alternate programmable logic accomplishing design performance, acceptable to the engineer of record.
7. It shall be possible to adjust and/or electronically measure the sensitivity of each individual intelligent analog smoke sensor from the control panel. Relative sensitivity or manual test methods, which check the smoke sensor at the maximum allowable obscuration, will not be considered as being equivalent.
8. Smoke detectors shall alarm at their programmed sensitivity settings and shall not revert to a common default setting when their operating system segment is in the fail safe degrade mode.
9. Heat detectors shall be 135° F fixed temperature or fixed temperature/rate of rise and be listed by Underwriters' Laboratories, Inc. Rate-of-rise alarm threshold rate shall be 15° F per minute with a maximum coverage area of 2,500 sq. ft. Activation of the rate-of-rise heat detector shall be self-restoring. All detectors shall be addressable and have a white finish. The thermal detectors shall be individually annunciated on the control panel. Each heat detector, when activated, shall have a flashing tri-color LED alarm indicator that shall indicate red for alarm, yellow for trouble and green for normal operational mode.
10. Interface modules shall be intelligent and listed by Underwriters' Laboratories, Inc. The unit shall incorporate a custom microprocessor based integrated circuit that provides communication with main fire control panel. The interface module shall supervise and monitor normally open or normally closed dry contacts and

report their status to the control panel. The intelligent interface module shall be used to uniquely identify field devices (contacts) such as water flow switches, tamper switches, OS&Y valves or as directed by these specifications and project drawings.

11. The intelligent interface module shall also be used when remote relays are required for system control functions, such as, but not limited to, fan shut downs. Relay dry contacts shall be rated at 4 AMPS, 120 VAC resistive or 30 VDC resistive and shall be Form "C".
12. Device address and sensitivity assignments shall be predetermined electronically, devices requiring dipswitch settings, rotary switch settings, staples or jumper settings are not acceptable.
13. The FACP addressable data communications circuits shall support one hundred percent (100%) of the addressable devices in alarm or operated at the same time, during both primary (AC) and secondary (battery) power conditions. Systems that cannot support one hundred percent (100%) of the system address capacity in alarm or operated simultaneously cannot assure appropriate system alarm responses and shall not be acceptable.
14. The FACP shall provide NFPA 72, Style Y, two-wire (Class B), notification appliance circuits.
  - a. General floor audible notification appliance circuits shall, as a minimum, consist of two (2) circuits. Circuits shall be installed in an alternate style, so that 50% of the audible devices installed would be operationally functional should one circuit fail.
  - b. Additional appliance circuits for other than general floor areas may be required for this project. Fire rated or special use areas, such as assembly areas, may require additional notification circuits. Refer to project drawings and/or specifications.
15. Horns shall be of sufficient number so that an alarm shall be clearly audible to all occupants of the building and/or fire area, as required by these specifications. Mounting height shall be a minimum of 96" inches to the centerline of the unit above the finished floor. Locations where ceilings prevent the installation at 96" inches centerline, the centerline of the unit shall be 6" inches below the ceiling.
16. Audible alarm signals shall produce a sound level at least 15 dBA above the average ambient sound level or 5 dBA above the maximum sound level having a duration of a least 60 seconds (whichever is greater) measured 5 feet above the floor in each occupiable area. The average ambient sound level is the root mean square, a weighted sound pressure measured over a 24-hour period.
17. Strobes shall be installed as shown on the drawings in accordance with the requirements of the UL 1971 standard and NFPA 72. Where multiple visual notification appliances can be seen from any location, circuitry shall be incorporated for the synchronization of flash rate.
  - a. Strobes shall produce a flash rate of one (1) flash per second minimum over the listed input voltage (20VDC - 31VDC) range.
  - b. Strobes shall incorporate a Xenon flashtube enclosed in a rugged Lexan lens or equivalent with solid state circuitry.
  - c. Strobe intensity shall be rated per UL 1971 for 15, 30, 60, 75 or 110 Candela.
  - d. Strobes shall be available for semi-flush or surface mounting and in conjunction with audible appliances as required.
18. Software and firmware control:

- a. All software and firmware provided with a fire alarm system shall be listed for use with the fire alarm control unit.
  - b. A record of installed software and firmware version numbers shall be maintained at the location of the fire alarm control unit.
  - c. All software and firmware shall be protected from unauthorized changes through the use of "access levels."
- B. System Alarm Operation**
1. Activation of any addressable manual fire pull box, area smoke detector, heat, or alarm causing intelligent interface module shall result in, as a minimum, the following functions and indications:
    - a. Activate "ALARM" notification to the FACP.
    - b. Activate "ALARM" notification to a approved U.L. listed central station and/or on site location as shown on the drawings.
    - c. Activate emergency evacuation audible and visual notification appliances throughout the facility.
    - d. Annunciate alarm notification on system remote alphanumeric annunciators.
    - e. Record event in the non-volatile system historical log.
    - f. Activate the associated device alarm LED alarm indicator.
- C. System Supervisory Functions**
1. Activation of any supervisory circuit, (i.e.; supervised fire sprinkler valve closure, low temperature) shall cause the following actions and indications:
    - a. Activate "Supervisory Alarm" notification to the FACP indicating device address, device type, device location, time and date.
    - b. Activate "Supervisory Alarm" notification to a approved U.L. listed central station and/or on site location as shown on the drawings.
    - c. Annunciate alarm notification on system remote alphanumeric annunciators.
    - d. Audible signals shall be silencable from the control panel by an acknowledge switch.
    - e. Record event in the non-volatile system historical log.
- D. System Trouble Functions**
1. Receipt of a system trouble alarm, shall cause the following actions and indications:
    - a. Activate "Trouble Alarm" notification to the FACP indicating device address, device type, device location, time and date.
    - b. Activate "Trouble Alarm" notification to a approved U.L. listed central station and/or on site location as shown on the drawings.
    - c. Audible signals shall be silencable from the control panel by an acknowledge switch.
    - d. Record event in the non-volatile system historical log.
  2. The fire alarm system wiring shall be electrically supervised to automatically detect and report trouble conditions to the FACP.
  3. System addressable devices shall be supervised for placement and normal operation. Removal of an addressable device or the failure of its internal electronic circuitry shall initiate a system trouble condition.

4. The FACP panel shall initiate a system trouble condition when the following occurs:
    - a. Primary 120/220 VAC power loss.
    - b. Battery disconnect.
    - c. Battery low voltage.
  5. Operating a central station agency alarm disconnect switch or any manual control commands that alter the system from its normal programmed standby configuration shall initiate a trouble condition.
  6. Trouble conditions shall automatically activate an audible signal and flash the general system trouble LED indicator at the FACP. Pressing the trouble acknowledge key on the FACP shall silence the audible signal and continuously light the LED indicator, until the trouble condition is repaired. Subsequent trouble conditions shall re-sound the audible signal and again flash the LED. Each trouble condition must be individually acknowledged.
  7. Removal of or failure of internal electronic circuitry of any addressable device shall initiate a system trouble condition.
- E. Installation Shop/As-built Drawings
1. Show general layout of complete system including equipment arrangement. It shall be the responsibility of the fire alarm contractor to verify dimensions and ensure compatibility of all system interfaces. Shop drawings shall be maintain at the job site and shall be updated on an as needed basis. During the project life cycle, the Engineer may require updated drawings as reference during scheduled project meetings.
    - a. Identify on the drawings, conduit and conductor sizes and types with number of conductors in each conduit. Provide each conduit and device with a unique identification. For addressable alarm initiation devices, the system identifier shall be the system address for that device. Signals shall be sequentially numbered with the address of the associated control module.
  2. As-built drawings shall indicate point to point wiring diagrams of interconnecting wiring within all system control panels and termination enclosures showing wiring between modules and connecting field device terminals. All field numbering and/or labeling shall be reflected on As-built drawings.
  3. Provide mounting details of FACP, remote transponder control panels, system terminal enclosures and other boxes to building structure, showing fastener type, sizes, material and embedded depth.
  4. A wiring diagram of the alarm system shall be prepared and installed within the main control panel and in each remote system control panel respectively. When it becomes necessary to mount the diagram outside of the cabinet, the diagram shall be framed under glass or equivalent material.
- F. Boxes, Enclosures and Wiring Devices
1. Boxes shall be installed plumb and firmly in position.
  2. Extension rings with blank covers shall be installed on junction boxes where required.
  3. Junction boxes served by concealed conduit shall be flush mounted.
  4. Upon initial installation, all wiring outlets, junction, pull and outlet boxes shall have dust covers. Dust covers shall not be removed until wiring installation when permanent dust covers or devices are installed.

5. All junction boxes shall be painted fire department red and be affixed with a decal or silk-screened label "Fire Alarm System."
6. Wet or damp locations shall require a NEMA rated enclosure suitable for the environment in which an addressable field device or module are to be installed. (i.e. monitoring of sprinkler water flow, tamper switches and OS&Y valves)
7. Termination enclosures shall be, as a minimum, NEMA 12 rated. Termination junction boxes shall be of adequate size and room to facilitate ease of accessibility to work on wiring and to provide ample space for proper identification labeling. Enclosure design shall incorporate the use of a back plate within the enclosure to provide ease of installation. Terminal blocks shall be affixed to a secured mounting rail. Terminal enclosures shall be painted fire department red and stenciled "Interior Fire Alarm System."
8. Electrical conduits shall enter only at the side or the bottom of control cabinets, unless designed and approved for entry on the top.
9. All conduits shall be grounded to a water main by approved ground clamps with a conductor equal in size to the largest conductor used in the system; but in no case shall the ground conductor be smaller than no. 10 AWG.
10. All openings in fire rated walls, floors or ceilings where conduits, cables or wiring trays pass through shall be fire stopped with an approved fireproofing material rated to meet or exceed the rating of the assembly penetrated.
11. Structural steel fireproofing shall not be removed or degraded during the installation of fire protection conduits, conduit hangers, clamps, enclosures or cabling unless properly repaired or replaced with an approved compatible fireproofing material consisting of proper depth and density. Should the fireproofing repairs prove inadequate, the installing contractor shall be responsible for adhesion and cohesion testing by an independent testing company and repair as needed.

**G. Conductors**

1. Each conductor shall be identified as shown on the drawings at each with wire markers at terminal points. Attach permanent wire markers within 2 inches of the wire termination. Marker legends shall be visible.
2. All wiring shall be supplied and installed in compliance with the requirements of the National Electric Code, NFPA 70, Article 760, and that of the manufacturer-wiring guides.
3. Wiring for analog loop circuits, conventional detection circuits, audio/visuals shall be based on the fire alarm manufacturer's wiring guidelines, but shall not be smaller than #18 AWG.
4. Plenum rated cable, if used, shall be rated for 150°C with an insulation of Teflon or its equivalent.
5. Splices shall be made with UL listed mechanical connectors to assure reliable service.
6. Crimp-on type spade lugs shall be used for terminations of stranded conductors to binder screw or stud type terminals. Spade lugs shall have upset legs and insulation sleeves sized for the conductors.
7. Wire nuts or other solderless splicing devices shall not be used.
8. A consistent color code for fire alarm system conductors throughout the installation shall be provided. The installation contractor shall submit for approval prior to installation of wire, a proposed color code for system conductors to allow rapid identification of circuit types.

9. All nominal voltage branch circuit power feeds (120/220 VAC) shall be identified "labeled" at both ends of the circuit to indicate its source and purpose.
10. Wiring within system control panels shall be arranged and routed to allow accessibility to equipment for adjustment and maintenance and to isolate nominal voltage wiring from system low voltage wiring.
11. Splices in electrical conductors in vertical risers are prohibited except when the length of conductors exceeds 150 feet in vertical risers, an approved terminal cabinet shall be used.

### PART 3 - TEST AND ACCEPTANCE

#### 3.1 FIELD QUALITY CONTROL

- A. Certificate of Compliance
  1. Complete and submit to the project engineer in accordance with NFPA 72.
- B. Field – Testing General
  1. Detectors shall not be installed until after the construction clean up of all trades is complete and final. *Where required by the authority having jurisdiction for protection during construction, detectors that have been installed prior to final clean-up by all trades shall be cleaned or replaced in accordance with Chapter 7 -NFPA 72.*
  2. Each addressable analog smoke detector shall be individually field tested prior to installing the device at its designated location to ensure reliability after shipment and storage conditions. A dated log indicating correct address, type of device, sensitivity and initials of the technician performing test - using test equipment specifically designed for that purpose - shall be prepared and kept for final acceptance documentation. After testing, the detection devices and base shall be labeled with the system address, date and initials of installing technician. Labeling shall not be visible after installation is complete.
  3. Wiring runs shall be tested for continuity, short circuits and grounds before system is energized. Resistance, current and voltage readings shall be made as work progresses.
    - a. A systematic record shall be maintained of all readings using schedules or charts of tests and measurements. Areas shall be provided on the logging form for readings, dates and witnesses.
    - b. The acceptance inspector shall be notified before the start of any required tests. All items found at variance with the drawings or this specification during testing or inspection by the acceptance inspector shall be corrected.
    - c. Test reports shall be delivered to the acceptance inspector as completed.
  4. All test equipment, instruments, tools and labor required to conduct the system tests shall be made available by the installing Contractor. The following equipment shall be a minimum for conducting the tests:
    - a. Ladders and scaffolds as required to access all installed equipment.
    - b. Multimeter for reading voltage, current and resistance.
    - c. Intelligent device programmer-tester.
    - d. Laptop computer with programming software for any required program revisions.

- e. Two way radios, flashlights, smoke generation devices and supplies.
  - f. Decibel meter.
  - g. Testing documentation.
5. In addition to the testing specified to be performed by the installing contractor, the installation shall be subject to test by the acceptance inspector.

C. Final Acceptance Testing

1. A written "Acceptance Test Procedure" (ATP) for testing the fire alarm system components and installation will be prepared in accordance with NFPA 72 and this specification. The contractor shall be responsible for the performance of the ATP, demonstrating the function of the system and verifying the correct operation of all system components, circuits and programming.
2. A final As-built Function Matrix shall be prepared by the installing contractor referencing each alarm input to every output function affected as a result of an alarm, trouble or supervisory condition on that input. In the case of outputs programmed using more complex logic functions involving "any", "or", "not", "count", "time", and "timer" statements; the complete output equation shall be referenced in the matrix.
3. The installing contractor prior to the ATP shall prepare a complete listing of all device labels for alphanumeric annunciator displays.
4. The acceptance inspector shall use the system record drawings during the testing procedure to verify operation as programmed. In conducting the ATP, the acceptance inspector shall request demonstration of any or all input and output functions. The items tested shall include but not be limited to the following:
  - a. System wiring shall be tested to demonstrate correct system response and correct subsequent system operation in the event of:
    1. Open, shorted and grounded intelligent analog signaling line circuit.
    2. Open, shorted and grounded conventional initiating device circuits.
    3. Intelligent device removal.
    4. Primary power or battery disconnected.
    5. Incorrect device address.
    6. Loss of data communications between system annunciators.
  - b. System evacuation alarm indicating appliances shall be demonstrated as follows:
    1. All alarm notification appliances actuate as programmed.
    2. Audibility and visibility at required levels.
  - c. System indications shall be demonstrated as follows:
    1. Correct message display for each alarm input, at the control panel, each remote alphanumeric LCD display.
    2. Correct annunciator light for each alarm input, at each annunciator.
  - d. System on-site and/or off-site reporting functions shall be demonstrated as follows:
    1. Correct alarm custom message display, address, device type, date and time transmitted for each alarm input.
    2. Correct trouble custom message display, address, device type, date and time transmitted for each alarm input.
    3. Trouble signals received for disconnect.

- e. Secondary power capabilities shall be demonstrated as follows:
    - 1. System primary power shall be disconnected for a period of time as specified herein. At the end of that period, an alarm condition shall be created and the system shall perform as specified for a period as specified.
    - 2. System primary power shall be restored for forty-eight hours and system-charging current shall be normal trickle charge for a fully charged battery bank.
    - 3. System battery voltages and charging currents shall be checked at the fire alarm control panel using the test codes and displayed on the LCD display.
    - 4. In the event of system failure to perform as specified and programmed during the ATP procedure, at the discretion of the acceptance inspector, the test shall be terminated.
  - f. The installing Contractor shall retest the system, correcting all deficiencies and providing test documentation to the acceptance inspector.
  - g. In the event that software changes are required during the ATP, the system manufacturer to compare the edited program with the original shall furnish a utility program. This utility shall yield a printed list of the changes and all system functions, inputs and outputs affected by the changes. The items listed by this program shall be the minimum acceptable to be retested before calling for resumption of the ATP. The printed list of the retesting shall be submitted before scheduling of the ATP.
  - h. The acceptance inspector may elect to require the complete ATP to be performed again if, in his opinion, modifications to the system hardware or software warrant complete retesting.
- D. Documentation
- 1. System documentation shall be furnished to the owner and shall include but not be limited to the following:
    - a. System record drawings and wiring details including one set of reproducible masters and drawings on a CD in a DXF format suitable for use in a CAD drafting program.
    - b. System operation, installation and maintenance manuals.
    - c. Written documentation for all logic modules as programmed for system operation with a matrix showing interaction of all input signals with output commands.
    - d. Documentation of system voltage, current and resistance readings taken during the installation, testing and ATP phases of the system installation.
    - e. System program “hard copy” showing system functions, controls and labeling of equipment and devices.
- E. Test Equipment
- 1. The Contractor shall furnish to the owner all test equipment as required to program the field analog devices, specifically an intelligent device programmer-tester or a calibrated smoke generator with power source.

- F. Warranty/Services
  - 1. The Contractor shall warrant the entire system against system hardware and electrical defects including programming software defects for a period of one year. This period shall begin upon satisfactory completion and certification of final acceptance testing of the system and sign acceptance of consulting engineer. Contractor shall provide to owner a letter stating the start-date and end-date of warranty period. In addition, the contractor shall also provide an updated list of name(s) and phone number(s) for normal and off-hours contacts necessary to respond to warranty issues. Response to warranty notification shall require a reply within 24 hours of initial contact.
  
- G. Training
  - 1. The fire alarm contractor shall furnish training as follows for a minimum of four employees of the system user:
    - a. Training in the receipt, handling and acknowledgment of alarms.
    - b. Training on system operation including manual control of output functions from the FACP.
    - c. Training in the testing of the system including logging of detector sensitivity, field test of devices and response to common troubles.
    - d. The total training requirement shall be a minimum of 3 hours, but shall be sufficient to cover all items specified.
    - e. The manufacturer shall provide a written schedule of training dates for factory training of Owner's representatives. Include all fees, dates, times, phone numbers and contact individual.

END OF SECTION