**Company Name:** 



TARRANT COUNTY PURCHASING DEPARTMENT

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## **VOLUME 2 – TECHNICAL SPECIFICATIONS**

### RFB NO. 2023-071

# PROJECT MANUAL FOR FIRE ALARM REPLACEMENT

TARRANT COUNTY PLAZA BUILDING 200 TAYLOR STREET FORT WORTH, TEXAS 76196

### BIDS DUE FEBRUARY 23, 2023 2:00 P.M. CST

Technical Specifications Prepared by

BAIRD, HAMPTON & BROWN 6300 RIDGLEA PLACE, SUITE 700 FORT WORTH, TEXAS 76116

### RFB NO. 2023-071



### **Scope Summary**

То:	Bidders
Date:	October 18, 2022
Subject:	Plaza Building – Fire Alarm System Replacement

Turnkey project including the replacement of an existing addressable fire alarm detection and notification system with a new addressable fire alarm detection and notification system with voice evacuation meeting high-rise building requirements. The work will require the following trades: electrical, fire alarm, demolition, core drilling, drywall repair, painting and ceiling repair.

- 1. This is a turnkey project. The awarded bidder is responsible to provide all labor, materials, supervision, tools, services equipment, and incidentals necessary for complete and operational systems shown on the contract documents.
- 2. This building is a high-rise building and shall meet all high-rise requirements for the fire alarm voice evacuation system.
- 3. Provide all testing and inspections during weekends. Provide city's premium cost in bid for testing and inspections performed on weekends.
- 4. A fire watch is required for full duration of time of any outage of fire alarm coverage for the facility. The fire watch will be provided by the owner. Coordinate outages requiring a fire watch with the owner with two weeks' notice in writing.
- 5. Re-use existing electrical conductors where possible. Extend new circuits as required to serve new fire alarm system from spare 20a/1p circuit breakers in nearby emergency panelboard.
- 6. Re-use existing fire alarm cabling to the furthest extent possible. The existing system is wired as Class B. Upgrade to Class A wiring where required by code.
- Remove existing fire alarm cabling and exposed conduits associated with existing devices that are being demolished but not replaced. Refer to specifications section 26 05 11 for requirements for performing work in existing buildings.
- All work in this project shall be performed after regular work hours (5:00PM to 6:00AM).
  Contractor will be escorted by Tarrant County Personnel at all times.

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- 9. Coordinate switchover from old fire alarm system to new fire alarm system with city of Fort Worth fire department prior to switchover. Contractor shall provide proposed method/schedule of sequence of switchover for review as part of bid package.
- 10. Provide blank coverplates over any wall openings left by demolition of existing devices. Refer to division 1 and 26 specifications for any cutting of walls, ceilings, and other construction.
- 11. Provide interface between new fire alarm system and the existing smoke control, access control, air sampling, smoke curtain, fire pump, building public address/speakers, building automation system, server room pre-action, elevator recall and sprinkler systems. Existing elevator pits are sprinklered. All work interfacing with building control system must be coordinated with Enviromatic Systems. All work on the building control system shall be by Enviromatic Systems. Contact Sid Ellis at phone number 972-206-2590. The cost for all controls work shall be included in the contractors bid. The smoke control system will not be replaced as part of this project.
- 12. Replace existing firefighter telephone devices if required to interface with new fire alarm system. A radio study is not required to be included as part of this project.
- 13. Provide 2-hour rated fire alarm riser cabling through vertical path indicated on drawings and wherever else required by code. Provide additional vertical pathways as required with ratings as required for complete system installation. Coordinate additional floor coring locations with owner prior to coring.
- 14. Furnish attic stock to owner at location designated by owner including five of each type of the following devices: pull station, smoke detector, duct detector, heat detector, wall strobe, wall speaker, wall speaker/strobe, ceiling speaker, ceiling strobe and ceiling speaker/strobe.
- 15. Provide any additional coring as required to install new fire alarm system. Coordinate all locations of additional floor cores with engineer.
- 16. New fire alarm control panel shall be UUKL listed.
- Elevator interface and associated testing of new fire alarm system are to be included in the bid. Owner's elevator service contractor is Southwest Elevators, LLC, (817)924-2828, 301 Commerce St., STE 2360, Fort Worth, TX 76102. The elevator pits are presently sprinklered; the elevator shafts are not.

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#### SECTION 01 02 70

#### APPLICATIONS FOR PAYMENT

#### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This section specifies administrative and procedural requirements governing the Contractor's Applications for Payment.
- B. The Contractor's Construction Schedule and Submittal Schedule are included in section "Submittals."

#### 1.3 APPLICATION FOR PAYMENT:

- A. Each Application for Payment shall be consistent with previous applications and payments as certified by the Engineer and paid for by the Owner.
  - 1. The initial Application for Payment, the application for payment at the time of substantial Completion, and the final Application for payment involve additional requirements.
- B. Payment Application Times: Each progress payment date is as indicated in the agreement. The period of construction work covered by each Application or payment is the period indicated in the agreement.
- C. Payment Application Times: Use AIA Document G702 and Continuation Sheets G703 as the form for application for payment.
- D. Application Preparation: Complete every entry on the form, including notarization and execution by person authorized to sign legal documents on behalf of the Owner. Incomplete applications will be returned without action.
- E. Transmittal: Submit three (3) executed copies of each Application for Payment.
  - 1. Transmit each copy with a transmittal form listing attachments, and recording appropriate information related to the application.
- F. Waivers of Mechanics Lien: With each Application for Payment, submit waivers of mechanics lien from every entity who may lawfully be entitled to file a mechanics lien arising out of the Contract, and related to the work covered by the payment. Owner will provide partial waiver and final waiver lien forms to be attached to each application, for payment.
- G. Initial application for Payment: Administrative actions and submittals that must precede or coincide with submittal of the first Application for payment include the following:

- 1. Certificates of insurance and insurance policies must be submitted and approved before any on-site work begins
- 2. Performance and payment bonds (if required).
- 3. Data needed to acquire Owner's insurance.
- 4. Initial settlement survey and damage report, if required.
- H. Application for payment at Substantial Completion: following issuance of the Certification of Substantial Completion, submit an application for payment; this application shall reflect any certificates of partial Substantial Completion issued previously for Owner occupancy of designated portions of the work, if any.
- I. Administrative actions and submittals that shall proceed or coincide with Application for Payment at Substantial Completion included:
  - 1. Occupancy permits and similar approvals.
  - 2. Warranties (guarantees) and maintenance agreements.
  - 3. Test/adjust/balance records.
  - 4. Maintenance instructions.
  - 5. Change-over information related to Owners occupancy use, operation and maintenance.
  - 6. Final cleaning.
  - 7. Application for reduction of retainage and consent of surety.
  - 8. Advice on shifting insurance coverage.
  - 9. List of incomplete work, recognized as exceptions to Engineer's Certificate of Substantial Completion.
- J. Final Payment Application: Administrative actions and submittals that must precede or coincide with submittal of the final payment Application for Payment include the following:
  - 1. Completion of project close out requirements.
  - 2. Completion of items specified for completion after substantial completion.
  - 3. Assurance that unsettled claims will be settled.
  - 4. Assurances that work not complete and accepted will be completed without undue delay.
  - 5. Proof that taxes, fees and similar obligations have been paid.
  - 6. Removal of temporary facilities and services.
  - 7. Removal of surplus materials, rubbish and similar elements.

#### PART 2 - PRODUCTS - NOT USED

#### PART 3 - EXECUTION - NOT USED

#### END OF SECTION 01 02 70

#### SECTION 01 03 50

#### MODIFICATION PROCEDURES

#### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of contract, including supplementary conditions and other division 1 specification sections, apply to this section.

#### 1.2 SUMMARY:

- A. This section specifies administrative and procedural requirements for handling and processing contract modifications.
- B. Related Sections: The following sections contain requirements that relate to this section.
  - 1. Division 1 Section 01 02 70, "Applications for Payment" for administrative procedures governing applications for payment.
  - 2. Division 1 Section 01 60 50, "Products, Substitutions, and Submittals", for administrative procedures for handling requests for substitutions made after award of the contract.

#### 1.3 MINOR CHANGES IN THE WORK:

A. Supplemental instructions authorizing minor changes in the work, not involving an adjustment to the contract sum or contract time, will be issued by the Engineer on AIA form, G710, Engineers Supplemental Instructions.

#### 1.4 CHANGE ORDER PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Proposed changes in the work that will require adjustment to the contract sum or contract time will be issued by the Engineer, with a detailed description of the proposed change and supplemental or revised drawings and specifications, if necessary.
  - 1. Proposal requests issued by the Engineer are for information only. Do not consider them instruction either to stop work in progress, or to execute the proposed change.
  - 2. Unless otherwise indicated in the proposal request, within 10 days of receipt of the proposal request, submit to the Engineer for the Owner's review an estimate of cost necessary to execute the proposed change.
    - a. Include a list of quantities of products to be purchased and unit costs, along with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.
    - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
    - c. Include a statement indicating the effect the proposed change in the work will have on the contract time.
- B. Contractor-Initiated Change Order Proposal Requests: When latent or other unforeseen conditions require modifications to the contract, the Contractor may propose changes by

submitting a request for a change to the Engineer, with a copy to the Owner's Representative.

- 1. Include a statement outlining the reasons for the change and the effect of the change on the work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the contract sum and contract time.
- 2. Include a list of quantities of products to be purchased and unit costs along with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.
- 3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
- 4. Comply with requirements in section "Product Substitutions" if the proposed change in the work requires the substitution of one product or system for a product or system specified.
- C. Proposal Request Form: Use AIA Doc. G709 for Change Order Proposal Requests.

#### 1.5 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: When the Owner and Contractor are not in total agreement on the terms of a Change Order Proposal Request, the Engineer may issue a Construction Change Directive on AIA Form G714, instructing the Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
  - 1. The Construction Change Directive will contain a complete description of the change in the Work and designate the method to be followed to determine change in the contract sum or contract time.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION 01 03 50

#### SECTION 01 04 00

#### PROJECT COORDINATION

#### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section specifies administrative and supervisory requirements necessary for Project coordination including, but not necessarily limited to:
  - 1. Coordination.
  - 2. General installation provisions.
  - 3. Cleaning and protection.

#### 1.3 PROJECT SCHEDULE

A. Prior to the start of any work on the project, the Contractor shall develop an overall project schedule for completion of all elements of the work. The project schedule shall be reviewed and approved by the Engineer and Owner prior to the start of any work. The Engineer and the Owner will be kept informed as to any proposed revisions to the project schedule.

#### 1.4 COORDINATION

- A. Coordination: Coordinate construction activities included under various Sections of these Specifications to assure efficient and orderly installation of each part of the Work. Coordinate construction operations included under different Sections of the Specifications that are dependent upon each other for proper installation, connection, and operation.
  - 1. Where installation of one part of the Work is dependent on installation of other components, either before or after its own installation, schedule construction activities in the sequence required to obtain the best results.
  - 2. Where availability of space is limited, coordinate installation of different components to assure maximum accessibility for required maintenance, service and repair.
  - 3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Where necessary prepare memoranda for distribution to each party involved outlining special procedures required for coordination. Include such items as required notices, reports, and attendance at meetings.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
  - 1. Installation and removal of temporary facilities.

- 2. Delivery and processing of submittals.
- 3. Progress meetings. Coordinate meeting schedule with the Engineer.
- 4. Project Close-Out Activities.
- D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.

PART 2 - PRODUCTS - NOT USED

#### PART 3 - EXECUTION

#### 3.1 GENERAL INSTALLATION PROVISIONS

- A. Inspection of Conditions: Require the Installer of each major component to inspect both the substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.
- B. Manufacturer's Instructions: Comply with manufacturer's installation instructions and recommendations, to the extent that those instructions and recommendations are more explicit or stringent than requirements contained in the Contract Documents.
- C. Inspect materials or equipment immediately upon delivery and again prior to installation. Reject damaged and defective items.
- D. Provide attachment and connection devices and methods necessary for securing work. Secure Work true to line and level. Allow for expansion and building movement.
- E. Visual Effects: Provide uniform joint widths in exposed Work. Arrange joints in exposed Work to obtain the best visual effect. Refer questionable choices to the Engineer for final decision.
- F. Recheck measurements and dimensions, before starting each installation.
- G. Install each component during weather conditions and Project status that will ensure the best possible results. Isolate each part of the completed construction from incompatible material as necessary to prevent deterioration.
- H. Coordinate temporary enclosures with required inspections and tests, to minimize the necessity of uncovering completed construction for that purpose.
- I. Mounting Heights: Where mounting heights are not indicated, install individual components at standard mounting heights indicated. Refer questionable mounting height decisions to the Engineer for final decision.

#### 3.2 CLEANING AND PROTECTION

A. During handling and installation, clean and protect construction in progress and adjoining materials in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

- B. Clean and maintain completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- C. Limiting Exposures: Supervise construction activities to ensure that no part of the construction, completed or in progress is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period. Where applicable, such exposures include, but are not limited to, the following:
  - 1. Excessive static or dynamic loading.
  - 2. Excessive internal or external pressures.
  - 3. Excessively high or low temperatures.
  - 4. Thermal shock.
  - 5. Excessively high or low humidity.
  - 6. Air contamination or pollution.
  - 7. Water or ice.
  - 8. Solvents.
  - 9. Chemicals.
  - 10. Bacteria.
  - 11. Rodent and insect infestation.
  - 12. Combustion.
  - 13. Electrical current.
  - 14. High speed operation.
  - 15. Improper lubrication.
  - 16. Unusual wear or other misuse.
  - 17. Contact between incompatible materials.
  - 18. Misalignment.
  - 19. Excessive weathering.
  - 20. Unprotected storage.
  - 21. Improper shipping or handling.
  - 22. Theft.
  - 23. Vandalism.

END OF SECTION 01 04 00

#### SECTION 01 04 50

#### CUTTING AND PATCHING

#### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for cutting and patching.
- B. Refer to other Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.
  - 1. Requirements of this Section apply to fire alarm and electrical installations. Refer to Division 26 and Division 28 Sections for other requirements and limitations applicable to cutting and patching electrical installations.

#### 1.3 SUBMITTALS

- A. Cutting and patching Proposal: Where approval of procedures for cutting and patching is required before proceeding, submit a proposal describing procedures well in advance of the time cutting and patching will be performed and request approval to proceed. Include the following information, as applicable, in the proposal:
  - 1. Describe the extent of cutting and patching required and how it is to be performed; indicate why it cannot be avoided.
  - 2. Describe anticipated results in terms of changes to existing construction; include changes to structural elements and appearance and other significant visual elements.
  - 3. List products to be used and firms or entities that will perform Work.
  - 4. Indicate dates when cutting and patching is to be performed.
  - List utilities that will be distributed or affected, including those that will be relocated and those that will be temporarily out-of-service. Indicate how long service will be disrupted.
  - 6. Where cutting and patching involves addition of reinforcement to structural elements, submit details and engineering calculations to show how reinforcement is integrated with the original structure.
  - 7. Approval by the Engineer to proceed with cutting and patching does not waive the Engineer's right to later require complete removal and replacement of a part of the work found to be unsatisfactory.

#### 1.4 QUALITY ASSURANCE

A. Requirements for Structural Work: Do not cut and patch structural elements in a manner that would reduce their load-carrying capacity or load-deflection ratio.

- 1. Obtain approval of the cutting and patching proposal before cutting and patching the following structural elements:
  - a. Foundation construction.
  - b. Bearing and retaining walls.
  - c. Structural concrete.
  - d. Structural steel.
  - e. Lintels.
  - f. Timber and primary wood framing.
  - g. Structural decking.
  - h. Miscellaneous structural metals.
  - i. Equipment supports.
  - j. Piping, ductwork, vessels and equipment.
  - k. Structural systems of special construction in Division-13.
- B. Operational and Safety Limitations: Do not cut and patch operating elements or safety related components in a manner that would result in reducing their capacity to perform as intended, or result in increased maintenance, or decreased operational life or safety.
- C. Visual Requirements: Do not cut and patch construction exposed on the exterior or in occupied spaces, in a manner that would, in the Engineer's opinion, reduce the building's aesthetic qualities, or result in visual evidence of cutting and patching. Remove and replace all work cut and patched in a visually unsatisfactory manner.
  - 1. If possible retain the original installer or fabricator to cut and patch the following categories of exposed Work, or if it is not possible to engage the original installer or fabricator, engage another recognized experienced and specialized firm:
    - a. Processed concrete finishes.
    - b. Matched-veneer woodwork.
    - c. Pre-formed metal panels.
    - d. Window wall system.
    - e. Stucco and ornamental plaster.
    - f. Acoustical ceilings.
    - g. HVAC enclosures, cabinets or covers.

#### PART 2 - PRODUCTS

#### 2.1 MATERIALS

A. Use materials that are identical to existing materials. If identical materials are not available or cannot be used where exposed surfaces are involved, use materials that match existing adjacent surfaces to the fullest extent possible with regard to visual effect. Use materials whose installed performance will equal or surpass that of existing materials.

#### PART 3 - EXECUTION

- 3.1 INSPECTION
  - A. Before cutting existing surfaces, examine surfaces to be cut and patched and conditions under which cutting and patching is to be performed. Take corrective action before proceeding, if unsafe or unsatisfactory conditions are encountered.
    - 1. Before proceeding, meet at the site with parties involved in cutting and patching. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

#### 3.2 PREPARATION

- A. Temporary Support: Provide temporary support of work to be cut.
- B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of the project that might be exposed during cutting and patching operations.
- C. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- D. Take all precautions necessary to avoid cutting existing pipe, conduit or ductwork serving the building, but scheduled to be removed or relocated until provisions have been made to bypass them.

#### 3.3 PERFORMANCE

- A. General: Employ skilled workmen to perform cutting and patching. Proceed with cutting and parching at the earliest feasible time and complete without delay.
- B. Cutting: Cut existing construction using methods least likely to damage elements to be retained or adjoining construction. Where possible review proposed procedures with the original installer; comply with original installer's recommendations.
  - 1. In general, where cutting is required, use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots neatly to size required with minimum disturbance of adjacent structures. Temporarily cover openings when not in use.
  - 2. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces.
  - 3. Cut through concrete and masonry using a cutting machine such as a Carborundum saw or diamond core drill.
  - 4. Comply with requirements of applicable Sections of Division-2 where cutting and patching requires excavating and backfilling.
- C. Patching: Patch with durable seams that are as invisible as possible. Comply with specified tolerances.
  - 1. Where feasible, inspect and test patched areas to demonstrate integrity of the installation.
  - 2. Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
  - 3. Where removal of walls or partitions extends one finished area into another, patch and repair floor and wall surfaces in the new space to provide an even surface of uniform color and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
    - a. Where patching occurs in a smooth painted surface, extend final paint coat over entire unbroken containing the patch, after the patched area has received primer and second coat.

4. Patch, repair or rehang ceilings as necessary to provide an even plane surface of uniform appearance.

#### 3.4 CLEANING

A. Thoroughly clean areas and spaces where cutting and patching is performed or used as access. Remove completely paint, mortar, oils, putty and items of similar nature. Thoroughly clean piping, conduit and similar features before painting or other finishing is applied. Restore damaged pipe coverings to their original condition.

#### END OF SECTION 01 04 50

#### SECTION 01 20 50

#### PROCEDURES AND CONTROLS

#### PART 1 - GENERAL

#### 1.1 DESCRIPTION OF REQUIREMENTS:

- A. Definitions: Specific quality control requirements for the work are indicated throughout the contract documents. In particular, quality control provisions for manufactured products are specified in individual work sections and are not repeated herein. The requirements of this section are primarily related to performance of the work beyond furnishing of manufactured products. The term "Quality Control" includes, but is not necessarily limited to, inspection and testing and associated requirements.
- 1.2 LIMITATIONS FOR USE OF SITE:
  - A. Closely coordinate all site space requirements with the Owner.
  - B. General: In addition to site utilization limitations and requirements by contract documents, administer allocation of available space equitably among entities needing access and space, so as to produce best overall efficiency in performance of total work of project. Schedule deliveries so as to minimize space and time requirements for storage of materials and equipment on site.
  - C. Waste Materials: Dispose of organic and hazardous materials off the site.
- 1.3 TRADESPERSONS AND WORKMANSHIP STANDARDS:
  - A. General: Instigate and maintain procedures to ensure that persons performing work at site are skilled and knowledgeable in methods and craftsmanship needed to produce required quality-levels for workmanship in completed work. Remove and replace work that does not comply with workmanship standards as specified and as recognized in the construction industry for applications required. Remove and replace other work damaged or deteriorated by faulty workmanship or by its replacement.
- 1.4 INSPECTIONS, TESTS AND REPORTS:
  - A. All testing required during the course of construction shall be performed by an independent testing laboratory employed and paid for by the Contractor. The cost of all testing shall be included as a part of the Contract Amount.
  - B. The Owner may perform his own independent testing or may observe the Contractor's testing, at his option.
  - C. Failure of test agencies to perform satisfactorily shall not relieve contractor of responsibility for fulfillment of requirements of contract documents. Required inspection and testing services are intended to assist in determination of probably compliances of work with requirements, but do not relieve Contractor of responsibility for those compliances, or for general fulfillment of requirements of contract documents. Specified inspections and tests are not intended to limit Contractor's quality control program. Afford reasonable access to agencies performing tests and inspections.

#### PART 2 - PRODUCTS - NOT USED

#### PART 3 - EXECUTION

#### 3.1 COORDINATION OF TEST AGENCY WORK - NOT USED

- 3.2 GENERAL INSTALLATION PROVISIONS:
  - A. Installer's Inspection of Conditions: Require Installer of each major unit of work to inspect substrate to receive work, and conditions under which work will be performed, and to report in writing to Contractor unsatisfactory conditions. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to installer.
  - B. Manufacturer's Instructions: Where installations include manufactured products, with manufacturer's applicable instructions and recommendations for installation, to the extent these are more explicit or more stringent than requirements in contract documents.
  - C. Inspect each item of materials or equipment immediately prior to installation, and reject damaged and defective items.
  - D. Provide attachment and connection devices and methods for securing work properly as it is installed, true to line and level, and within recognized industry tolerances if not otherwise required. Allow for expansions and building movements. Provide uniform joint widths in exposed work, organized for best possible visual effect. Refer questionable visual-effect choices to the Engineer for final decision.
  - E. Recheck measurements and dimensions of the work, as an integral step of starting each installation.
  - F. Install work during conditions of temperature, humidity, exposure, forecast weather, and status of project completion that will ensure best possible results for each unit of work, in coordination with entire work. Isolate each unit of work from non-compatible work, as required to prevent deterioration.
  - G. Coordinate enclosure (closing-in) of work with required inspections and tests, so as to minimize necessity of uncovering work for that purpose.
  - H. Mounting Heights: Where mounting heights are not indicated, mount individual units of work at industry-recognized standard mounting heights for applications required. Facilities intended for use by the physically handicapped shall be mounted as required by current rules relating to the elimination of architectural barriers. Refer questionable mounting height choices to the Engineer for final decision.

#### 3.3 CLEANING AND PROTECTION

A. General: During handling and installation of work at project site, clean and protect work in progress and adjoining work on a basis of continuous maintenance. Apply suitable protective covering on newly installed work where reasonable required to ensure freedom from damage or deterioration at time of substantial completion; otherwise, clean and perform maintenance on newly installed work as frequently as necessary through remainder of construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

B. Limiting Exposures of Work: To the extent possible through reasonable control and protection methods, supervise performance of work in a manner and by means which will ensure that none of the work, whether completed or in progress, will be subjected to harmful, dangerous, damaging, or otherwise deleterious exposures during construction period. Such exposures include, but are not necessarily limited to, static loading, dynamic loading, internal pressures, high or low temperatures, thermal shock, high or low humidity, air contamination or pollution, water, ice, solvents, chemicals, light, radiation, puncture, abrasion, heavy traffic, soiling bacteria, insect infestation, combustion, electrical current, high speed operation, improper lubrication, unusual wear, misuse, incompatible interface, destructive testing, misalignment, excessive weathering, unprotected storage, improper shipping/handling, theft and vandalism.

#### END OF SECTION 01 20 50

#### SECTION 01 60 50

#### PRODUCTS, SUBSTITUTIONS, AND SUBMITTALS

#### PART 1 - GENERAL

#### 1.1 DEFINITIONS

- A. "Products" is defined to include purchased items for incorporation into the work, regardless of whether specifically purchased for project or taken from Contractor's stock of previously purchased products.
- B. "Materials" is defined as products which must be substantially cut, shaped, worked, mixed, finished, refined or otherwise fabricated, processed, installed or applied to form units of work.
- C. "Equipment" is defined as products with operational parts, regardless of whether motorized or manually operated, and particularly including products with service connections (wiring, piping, etc.).
- D. Definitions in this paragraph are not intended to negate the meaning of other terms used in contract documents, including "specialties," "systems," "structure," "finishes," "accessories," "furnishings," "special construction," and similar terms, which are self-explanatory and have recognized meanings in the construction industry.

#### 1.2 QUALITY ASSURANCE:

A. Source Limitations: To the greatest extent possible for each unit of work, provide products or materials of a singular generic kind and from a single source.

#### 1.3 PRODUCT DELIVERY-STORAGE-HANDLING:

A. General: Deliver, handle and store products in accordance with manufacturer's recommendations and by methods and means that will prevent damage, deterioration, and loss including theft. Control delivery schedules to minimize long-term storage of products at site and overcrowding of construction spaces. In particular, provide delivery/installation coordination to ensure minimum holding or storage times for products recognized to be flammable, hazardous, easily damaged, or sensitive to deterioration, theft and other sources of loss.

#### 1.4 WARRANTIES / GUARANTEES:

- A. Categories of Specific Warranties: Warranties on the work are in several categories, including those of General conditions, and including (but not necessarily limited to) the following specific categories related to individual units of work specified in sections of Divisions 26 and 28 of these specifications:
  - 1. Special Project Warranty (Guarantee): A warranty specifically written and signed by Contractor for a defined portion of the work and, where required, countersigned by subcontractor, installer, manufacturer or other entity engaged by Contractor.
  - 2. Specified Product Warranty: A warranty which is required by contract documents to be provided for a manufactured product incorporated into the work, regardless of whether manufacturer has published a similar warranty without regard for specific

incorporation of product into the work, or has written and executed a special project warranty as a direct result of contract document requirements.

- 3. Coincidental Product Warranty: A warranty which is not specifically required by contract documents (other than as specified in this Section), but which is available on a product incorporated into the work, by virtue of the fact that manufacturer of product has published warranty in connection with purchases and uses of project without regard for specific applications except as otherwise limited by terms of warranty.
- B. Refer to individual sections of Divisions 26 and 28 for the determination of units of work that are required to be specifically or individually warranted, and for the specific requirements and terms of those warranties.
- C. General Limitations: It is recognized that specific warranties are intended primarily to protect Owner against failure of the work to perform as required, and against deficient, defective and faulty materials and workmanship, regardless of sources. Except as otherwise indicated, specific warranties do not cover failures in the work which result from the following:
  - 1. Unusual and abnormal phenomena of the elements.
  - 2. The Owner's misuse, maltreatment or improper maintenance of the work.
  - 3. Vandalism after time of substantial completion.
  - 4. Insurrection or acts of aggression including war.
- D. Related Damages and Losses: In connection with Contractor's correction of warranted work which has failed, remove and replace other work of project which has been damaged as a result of such failure, or which must be removed and replaced to provide access for correction of warranted work.
  - 1. Consequential Damages: Except as otherwise indicated or required by governing regulations, special project warranties and product warranties are not extended to cover damage to building contents (other than work of Contract) which occurs as a result of failure of warranted work.
- E. Reinstatement of Warranty Period: Unless specifically noted otherwise, when work covered by a special project warranty or product warranty has failed and has been corrected by replacement or restoration, reinstate warranty by written endorsement for a period of time starting on date of acceptance of replaced or restored work and ending upon date original warranty would have expired if there had been no failure.
- F. Replacement Cost, Obligations: Unless specifically noted otherwise, cost of replacing of restoring a warranted unit or product is Contractor's obligation, without regard for whether Owner has already benefited from use through a portion of the anticipated useful service life.
- G. Rejection of Warranties: Owner reserves the right, at time of substantial completion or thereafter, to reject coincidental product warranties submitted by Contractor, which in opinion of Owner tend to detract from or confuse interpretation of requirements of contract documents.
- H. Contractor's Procurement Obligations: Do not purchase, subcontract for, or allow others to purchase or sub-subcontract for materials or units of work for project where a special project warranty, specified product warranty, certification or similar commitment is required,

until it has been determined that entities required to countersign such commitments are willing to do so.

#### 1.5 GENERAL PRODUCT COMPLIANCES:

- A. General: The compliance requirements, for individual products as indicated in contract documents, are multiple in nature and may include generic descriptive, proprietary performance, compliance with standards, compliance with codes, conformance with graphic details and other similar forms and methods of indicating requirements, all of which must be complied with.
- B. Procedures for Selecting Products: Contractor's options for selecting products are limited by contract document requirements, and governing regulations, and are not controlled by industry traditions or procedures experienced by Contractor on previous construction projects. Required procedures include, but are not necessarily limited to, the following for various indicated methods of specifying:
  - 1. Single Product/Manufacturer Name: Provide product indicated, except advise Engineer before proceeding, where known that named product is not a feasible or acceptable selection.
  - Two or More Product/Manufacturer Names: Provide one of the named products, at Contractor's option, but excluding products which do not comply with requirements. Do not provide or offer to provide an unnamed product, except where none of named products comply with requirements or are a feasible selection; advise Engineer before proceeding.
  - 3. "Or Equal:" Where named products in specifications text are accompanied by the term "or equal," or other language of similar effect, comply with those contract document provisions concerning "substitutions" for obtaining Engineer's approval (by change order) to provide an unnamed product.
  - 4. Standards, Codes and Regulations: Where only compliance with an imposed standard, code or regulation is required, selection from among products which comply with requirements including those standards, codes and regulations, is Contractor's option.
  - 5. Performance Requirements: Provide products that comply with specific performance indicated, and which are recommended by manufacturer (in published product literature or by individual certification) for application indicated. Overall performance of a product is implied where product is specified with only certain specific performance requirements.
  - 6. Prescriptive Requirements: Provide products which have been produced in accordance with prescriptive requirements, using specified ingredients and components, and complying with specified requirements for mixing, fabricating, curing, finishing, testing and similar operations in manufacturing process.
  - 7. Visual Matching: Where matching with an established sample is required, final judgment of whether a product proposed by Contractor matches sample satisfactorily shall be made by the Engineer. Where no product within specified cost category is available which matches sample satisfactorily and complies with requirements, comply with contract document provisions concerning "substitutions" and "change orders" for selection of a matching product outside established cost category, of a product not complying with requirements.
  - 8. Visual Selection: Except as otherwise indicated, where specified product requirements include "as selected from manufacturer's standard colors, patterns, textures..." or words of similar effect, the selection of manufacturer and basic product (comply with

requirements) is Contractor's option, and subsequent selection of color, pattern and texture is Engineer's selection. Where specified product requirements include "...as selected from standard colors, patterns, textures available within the industry...", or words to that effect, selection of product (complying with requirements, and within established cost category) is Engineer's selection, including designation of manufacturer where necessary to obtain desired color, pattern or texture.

#### 1.6 GENERAL PRODUCT REQUIREMENTS:

- A. General: Provide products which comply with requirements, and which are undamaged and unused at time of installation, and which are complete with accessories, trim, finish, safety guards and other devices and details needed for complete installation and for intended use and effect.
  - 1. Standard Products Where Available: Provide standard products of types that have been produced and used previously and successfully on other projects and in similar applications.
  - 2. Continued Availability: Where additional amounts of a product, by nature of its application, are likely to be needed by Owner at a later date for maintenance and repair or replacement work, provide a standard, domestically produced product which is likely to be available to Owner at such later date.
- B. Nameplates: Except as otherwise indicated, for required approval labels, do not permanently attach or imprint manufacturer's or producer's nameplates or trademarks on exposed surfaces or products which will be exposed to view on exterior of the work.
  - 1. Labels: Locate required labels and stamps on a concealed surface or, where required for observation after installation, on an accessible surface which is not conspicuous.

#### 1.7 SUBSTITUTIONS:

- A. General:
  - 1. The requirements for substitutions do not apply to specified Contractor options on products and construction methods.
  - 2. Revisions to contract documents, where requested by Owner or Engineer, are "changes," not "substitutions."
  - 3. Requested substitutions during bidding period, which have been accepted prior to Contract Date, are included in contract document and are not subject to requirements for substitutions as specified herein.
  - 4. Contractor's determination of and compliance with governing regulations and orders issued by governing authorities do not constitute a basis for change orders, except as provided for in contract documents.
  - 5. All other requests by the Contractor for changes in products, materials and methods of construction required by contract documents will be considered requests for "substitutions," and are subject to requirements hereof.
- B. Requests for Substitutions Prior to Award of Contract:
  - 1. Reference Volume 1 requests for substitutions are to be submitted at the Questions and Answer period and submitted per the bid documents.

- 2. It shall be the responsibility of the Bidder to provide a clear, well-documented, and easily referenced presentation of all comparison data and physical samples relating to any request for substitution. Time constraints and the quantity of materials will not allow the Engineer to research or perform any comparison work relating to requests for substitution.
- 3. All substitute materials, products, or equipment that are acceptable to the Engineer will be listed in an addendum that will be distributed to all Bidders.
- 4. Requests for substitution that are deemed by the Engineer to be incomplete or unacceptable will not be acted upon.
- C. Requests for Substitutions After Award Contract:
  - 1. After the Contract has been executed, the Owner and Engineer will consider a formal request for the substitution of products in place of those specified, under the following conditions:
    - a. The request for proposed substitution shall be submitted within 30 days after award of the Contract. All requests submitted after expiration of this time limit shall be accompanied by a certified letter from the manufacturer that the specified product(s) is/are no longer available.
    - b. The request shall be accompanied by complete data on the proposed substitution substantiating compliance with the Contract Documents including product identification and description, performance and test date, references and samples where applicable, and an itemized comparison of the proposed substitution with the products specified or named by Addenda, with data relating to Contract time and schedule, design and artistic effect where applicable, and its relationship to separate contracts.
    - c. The request shall be accompanied by accurate cost data on the proposed substitution if modification of the Contract Sum is to be a consideration.
    - d. Extensive revisions to contract documents shall not be required and changes shall be in keeping with general intent of contract documents.
    - e. One or more of the following conditions shall be satisfied in the judgment of the Engineer:
      - 1) Request is directly related to an "or equal" clause or other language of same effect in contract documents.
      - 2) Required product, material or method cannot be provided within Contract Time, but not as a result of Contractor's failure to pursue the work promptly or to coordinate various activities properly.
      - 3) Required product, material or method cannot be provided in a manner which is compatible with other materials of the work, or cannot be properly coordinated therewith, or cannot be warranted as required, or cannot be used without adversely affecting Owner's insurance coverage on completed work, or will encounter other substantial noncompliance which are not possible to overcome otherwise except by making requested substitution. In requesting the substitutions, Contractor thereby certifies to overcome such non-compatibility, non-coordination, non-warranty, non-insurability, or other non-compliance as claimed.
      - 4) Required product, material or method cannot receive required approval by a governing authority, and requested substitution can be so approved.
      - 5) Substantial advantage is offered Owner, in terms of cost, time, energy conservation or other valuable considerations, after deducting off-setting responsibilities Owner may be required to bear, including additional compensation to Engineer for redesign and evaluation services, increased cost of other work by Owner or separate contractors, and similar considerations.

- f. A request for substitution not meeting the above conditions will be returned without action having been taken, except to record non-compliance with the requirements.
- g. Requests for substitution, when forwarded by the Contractor to the Engineer in accordance with the conditions described above, are understood to mean that the Contractor:
  - 1) Represents that he has personally investigated the proposed substitute product and determined that it is equal or superior in all respects to that specified;
  - 2) Will provide the same guarantee for the substitution that he would for that specified;
  - 3) Certifies that the cost data presented is complete and includes all related costs under this Contract, but excludes costs under separate contracts and the Engineer's redesign costs, and that he waives all claims for additional costs related to the substitution which subsequently becomes apparent; and
  - 4) Will coordinate the installation of the accepted substitute, making such changes as may be required for the work to be complete in all respects.
- h. Substitutions will not be considered if:
  - 1) They are requested after expiration of specified time limit;
  - 2) They are indicated or implied on shop drawing submissions without the formal request required above; or
  - 3) For their implementation they require a substantial revision of the contract documents in order to accommodate their use.

#### 1.8 SUBMITTALS:

- A. General:
  - 1. The Contractor shall carefully review the individual sections of specifications to determine the requirements for submittals of shop drawings, samples, test reports, certificates and other data. He shall forward all submittals to the Engineer at the time and in the number required by the specifications.
  - 2. The Contractor shall provide a list of all required submittals in the form of the sample schedule included as the last page of this section. This schedule shall be forwarded to the Engineer not later than seven (7) days following the date of a written "Notice to Proceed."
  - 3. Contractor shall check all submittals for completeness and accuracy prior to forwarding them to the Engineer. If submittals are incomplete or obviously inaccurate, the Engineer will send them back to the Contractor unchecked.
  - 4. All submittals shall be dated and marked to show the names of the Project, Engineer, Contractor, manufacturer or supplier, and separate detailer, if pertinent. Submittals shall completely identify the specification section and locations at which material or equipment is to be installed. Reproductions of contract drawings are acceptable as shop drawings only when specifically authorized in writing by the Engineer.
  - 5. Each submittal shall be accompanied by a separate transmittal letter on which the following information is stated:
    - a. Name of project
    - b. Name of Contractor
    - c. Date of submittal
    - d. Contractor's submittal number
    - e. Specification section number (and paragraph number, if required for clarification.)
    - f. Name of material or product
    - g. Other pertinent data as required for complete identification

- B. Shop Drawings:
  - 1. Shop drawing submittals which relate to architectural and structural items shall consist of one reproducible transparency and one blue-line print of each drawing; for items relating to mechanical and electrical work, include one reproducible transparency and two blue-line prints of each drawing. Shop drawings shall include details of fabrication, erection, layout and setting, as well as such other information as may be required by the various sections of the specifications.
  - After shop drawings have been checked and any corrections noted, the transparencies would be returned to the Contractor for reproduction and distribution. The Engineer will retain blue-line prints.
  - 3. Contractor is responsible for distributing required prints of shop drawings to his subcontractors and material suppliers. Prints of reviewed shop drawings shall be made from transparencies that carry the Engineer's stamp.
- C. Descriptive Data:
  - 1. Submittals which consist of manufacturer's descriptive data, including catalogue sheets for materials, equipment and fixtures, shall show dimensions, performance characteristics and capacities, wiring diagrams and controls, schedules, and other pertinent information as required. Where printed materials describe more than one product or model, clearly identify which is to be furnished.
- D. Review by Engineer:
  - 1. For any single item, the Engineer will review the original submittal and, if necessary, one revised submittal without cost to the Contractor. However, should a revised submittal be so incomplete or inaccurate, in the judgment of the Engineer, as to require further corrections and resubmittals, the cost of reviewing the subsequent resubmittals will be billed to the Contractor by the Engineer.

#### PRODUCT SUBMITTAL LISTING FORM

#### INSTRUCTIONS:

Do not use the terminology "as specified", rather indicate specifically the product proposed. Refer to the Instructions to Bidders, Construction Contract Agreement and other Division 1 Sections for product options and substitutions.

#### Prepared by:

**ITEM** 

MANUFACTURER

END OF SECTION 01 60 50

#### SECTION 01 70 00

#### PROJECT CLOSEOUT

#### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for project close out, including but not limited to:
  - 1. Inspection procedures.
  - 2. Project record document submittal.
  - 3. Operating and maintenance manual submittal.
  - 4. Submittal of warranties.
  - 5. Final cleaning.
- B. Close out requirements for specific construction activities are included in the appropriate Sections in Divisions 26 and 28.

#### 1.3 SUBSTANTIAL COMPLETION

- A. Preliminary Procedures: Before requesting inspection for certification of Substantial Completion, complete the following. List exceptions in the request.
  - 1. In the Application for Payment that coincides with, or first follows, the date Substantial Completion is claimed, show 100 percent completion for the portion of the Work claimed as substantially complete. Include supporting documentation for completion as indicated in these Contract documents and a statement showing an accounting of changes to the Contract Sum.
    - a. If 100 percent completion cannot be shown, include a list of incomplete items, the value of incomplete construction, and reasons the Work is not complete.
  - 2. Advise Owner of pending insurance changeover requirements.
  - 3. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications and similar documents to Owner.
  - 4. Deliver tools, spare parts, extra stock, and similar items to Owner.
  - 5. Complete start-up testing of systems, and instruction of Owner's operating and maintenance personnel. Discontinue or change over and remove temporary facilities from the site, along with construction tools, mock-ups, and similar elements.
- B. Inspection Procedures: On receipt of a request for inspection, Owner will either proceed with inspection or advise the Contractor of unfilled requirements. Owner will prepare the Certificate of Substantial Completion following inspection, or advise the Contractor of construction that must be completed or corrected before the certificate will be issued.

- 1. Owner will repeat inspection when requested and assured that the Work has been substantially completed.
- 2. Results of the completed inspection will form the basis of requirements for final acceptance.

#### 1.4 FINAL ACCEPTANCE

- A. Preliminary Procedures: Before requesting final inspection for certification of final acceptance and final payment, complete the following. List exceptions in the request.
  - 1. Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.
  - 2. Submit an updated final statement, accounting for final additional changes to the Contract Sum.
  - 3. Submit a certified copy of the final inspection list of items to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance, and the list has been endorsed and dated by Owner.
  - 4. Submit a final liquidated damages settlement statement.
  - 5. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
- B. Re-inspection Procedure: Owner will re-inspect the work upon receipt of notice that the work, including inspection list items form earlier inspections, has been completed, except items whose completion has been delayed because of circumstances acceptable to Owner.
  - 1. Upon completion of re-inspection, Owner will prepare a certificate of final acceptance, or advise the Contractor of Work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance.
  - 2. If necessary, re-inspection will be repeated.

#### 1.5 RECORD DOCUMENT SUBMITTALS

- A. General: Do not use record documents for construction purposes; protect from deterioration and loss in a secure, fire-resistive location; provide access to record documents for Owner's reference during normal working hours.
- B. Record Drawings:
  - 1. During the progress of work the job superintendents electrical subcontractors shall record on their field sets of drawings the exact locations as installed of all concealed conduits which were not installed exactly as shown on the contract drawings.
  - Upon completion of the work, this data shall be recorded, to scale, and used to develop As-Built drawings. Each sheet shall bear the name of the contractor who prepared the drawing.
  - One set digital As-Built drawings and two sets of bond plots shall be submitted to Owner upon completion of the work and prior to final payment. The Engineer shall approve as-Built drawings.
  - 4. Maintain a clean, undamaged set of approved Shop Drawings for submission to the Owner upon completion of the work and prior to final payment.

- a. Organize record Shop Drawings into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates and other identification as appropriate.
- C. Maintenance Manuals: Organize operating and maintenance data into suitable sets of manageable size. Submit 2 complete sets of all manuals to the Engineer for approval. Bind properly indexed data in individual heavy-duty, 3-ring vinyl-covered binders, with pocket folders for folded sheet information. Mark appropriate identification on front and spine of each binder. Include the following types of information:
  - 1. Emergency instructions.
  - 2. Spare parts list.
  - 3. Copies of warranties.
  - 4. Wiring diagrams.
  - 5. Recommended "turn around" cycles.
  - 6. Inspection procedures.
- D. Prior to final payment, submit a list of all sub-contractors, including address and phone numbers, to Owner.
- PART 2 PRODUCTS NOT USED
- PART 3 EXECUTION
- 3.1 CLOSEOUT PROCEDURES
  - A. Operating and Maintenance Instructions: Arrange for each installer of equipment that requires regular maintenance to meet with Owner's personnel to provide instruction in proper operation and maintenance. If installers are not experienced in procedures, provide instruction by manufacturer's representatives. Include a detailed review of the following items:
    - 1. Maintenance manuals.
    - 2. Record documents.
    - 3. Spare parts and materials.
    - 4. Tools.
    - 5. Lubricants.
    - 6. Identification systems.
    - 7. Control sequences.
    - 8. Hazards.
    - 9. Cleaning.
    - 10. Warranties and bonds.
    - 11. Maintenance agreements and similar continuing commitments.
  - B. As part of instruction for operating equipment, demonstrate the following procedures:

- 1. Start-up.
- 2. Shutdown.
- 3. Emergency operations.
- 4. Noise and vibration adjustments.
- 5. Safety procedures.
- 6. Economy and efficiency adjustments.
- 7. Effective energy utilization.

#### 3.2 FINAL CLEANING

- A. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. Comply with manufacturer's instructions.
  - 1. Complete the following cleaning operations before requesting inspection for Certification of Substantial completion.
    - a. Remove labels that are not permanent labels.
    - b. Clean transparent materials, including mirrors and glass indoors and windows. Remove glazing compound and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.
    - c. Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition, free of stains, flaws, films and similar foreign substances. Restore reflective condition. Leave all concrete floors broom clean. Vacuum entrance matted surfaces.
    - d. Wipe surfaces of mechanical and electrical equipment. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps.
    - e. Clean the site, including landscape development areas, of rubbish, litter and other foreign substances. Sweep paved areas broom clean; remove stains, spills and other foreign deposits. Rake grounds that are neither paved nor planted, to a smooth even-textured surface.
- B. Pest Control: Engage an experienced exterminator to make a final inspection, and rid the Project of rodents, insects and other pests.
- C. Removal of Protection: Remove temporary protection and facilities installed for protection of the work during construction.
- D. Compliance: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the owner's property. Do not discharge volatile, harmful or dangerous materials into drainage systems. Remove waste materials from the site and dispose of in a lawful manner.
  - 1. Where extra materials of value remaining after completion of associated Work have become the owner's property, arrange for disposition of these materials as directed.

END OF SECTION 01 70 00

#### SECTION 26 05 10

#### GENERAL REQUIREMENTS FOR ELECTRICAL WORK

#### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Provide all labor, materials, supervision, tools, services, equipment and incidentals necessary for complete and operational systems as specified under this division and as shown on the Contract Drawings.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Division.

#### 1.2 DRAWINGS AND SPECIFICATIONS

- A. Prior to submitting a bid:
  - 1. Examine the Drawings.
  - 2. Read the Specifications and other Contract Documents, including Addenda and referenced material.
  - 3. Visit the site of the work.
  - 4. Become informed prior to bidding as to existing conditions and limitations of the project.
- B. Bring exceptions and inconsistencies in Drawings, specifications, addenda, referenced material, other Contract Documents and site conditions to the attention of the Engineer in writing seven days before the bid opening; otherwise be responsible for changes and additions that become necessary during construction.
- C. Interpretation or correction of the Contract Documents will be made by Addendum and will be mailed or delivered to each Contract Bidder of Record.
- D. Location of material, equipment, devices and appliances shown in the Contract Drawings are approximate and are subject to such revisions as may be necessary or desirable at the time the work is installed. Install the work in relation to existing conditions and be responsible for the correctness of the work with reference to finish elevations and surrounding conditions.
- E. The Contract Documents show the general arrangements of the work. Should project conditions require any rearrangement, or if equipment or accessories can be installed to better advantage in a different manner, the Contractor may, before proceeding with the work, prepare and submit five copies of shop drawings of the proposed rearrangement for the Engineer's review.
- F. If the Contractor proposes to install equipment requiring space conditions other than those shown, he shall assume responsibility for the rearrangement of the space and shall have the Engineer review the change before proceeding with the work. The request for such changes shall be accompanied by shop drawings of the space affected.

G. The accompanying Drawings do not indicate the existing electrical installations other than to identify modifications and extensions thereto. Visit the site and ascertain the conditions to be met and the work to be accomplished in removing and modifying the existing work, and installing the new work. Failure to comply with this shall not constitute grounds for any additional payment in connection with removing or modifying any part of the existing installations and/or installing any new or temporary work under this Division.

#### 1.3 CODES AND STANDARDS

- A. Execute the work in accordance with local, state and national codes, ordinances and regulations having jurisdiction or authority over the work. Make any and all adjustments required by these agencies without further cost to the Owner. In addition, conform to the applicable provisions and recommendations of the following standards:
  - 1. National Electrical Manufacturer Association (NEMA)
  - 2. American Society for Testing and Materials (ASTM)
  - 3. National Fire Protection Association (NFPA)
  - 4. National Electrical Safety Code (NESC)
  - 5. Institute of Electrical and Electronic Engineers (IEEE)
  - 6. National Electrical Code (NEC)
  - 7. Underwriters' Laboratories (UL)
  - 8. American National Standards Institute (ANSI)
  - 9. International Building Code (IBC)
  - 10. Occupational Safety and Health Administration (OSHA)
  - 11. Americans with Disabilities Act (ADA)
  - 12. Applicable utility companies
  - 13. Texas Accessibility Standards (TAS)
  - 14. International Energy Conservation Code (IECC)
- B. Execute the work in accordance with the most current codes and standards in effect at the time of bidding.
- C. In the event standards and codes conflict with each other, the most stringent shall apply.
- D. Conform to National Electrical Code rules. Provide material and equipment, which is approved by Underwriter's Laboratories, bears UL label and is acceptable to Factory Mutual.
- E. It is specifically understood, however, that in those instances where capacities, sizes, etc., of electrical equipment, devices or material as designated in these Specifications or on the Drawings are in excess of the minimum requirements of the National Electrical Code, such designated capacities shall prevail.

#### PART 2 - PRODUCTS

#### 2.1 SHOP DRAWINGS AND SUBMITTALS

- A. Submit Shop Drawings for all material furnished under this division of the work where specifically noted. Refer to the General Requirements for additional requirements. In addition to the quantity of Shop Drawing copies required by the General Requirements, furnish one additional copy for the Electrical Engineer's file. No material shall be fabricated, delivered to the jobsite, or installed which the Engineer through Shop Drawing submittals has not approved.
- B. The submittals shall include sufficient descriptive material, such as catalog cuts, diagrams, and other data published by the manufacturer, as well as evidence of compliance with safety and performance standards, to demonstrate conformance to the specification requirements; catalog numbers alone will not be acceptable. The data shall include the name and address of the nearest service and maintenance organization that regularly stocks repair parts.
- C. Before submitting Shop Drawings for review, examine them and verify that they correctly represent the material or equipment intended for this project. The Contractor's review of Shop Drawings is not intended to take the place of the review of the Engineer, and Shop Drawings which have not been reviewed by the Engineer shall not be used in fabricating or installing any work.
- D. List deviations and exceptions from the specified equipment in writing. Failure to do so will be cause for rejection of submittals. Contractor agrees that if deviations, discrepancies, or conflicts between Shop Drawing submittals and the Contract Documents are discovered either prior to or after Shop Drawing submittals are reviewed by the Engineer, the Contract Documents shall control and shall be followed, unless deviations have been specifically approved by the Engineer.
- E. The review of Shop Drawings or catalog data by the Engineer shall not relieve the Contractor from responsibility for deviations from plans and specifications unless he has, in writing, specifically called attention to such deviations at the time of submission and has obtained the permission of the Engineer thereon; nor shall it relieve him from responsibility for error of any kind in Shop Drawings. When the Contractor does call such deviations to the attention of the Engineer, he shall state in his letter whether or not such deviations involve any extra cost. If this is not mentioned, it will be assumed that no extra cost is involved for making the change.
- F. Contractor agrees that Shop Drawing submittals reviewed by the Engineer are not change orders; that the purpose of Shop Drawing submittals by the Contractor is to demonstrate to the Engineer that the Contractor understands the design concept, that he demonstrates his understanding by indicating which equipment and material he intends to furnish and install and by detailing the fabrication and installation methods he intends to use.

#### 2.2 STANDARDS FOR MATERIALS

A. It is the intention of these specifications to indicate a standard of quality for all materials incorporated in this work. Manufacturer's names and catalog numbers are used to designate the item of equipment or material as a means of establishing grade and quality. Where several manufacturers are named, only the named manufacturer's products will be considered and the Contractor's bid shall be based on their product.

- B. Where the phrase 'or approved equivalent' or 'or equivalent' or 'equivalent to' or 'accepted substitute' is used in these specifications, the names or name mentioned are to be used as a basis of quality. Other manufacturers will be considered if the quality of the proposed material is equivalent to that of materials named, in the opinion of the Engineer. Such unnamed manufacturers' products will, however, be considered as substitutions and shall not be used as a basis for bidding.
- C. Basis of quality shall include material, workmanship, weight, finishes, and gauges of material, appearances, capacity and performance. Manufacturer's representation as to availability of equipment, replacement parts and service personnel in the area will be a factor in consideration of submittals.
- D. All materials shall be fully warranted.
- E. Furnish standard products and manufacturers regularly engaged in production of such equipment.
- F. Furnish manufacturer's latest standard design.
- G. All equipment shall conform with applicable IEEE, UL, ANSI and/or NEMA Standards.
- H. Obtain manufacturer's recommendations and instructions for all installed equipment including installation instructions, preparation cleaning, tests and preservice checks, and then ensure all have been performed prior to completion of work.

#### 2.3 SUBSTITUTIONS

- A. The Engineer prior to installation shall approve substitutions of equipment. Substitution of equipment shall be in accordance with Division 01 of the specifications.
- B. When alternate or substitute materials and equipment are used, the Contractor shall be responsible for space requirements, configurations, performance, changes in bases, supports, structural members and openings in structure, and other apparatus and trades that may be affected by their use.
- C. Contractor shall bear all additional costs resulting from the use of substituted materials. Such changes shall be at no additional cost to the Owner.

#### PART 3 - EXECUTION

#### 3.1 COORDINATION

- A. Coordinate and direct the work under this division of the specifications with the work under other divisions of the specifications. Examine the Contract Documents and report any discrepancies between divisions of the work to the Engineer and obtain written instructions for changes necessary in the work.
- B. Before installation, make proper provisions to avoid interferences with the work under other divisions of the specifications. Changes required in the work of the Contractor caused by his neglect to do so shall be made by him at his own expense.

C. Harmonize the work under this division with the work under other divisions of the specifications such that it may be installed in the most direct and workmanlike manner without hindering, handicapping, or conflicting with the work under other divisions of the specifications. Piping interferences shall be handled by giving precedence to pipelines that require a stated grade for proper operation.

#### 3.2 PERMITS AND FEES

- A. Secure and pay for all necessary permits, licenses and inspections required by law for the completion of the Work. Secure and pay for all certificates of approval that are required and deliver them to the Engineer before final acceptance of the Work.
- B. If a utility company in connection with the work under this division makes any charges, the Contractor shall advise the Owner, so that the Owner can pay these charges. Advise the Owner of these charges in a timely manner, so as not to delay construction of the project.

#### 3.3 QUALITY ASSURANCE

- A. Use adequate quantities of skilled workmen who are trained and experienced in their crafts and who are familiar with the specified requirements and methods needed to perform the work in this division.
- B. Install materials and equipment based upon actual dimensions and conditions at the project site. Field measure for materials or equipment requiring exact fit.
- C. Be responsible for the proper location and sizes of all slots, holes or openings in the building structure pertaining to the work in this division, and for the correct location of pipe sleeves.
- D. Perform work in accordance with good commercial practice. The good appearance of the finished work shall be of equivalent importance with its operation.
- E. Isolate all conduit to insure an acceptable noise level free from objectionable vibration for all systems.

#### 3.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Follow the manufacturer's directions in the delivery, storage and handling of equipment and materials.
- B. Equipment and materials shall be tightly covered and protected against dirt, water, chemical or mechanical injury and theft. Damaged equipment will not be accepted.
- C. After materials are installed, protect the installation until the work is completed and accepted by the Owner.

#### 3.5 CLEANING UP

A. Remove all shipping labels, dirt, paint, grease and stains from all equipment under this division of the Work. Remove debris as it accumulates. Upon completion of the Work, clean all electrical equipment and the entire electrical installation in order to present a first
class electrical installation suitable for occupancy. No loose parts, scraps, tools nor debris shall be left on the premises.

# 3.6 FLASHINGS, SLEEVES, INSERTS

- A. Be responsible for maintaining the integrity of the waterproofing of conduit penetrations through roofs, exterior walls and floors.
- B. Be responsible for the installation of counterflashing of roof penetrations to provide a weatherproof installation.
- C. Install 22 gauge galvanized sheet iron sleeves for each conduit passing through floors. Extend sleeves 1-1/2 in. above the floor slab and cement watertight. The sizes of sleeves shall be installed to permit the subsequent insertion of the proper size conduits or raceways.
- D. Install galvanized wrought iron pipe sleeves around conduits and raceways that pass through concrete beams or walls and masonry exterior walls. The inside diameter of these sleeves shall be at least 1/2 in. greater than the outside diameters of the service pipes. After the pipes are installed in these sleeves, fill the annular space between pipes and sleeves with mastic. The completed installation shall be watertight.
- E. Be responsible for maintaining the fire rating of penetrations through walls, floors and ceilings.
- F. Waterproofing and fireproofing work shall conform to the requirements of other applicable sections of the specifications.

## 3.7 PAINTING

A. Maintain original factory finish on all material and equipment installed under this division of the work unless specifically noted otherwise within the Contract Documents. Should the finish be marred in transit or during installation, it shall be re-finished to present a neat, workmanlike appearance. Leave equipment clean and free from any grease, dirt and rust and in a suitable condition for painting.

## 3.8 IDENTIFICATION OF ELECTRICAL EQUIPMENT

- A. Identify electrical equipment in accordance with the NEC, local authorities and in accordance with the requirements of the Contract Documents.
- B. Use laminated three-ply, engraved plastic nameplates with black surface and white interior core, at least 1/16 in. thick. Engraved lettering shall be condensed gothic at least 1/4 in. high and properly spaced for legible and easy reading. Attach plates to equipment with chromium-plated screws. Adhesive attachment is not acceptable. Identify the following items with engraved nameplates, located as follows:
  - 1. Spares shall be labeled 'Spare'.
  - 2. Each branch circuit panel on panel trim cover immediately above panel door.
  - 3. Engrave coverplates for wiring devices served by emergency power systems with panel designation and circuit number(s) connected to the devices. Fill engraving with indelible black ink.

- C. Custom engraving on cover plates for items noted above shall be equivalent to custom engraving as performed by Hubbell, or accepted substitute.
- D. Refer to other sections of the specifications for conductor color-coding requirements.

# 3.9 ACCESS DOORS

- A. Wherever access is required in walls, ceilings, or soffits to concealed junction boxes, pull boxes or other electrical equipment installed under this division, provide and install access doors as indicated herein.
- B. Furnish and install hinged access door and frame with flush latch handle as follows:
  - 1. Plaster surfaces Milcor Style K, or accepted substitute.
  - 2. Ceramic tile or drywall surface Milcor Style M (with 'B' label where required), or accepted substitute.
  - 3. Install panels in locations approved by the Engineer and paint as directed.

# 3.10 RECORD DOCUMENTS

- A. Job set: Promptly following receipt of the Owner's Notice to Proceed, secure from the Engineer at no charge to the Contractor, one complete set of all Documents comprising the Contract.
- B. Final Record Documents: At a time nearing the completion of the work, secure from the Engineer at no charge to the Contractor one complete set of sepia transparencies of all Drawings in the Contract.
- C. Maintenance of Job Set: Immediately upon receipt of the job set described in paragraph above, identify each of the Documents with the title, "RECORD DOCUMENTS JOB SET".
- D. Preservation:
  - 1. Considering the Contract completion time, the probable number of occasions upon which the job set must be taken out for the new entries and for examination, and the conditions under which these activities will be performed, devise a suitable method for protecting the job set to the approval of the Engineer.
  - 2. Do not use the job set for any purpose except entry of new data and for review by the Engineer, from start of transfer of data to final Project Record Documents.
  - 3. Maintain the job set at the site of Work where the Engineer designates that site.
- E. Making Entries on Drawings:
  - 1. Using an erasable colored pencil (not ink or indelible pencil), clearly describe the change by graphic line and note as required.
  - 2. Date all entries.
  - 3. Call attention to the entry by a 'cloud' drawn around the area or areas affected.
  - 4. In the event of overlapping changes, use different colors for the overlapping changes.

- 5. All equipment shall be clearly indicated in its installed location. Exposed items or those easily accessible, as above lay-in ceilings, may be located to scale. Concealed items not readily accessible, such as underground piping, shall be located by dimension.
- F. Transfer of Data to Final Project Documents:
  - 1. Approval of recorded data prior to transfer:
    - a. Following receipt of the transparencies described above, and prior to beginning transfer of recorded data thereto, secure the Engineer's approval of all recorded data.
    - b. Make required revisions.
  - 2. Transfer of Data to Drawings:
    - a. Carefully transfer change data shown on the job set of Record Drawings to the corresponding transparencies, coordinating the changes as required.
    - b. Clearly indicate at each affected detail and other drawing a full description of changes made during construction, and the actual location of items described above.
    - c. Call attention to each entry by drawing a 'cloud' around the area or areas affected.
    - d. Make changes neatly, consistently, and with the proper media to assure longevity and clear reproduction.
- G. Review and Submittal:
  - 1. Submit the completed set of Project Record Documents to the Engineer as described above.
  - 2. Participate in review meetings as required.
  - 3. Make required changes and promptly deliver the final Project Record Documents to the Engineer.
- 3.11 OPERATIONS AND MAINTENANCE DATA
  - A. Accumulate, as the job progresses, the following data, in duplicate, prepared in a neat brochure or packet folder, and deliver to the Engineer for checking and subsequent delivery to the Owner.
    - 1. Manufacturers' warranties, guarantees, service manuals, and operating instructions for equipment and materials covered by this division of the specifications.
    - 2. Copies of approved Shop Drawings.
    - 3. Any and all other data and/or Drawings required during construction.
    - 4. Repair parts list of all major items and equipment including name, address, and telephone number of local supplier and agent.

# 3.12 INSTRUCTION OF OWNER'S PERSONNEL

A. Provide the services of competent engineers or technicians acceptable to the Engineer to instruct representatives of the Owner in the complete and detailed operation of each item of equipment, and each system. These instructions shall be provided for whatever periods may be necessary to accomplish the desired results. Upon completion of these instructions, the Contractor shall obtain a Letter of Release, acknowledged by the Owner or

his Authorized Representative, stating the dates on which the various kinds of instruction were given, and the personnel to whom the instructions were given.

- B. Be responsible for proper maintenance of equipment and systems until the instructions have been given to the Owner's personnel and the letter of release acknowledged.
- C. In providing the instructions to the Owner's personnel, follow the written operating and maintenance manuals in all instances, and familiarize the Owner's personnel with such manuals. Operating and maintenance manuals used for instructions shall include wiring diagrams, manufacturers' operation and maintenance manuals, parts lists (with sources identified), and other data as appropriate for each system, and as required elsewhere in the Specifications to be furnished to the Owner prior to final acceptance of the project.

## 3.13 LOCAL PARTS AND SERVICE

A. Each item of equipment furnished on this project shall have local representation, factory-authorized service, and an adequate stock of repair parts. "Local" shall be defined, for this purpose, as "within 150 miles of the project site".

## 3.14 INSTALLATION INSPECTIONS AND CERTIFICATIONS

- A. Obtain timely inspections of the installation by the constituted authorities. Remedy any deficiencies to the satisfaction of the inspection authority.
- B. Upon final completion of the Work, obtain certificates of acceptance from the constituted authorities. Deliver the certificates to the Engineer for transmission to the Owner.

## 3.15 OPERATION PRIOR TO ACCEPTANCE

- A. When any equipment is operable, and it is to the advantage of the Contractor to operate the equipment, he may do so provided that he properly supervises the operation and retains full responsibility for the equipment operated. Regardless of whether or not the equipment has or has not been operated, clean the equipment properly; make required adjustments, and complete punch list items before final acceptance by the Owner.
- B. The date of acceptance by the Engineer, for beneficial use by the Owner, shall be the beginning date of the warranty period.

# 3.16 ACCEPTANCE OF THE WORK

A. The Work, when completed, will be accepted in a finished, perfect and undamaged state only. Provide for protection of the Work during its progress, and if damaged, do all patching or replacing necessary to its full and satisfactory completion.

## 3.17 WARRANTY

A. Furnish a written certificate, guaranteeing all materials, equipment and labor to be free of all defects for a period of one year from the date of final acceptance by the Owner of the Work, and guarantee that if any defects appear within the stipulated guarantee period, such work shall be replaced without charge.

B. This guarantee shall be extended to include the capacity and integrated performance of all component parts of the various systems.

# 3.18 FINALLY

A. It is the intention that this Specification provide a complete installation. Include all accessory construction and apparatus necessary to the operation and testing of the work under this division. The omission of specific reference to any part of the work necessary for such complete installation shall not relieve this Contractor from furnishing and installing such parts.

# WORK IN EXISTING BUILDING

# PART 1 - GENERAL

# 1.1 DESCRIPTION

- A. Refer to Section 26 05 10 GENERAL REQUIREMENTS FOR ELECTRICAL WORK.
- B. Furnish all labor, materials, services, equipment, and appliances required in conjunction with the work in existing buildings as indicated in the Contract Documents.

# PART 2 - PRODUCTS

# 2.1 MATERIALS

A. Use materials to match existing construction unless specified elsewhere in these Contract Documents. Materials shall comply with local codes, be UL listed, and be properly applied for their intended function.

# PART 3 - EXECUTION

## 3.1 EXISTING CONDITIONS

- A. Inspect the jobsite prior to bidding and be familiar with all existing conditions. Include the cost of the work required to accommodate the existing conditions in the bid proposal.
- B. Obtain data related to existing facilities from existing documents, measurements, notations, photographs, surveys and other observations at the site.
- C. Relocate existing items as required to accommodate the new construction. Remove, relocate and reconnect equipment and accessories that are to be reused.
- D. Coordinate the Work with other divisions of the specifications. Determine which items and equipment are to remain, to be relocated or be removed, and perform all work consistent with the Scope of Work.
- E. Loads that exist and are to remain shall be connected to the new distribution system as shown on the Drawings or as required to maintain their proper operation.
- F. Refer to other divisions of the specifications and determine equipment that requires power to be disconnected, or power to be relocated and disconnect power and relocate power to this equipment.
- G. Remove all conductors and exposed conduit rendered unused back to the source of supply.
- H. Perform splices as required to maintain circuit continuity to existing devices or equipment to remain in service.

# 3.2 DISRUPTION OF EXISTING FUNCTIONS

- A. Access: Access to and use of the existing facilities and site will be restricted, and shall be under the direction and control of the Owner.
- B. Disruptions: Maintain existing electrical, communications, alarm, and other existing systems, and maintain existing functions in service except for scheduled disruptions.
  Where existing functions to remain in use are disrupted, they shall be fully restored after disruption, in full compliance with this division of the specifications for new work.
- C. Scheduling of Disruptions: Seek and obtain approval two weeks in advance of the event date. Indicate date of event, starting time, and duration of each required disruption.
- D. Notice of Disruption: Date, time and duration of each disruption shall be subject to the Owner's prior approval, and shall include the following information in the form of a memorandum submitted by the Contractor to the Architect for approval by the Owner:

	STARTING		
FACILITY/SYSTEM	DATE	TIME	DURATION

- E. Emergency Disruptions: When circumstances preclude obtaining advance approval as specified above, make request immediately upon knowledge of the requirement, and perform work so as to cause the minimum amount of disruption, for the minimum duration.
- F. Notification: Notify the Engineer and the Owner immediately by telephone and then in writing, as changes and additions to the scheduled disruption requirements become known.
- G. Duration: Complete as large a portion of the work as possible before initiating disruption and perform only that work necessary so as to minimize duration of disruption. Maintain adequate personnel, supplies, materials, equipment, tools, and other resources at job site to avoid unnecessary delay in resumption of normal service.

# 3.3 SALVAGE, DEMOLITION AND RELOCATION

- A. General
  - 1. Modify, remove, or relocate materials and items indicated in the Contract Documents and required by the installation of new facilities.
  - 2. Working jointly with the work under other divisions of the specifications establish and mark salvage and demolition items before commencing work; report items scheduled for relocation, reinstallation or reuse, which are found to be in damaged condition; await further instructions from the Owner's Representative and/or the Engineer before commencing with work.
  - 3. Owner shall have first right of refusal for all material and equipment. Deliver salvaged material accepted by the Owner to destinations on the premises as directed and remove material rejected by the Owner from the site.
- B. Relocations
  - 1. Make minor relocations necessitated by the conditions at the site or as directed by the Engineer, without additional cost to the Owner.

- 2. Repair and restore to good functional condition equipment, materials and items scheduled for relocation, which are damaged during dismantling or reassembly operations.
- 3. New materials and items of similar design and quality may be substituted for materials and items indicated to be relocated upon approval of shop drawings, product data, and samples.
- 4. Remove carefully, in reverse order to original assembly or placement, items that are to be relocated.
- 5. Protect items until relocation is complete.
- 6. Clean and repair items to be relocated, and provide new materials, fittings, and appurtenances required to complete the relocations and to restore items to good operating order.
- 7. Perform the relocation work in accordance with applicable sections of these specifications, utilizing skilled workers.
- C. Relocating Devices: Remove and reinstall, in locations designated by the Owner's Representative and the Engineer, temperature control system devices, relays, wire, conduit, fixtures, equipment and other devices required for the operation of the various systems that are installed in existing-to-be-removed construction.

# 3.4 EXISTING RACEWAYS

- A. Reuse raceways where possible and where permitted by local codes. Rework raceways to meet code requirements. Secure all raceways that are not properly supported. Paint raceways when exposed to view to match surroundings if existing finish is damaged or soiled.
- B. Fasten existing boxes and raceways securely to provide proper support.

## 3.5 NEW RACEWAYS

- A. Provide new raceways where required to provide wiring as indicated in the Contract Documents.
- B. Where raceways must be exposed to view, use wiremold, securely fastened, and painted to match surroundings. Provide number of coats of paint as required to cover prime coat of original finish of wiremold.

## 3.6 EXISTING CEILINGS

- A. Provide a typewritten list of existing damaged ceilings and ceiling tiles. Disregard rooms in which ceilings are to be repaired and replaced. Correlate list to room numbers indicated on drawings.
- B. Mark damaged ceilings and ceiling tiles with easily removable red "stick-on" labels, minimum size two square in.
- C. Submit list prior to commencing work. Do not start work until Engineer and Owner review list; otherwise repair and replace damaged ceilings and ceiling tiles.

# 3.7 EXISTING PANELBOARDS

- A. Service existing panelboards to be reused as follows:
  - 1. Clean interiors and exteriors.
  - 2. Touch-up damaged finishes with manufacturer's matching touch-up paint.
  - 3. Inspect for component damage and repair or replace as necessary.
  - 4. Tighten conduit and wire terminations.
  - 5. Verify panelboards and panelboard feeders are of adequate capacity for loads to be served as follows:
    - a. Activate loads connected to panelboards to simulate 100 percent demand.
    - b. Measure and record amperage readings of phase and neutral conductors of panelboards feeders.
    - c. Provide typewritten record of recorded measurements to the Engineer for review.
  - 6. Rebalance loads as specified in other sections of the specifications to provide for evenly balanced phases.
  - 7. Provide new typewritten circuit directories.
  - 8. Provide new panelboard identification labels if panelboard designation changes or if no labels exist.

# 3.8 EXISTING WIRING

- A. Inspect existing wiring to be reused for damage. Repair or replace damaged wiring.
- B. Secure and label existing wiring that is to be disturbed.
- C. Tighten existing wiring terminations and connections.

## 3.9 EXISTING FOUNDATIONS AND FLOORS

- A. Prior to coring, penetrating or cutting of existing foundations or floors, the Contractor shall notify the Engineer in writing and request all as-built and building record drawings showing the location of post tension cables in slabs and subsequent floors. In the event post tension cables do exist in the building, the Contractor shall X-ray the area to be cut, cored or penetrated. Two copies of the X-ray shall be forwarded to the Engineer and written approval issued to the Contractor prior to proceeding with the work.
- B. If no as-built or record building drawings are available, then the Contractor shall X-ray the area to be cut, cored or penetrated. Two copies of the X-ray shall be forwarded to the Engineer and written approval issued to the Contractor prior to proceeding with the work.

## WIRES AND CABLES

# PART 1 - GENERAL

## 1.1 DESCRIPTION

- A. Refer to Section 26 05 10 GENERAL REQUIREMENTS FOR ELECTRICAL WORK.
- B. Provide labor, materials, services, equipment and appliances required in conjunction with the installation of wire and cable systems as indicated in the Contract Documents.

## 1.2 SUBMITTALS

A. Manufacturer's Data: Submit copies of manufacturer's specifications for products to be used.

# PART 2 - PRODUCTS

# 2.1 MATERIALS

- A. Provide conductors made of soft-drawn-annealed copper with conductivity not less than that of 98 percent pure copper. Conductors #12 gauge and smaller shall be solid. Conductors No. 10 gauge and larger shall be stranded.
- B. Utilize conductors with insulation rated at 600 volts and insulated with type 'THHN' insulation in dry locations and type "THWN" in wet locations. Wire in fixture channels and other special locations shall be as specifically rated for temperature in Article 300 in the NEC.
- C. Minimum wire sizes shall be in accordance with other requirements of the specifications and as follows: For 20 ampere branch circuits #12 gauge, except that home runs greater than 50 ft. from the panel to the first outlet box on 120/208 volt shall be #10 gauge.
- D. All wire shall be color-coded. Mark conductors on each end with a 1 in. band of colored pressure-sensitive plastic tape or by the use of brilliant waterproof lacquer, applied according to manufacturer's instructions. Colors for each phase and the neutral shall be consistent throughout the system in accordance with the requirements of this section.
- E. Conductor sizes shown on the Contract Documents are selected based upon use with 75 degrees C terminations. Furnish terminations, which are UL listed for 75°C, or derate conductors for use at 60°C. Use of 90°C terminations is acceptable, but conductor must be sized at the 75°C rating. Do not use 90°C rating for conductors.
- F. Armored cable types AC and BX are specifically not allowed.
- G. Armored cable type MC is allowed for the following applications only:
  - 1. Where installed within existing wall cavities to a point 12 inches maximum above the top of the wall.

- 2. Where installed above existing unaccessible ceilings to points 12 inches maximum beyond the edges of the existing ceiling.
- H. Armored cable type MC: Galvanized, interlocking steel sheath. 90°C, 600V copper conductors with THHN/THWN insulation. Insulated copper conductor ground wire.

# PART 3 - EXECUTION

## 3.1 GENERAL WIRING METHODS

- A. Place an equivalent number of conductors for each phase, neutral and ground of a circuit in same raceway or cable.
- B. Do not share neutral conductors between branch circuits connected to single pole circuit breakers unless shown otherwise on drawings.
- C. Splice only in junction or outlet boxes.
- D. Neatly train and lace wiring inside boxes, equipment, and panelboards.
- E. Make conductor lengths equal for parallel circuits.
- F. Pull all conductors into a raceway at the same time. Use UL listed wire pulling lubricant for pulling #4 gauge and larger wires.
- G. When inserting conductors in raceways, comply with the following:
  - 1. Raceways shall first be installed as a complete raceway system without conductors.
  - 2. Do not install pull wires and conductors until the raceway system is in place.
  - 3. Do not use cleaning agents and lubricants that have a deleterious effect on the conductors.
  - 4. Completely and thoroughly swab raceway system before installing conductors.

## 3.2 PHASING

A. Identify wire and cable for feeders and branch circuits for general power and lighting with a visible color code in accordance with the requirements of this section as follows:

<u>120/208 Volt</u> Phase A - Black Phase B - Red Phase C - Blue Neutral - White Ground - Green 277/480 Volt Phase A - Brown Phase B - Orange Phase C - Yellow Neutral - Gray

B. Provide green or bare grounding conductor identification for grounding conductors. Identification of all ungrounded conductors at junction boxes, wireways, and/or terminations may be by means of colored tape or painting when color-coded conductors as specified above are not available.

- C. Phasing of the complete electrical installation shall be connected and maintained the same throughout the power distribution system. Where the project is an addition or modification to an existing facility, the electrical distribution system phasing shall be made the same as the existing.
- D. Switchgear, safety switches, motor starters, plug-in type bus duct, lighting and power panels and power receptacles shall have all the same phase arrangements throughout the facility.

# 3.3 INSTALLATION

- A. Install conductors in a neat and workmanlike manner to meet code requirements and make runs continuous without weld, splice, or joint between boxes. Do not install wires in conduit unless the entire system of conduit and outlet boxes is permanently in place. Pull conductors using a UL approved wire lubricant.
- B. Provide conductors continuous from outlet to outlet with no splices except at outlets. Leave sufficient wire at all outlets to make connections without straining.
- C. Deliver cable and wire to the project in original packages. Conductors with insulation showing deterioration within one year after final completion and acceptance of the Work shall be removed and replaced at no cost to Owner.
- D. Thoroughly clean wires before installing lugs and connectors.
- E. Make splices, taps and terminations to carry full ampacity of conductors without perceptible temperature rise.
- F. Terminate spare conductors with electrical tape.
- G. Torque test conductor connections and terminations to manufacturer's recommended values.
- H. Where more than three current-carrying conductors are installed in a raceway, use larger size conductor and appropriate larger size raceway to comply with Article 310 of the National Electrical Code.
- I. Where conductor is installed in an environment where the ambient temperature will exceed 86°F, use larger size conductor and appropriate larger size raceway to comply with Article 310 of the National Electrical Code.
- J. Test all circuits for grounds.
- K. Where MC cable is allowed for use on this project in Part 2 of this specification section:
  - 1. Install MC cable in accordance with NEC, Article 330.
  - 2. Provide fittings UL listed for use with MC cable.

## WIRE CONNECTION AND DEVICES

## PART 1 - GENERAL

# 1.1 DESCRIPTION

- A. Refer to Section 26 05 10 GENERAL REQUIREMENTS FOR ELECTRICAL WORK.
- B. Provide labor, materials, services, equipment and appliances required in conjunction with the installation of wire connections and devices systems as indicated in the Contract Documents.

## PART 2 - PRODUCTS

# 2.1 MATERIALS

- A. Make cable and wire connections for splicing or terminating with compression deforming type connectors as manufactured by Burndy Corp., Thomas & Betts Co., Inc., Dossert Manufacturing Corp., Ilsco Corp., or accepted substitute. Connectors for cable sizes 250 Kcmil and larger shall be the long barrel type for double indentation. Soldered connections will not be permitted. Twist-on insulated connectors, of proper size, and resistant to vibration, may be used. Use twist-on connectors as manufactured by Minnesota Mining and Manufacturing Co., Thomas & Betts Co., Inc., Ideal Industries, Inc., or approved equivalent.
- B. Provide terminal connectors with the hole sizes and spacing in accordance with NEMA standards. Terminal connectors are not required for connections to the circuit breakers in the lighting and/or receptacle panels.
- C. Insulate connections made with non-insulated connectors with three layers of plastic tape, each layer being half-lapped. Use No. 35+ plastic tape as manufactured by Minnesota Mining and Manufacturing Co., or similar and equivalent plastic tape as manufactured by Plymouth Rubber Co.

## PART 3 - EXECUTION

## 3.1 INSTALLATION

- A. Make all electrical power and control connections to equipment furnished under other divisions of the specifications and furnish wiring, conduit, outlet boxes, disconnect switches, etc., as required for same. Check General Construction, Controls, Plumbing, Heating, and Air Conditioning, etc. plans and specifications to determine the amount of such wiring required and include cost of same in bid. Verify locations, horsepower, voltages, etc., of all equipment as the job progresses. If a conflict arises in wiring, ask the Engineer immediately for clarification.
- B. Major equipment furnished under the mechanical and other sections of the specifications may require different rough-in requirements than indicated on the plans due to the 'or equivalent' equipment clause. Secure detailed drawings from the trade furnishing the equipment to determine actual rough-in locations, conduit and conductor requirements.

C. Before connecting equipment, check the nameplate data against the information shown on the Drawings. Call any discrepancies to the attention of the Engineer.

# GROUNDING

# PART 1 - GENERAL

# 1.1 SUMMARY

- A. Refer to Section 26 05 10 GENERAL REQUIREMENTS FOR ELECTRICAL WORK.
- B. Furnish all labor, materials, services, equipment and appliances required in conjunction with the installation of a grounding system as indicated in the Contract Documents.

# 1.2 TESTS

- A. Measure ground grid resistance with earth test megger and install additional ground rods and conductors as required until resistance to ground complies with Code requirements.
- PART 2 PRODUCTS NOT USED

# PART 3 - EXECUTION

## 3.1 INSTALLATION

- A. Ground electrical work in accordance with NEC Article 250, local codes as specified herein, and as shown on the Drawings.
- B. Use rigid metal conduit and electrical metallic tubing as equipment grounding conductors. Make-up couplings wrench tight. Install grounding conductor in nonmetallic raceways and under floor ducts.
- C. Install equipment-grounding conductors in nonmetallic raceways. Install equipment grounding conductors in metallic raceways where noted on the drawings.

## 3.2 COMMUNICATION GROUNDING

- A. Fire Alarm and Detection:
  - 1. Provide one No. 6 THW in 1/2 in. conduit to nearest ground bus.

## 3.3 COORDINATION

A. Coordinate the work under this section with the work under other divisions of the specifications.

## SUPPORTING DEVICES

# PART 1 - GENERAL

# 1.1 SUMMARY

- A. Refer to Section 26 05 10 GENERAL REQUIREMENTS FOR ELECTRICAL WORK.
- B. Furnish all labor, materials, services, equipment and appliances required in conjunction with installation of supporting devices as indicated in the Contract Documents.

# PART 2 - PRODUCTS

# 2.1 ACCEPTABLE MANUFACTURERS

- A. Kindorf
- B. Unistrut
- C. Superstrut
- D. Powerstrut

## 2.2 MATERIALS

- A. Continuous slotted channel: 12 gauge steel with electro-galvanizing and gold zinc dichromate barrier bases and dimensions as required for application.
- B. Hanger rods: Continuous thread, electro-galvanized, steel, with gold zinc dichromate barrier, sizes as required for loads imposed.
- C. Hex head cap screws and nuts: No. H-113 and No. 114, respectively.
- D. One-hole pipe straps: Series HS-100, galvanized steel.
- E. Single bolt channel pipe straps: Steel, with machine screw and nut, Series C-105 and Series C-106.
- F. Lay-in pipe hanger: Series C-149.
- G. Conduit and pipe hanger: Series 6H.
- H. Beam clamps: Series 500, RC, EC and PC as applicable.
- I. Concrete inserts, spot: Series D-256 or D-255.
- J. Concrete inserts, channel: Series D-980 or Series D-986.

- K. Riser clamps: Series C-210.
- L. Cable supports: O.Z./Gedney Type S.

# PART 3 - EXECUTION

## 3.1 INSTALLATION

- A. Carefully lay out supporting devices to coordinate with the work under other divisions of the specifications.
- B. Securely fasten and support conduits and raceways to the building structure.
- C. Suspend horizontal runs of conduits and raceways from the floor and roof construction by rod hangers spaced 10 ft. or less on centers for sizes 2-1/2 in. and greater, and 9 ft. or less on centers for 2 in. and smaller.
- D. Fasten single runs of conduit to the structure with one-hole pipe straps and beam clamps or hang on rod hangers.
- E. Support multiple runs of conduit and raceways from continuous channel inserts or from trapeze hangers constructed of rod hangers and channels.
- F. Fasten single conduits to rod hangers with adjustable lay-in pipe hangers or for conduits of sizes 2 in. and smaller with Series 6H pipe hangers.
- G. Fasten conduits to channels with pipe channel straps.
- H. Support conduits and raceways within 3 ft. of each bend, of each termination, and at other intervals to maintain horizontal and vertical alignment without sag and deformation.
- I. Do not use cable, strap, or wire hangers and fasteners.
- J. Provide riser clamps for conduits at floor lines. Provide wire and cable supports in pull boxes for risers in accordance with NEC.
- K. Install supports to permit equivalently distributed expansion and contraction of conduits and raceways with expansion joints. Use guides consisting of saddles, U-bolts and anchors designed for equivalent effectiveness for both longitudinal and transverse thrusts. Submit complete details for review.
- L. Do not support conduits and raceways from equipment connections.
- M. Provide special supports with vibration dampers to minimize transmission of vibrations and noises, where required.
- N. Provide hangers, racks, cable cleats, and supports for wires and cables in cable chambers and other locations to make a neat and substantial installation.

- O. Provide steel angle and channel supports to the floor and structure for panelboards, cabinets, pull and junction boxes. Provide independent support from entering conduits and raceways.
- P. Provide supports as specified for conduits and raceways for outlet boxes and pull boxes 100 cubic in. and smaller.
- Q. Paint all cuts, breaks, welds and other points where the rust inhibiting coating of supports is damaged.
- R. Provide supports sized for the ultimate loads to be imposed.
- S. Anchor supporting devices with:
  - 1. Wood screws on wood.
  - 2. Toggle bolts on hollow masonry.
  - 3. Bolts and expansion anchors in concrete or brick.
  - 4. Machine screws, threaded rods and clamps on steel.
- T. Provide supports with hot-dipped galvanized finish in outdoor and wet locations.
- U. Pipe and conduit supports:
  - 1. Single run pipe and conduits, 2-1/2 in. O.D. and less, shall have Type SS-8R/SS-8C as manufactured by Portable Pipe Hangers, Inc., or approved equivalent, spaced at maximum eight ft. on center and installed on roof pads if required by the roofing manufacturer.
  - 2. Multiple run pipe and conduits larger than 2-1/2 in. O.D. shall have Type PS, PSE, PP-10 with Roller, or PP-10 with Bar, as manufactured by Portable Pipe Hangers, Inc., or approved equivalent, spaced at maximum eight ft. on center and installed on roof pads if required by the roofing manufacturer. All conduits shall be held in place with clips on bars.

## PULL AND JUNCTION BOXES

## PART 1 - GENERAL

# 1.1 DESCRIPTION

- A. Refer to Section 26 05 10 GENERAL REQUIREMENTS FOR ELECTRICAL WORK.
- B. Provide labor, materials, services, equipment and appliances required in conjunction with the installation of pull and junction boxes as indicated in the Contract Documents.

# 1.2 SUBMITTALS

A. Manufacturer's Data: Submit copies of manufacturer's specifications for products to be used.

# PART 2 - PRODUCTS

# 2.1 MATERIALS

- A. Pull boxes and junction boxes used on concealed runs of conduit in walls and over ceilings shall be of code gauge galvanized steel with sheet steel covers. Pull boxes in floors shall be of galvanized malleable cast iron, with gasketed covers. Exposed pull boxes or junction boxes installed outdoors shall be weatherproof and shall be provided with watertight gasketed covers fastened with corrosion resistant screws.
- B. Pull Boxes and Junction Boxes: Metal construction conforming to National Electrical Code, with screw-on or hinged cover. Use hinged cover for boxes larger than 12 in. in any dimension.
- C. Flush-Mounted Pull Boxes: Provide overlapping covers with flush-head cover retaining screws, prime coated.

## PART 3 - EXECUTION

## 3.1 INSTALLATION

- A. Use separate pull boxes and junction boxes for electric power, control, lighting, computer and communication systems.
- B. Install pull boxes and junction boxes where required by the National Electrical Code and wherever required to overcome mechanical difficulties.
- C. Install pull boxes in interior conduit at not more than 100 ft. apart when junction or outlet boxes do not break conduit runs.
- D. Size pull boxes and junction boxes to best meet the needs of the particular situation and/or location and to comply with the National Electrical Code.

E. Coordinate the work in this section with the work under other divisions of this specification.

# CONDUITS

# PART 1 - GENERAL

# 1.1 DESCRIPTION

- A. Refer to Section 26 05 10 GENERAL REQUIREMENTS FOR ELECTRICAL WORK.
- B. Provide labor, materials, services, equipment, and appliances required in conjunction with the installation of conduit systems as indicated in the Contract Documents.

## 1.2 SUBMITTALS

A. Manufacturer's Data: Submit copies of manufacturer's specifications and product data for products to be used.

# PART 2 - PRODUCTS

# 2.1 MATERIALS

- A. Rigid Metal Conduit: Heavy-wall, mild steel tube with metallic corrosion-resistant coating on interior and exterior, hot-dipped galvanized, free from defects and manufactured in accordance with ANSI standards, and UL listed.
- B. Electric Metallic Tubing (EMT): Welded steel tubing formed of low carbon steel, electro-galvanized exterior, inside coated with a thick, baked, tough elastic low-friction coating of enamel, and UL approved.
- C. Intermediate Metal Conduit (IMC): Manufactured in accordance with UL 1242 with interior coating of silicone epoxy ester lubricant.
- D. Flexible Metal Conduit: Single strip helically wound interlocking galvanized steel, UL listed; provide liquid tight with extruded polyvinyl jacket in damp and wet locations and in kitchens.
- E. Elbows and Bends:
  - 1. Rigid nonmetallic conduit systems PVC coated rigid metal conduit.
  - 2. Other conduit systems same material as the conduit with which they are installed.
- F. Bushings:
  - 1. 1-1/4 in. and smaller high-impact thermosetting phenolic insulation, 150°C, O-Z/Gedney Type A.
  - 2. 1-1/2 in. and larger hot-dipped galvanized with thermosetting phenolic insulation, 150°C, O-Z/Gedney Type B.
- G. Locknuts:
  - 1. 1-1/4 in. and smaller zinc-plated heavy stock steel, O-Z/Gedney.

- 2. 1-1/2 in. and larger cadmium-plated malleable iron, O-Z/Gedney.
- H. Hubs: Cadmium-plated malleable iron, tapered threads, neoprene 'O' ring, insulated throat, O-Z/Gedney.
- I. EMT Connectors: Compression type, zinc-plated steel body, cadmium-plated malleable iron nut, insulated throat, O-Z/Gedney.
- J. EMT Couplings: Compression type, zinc-plated steel body, O-Z/Gedney.
- K. Liquid tight Conduit Connectors: Cadmium-plated malleable iron body and nut, cadmium plated steel ferrule, insulated throat, integrally-cast external ground lug, O-Z/Gedney Type 4QL.
- L. Through-Wall and Floor Seals: Malleable iron body, oversize sleeves, sealing rings, pressure clamps and hex-head cap screws, O-Z/Gedney Type FSK.
- M. End Bells: Hot-dipped galvanized, threaded, malleable iron, O-Z/Gedney Type TNS.
- N. Expansion Fittings: Hot-dipped galvanized, malleable iron with bonding jumpers.
  - 1. Linear O-Z/Gedney Type AX or TX.
  - 2. Linear with deflection O-Z/Gedney Type AXDX.
- O. Escutcheons: Chrome-plated sectional floor and ceiling plates, Crane No. 10.
- P. Accessories: Reducers, bushings, washers, etc., shall be cadmium-plated, malleable iron of the forms and dimensions best suited for the application.

## PART 3 - EXECUTION

## 3.1 INSTALLATION

- A. Size conduits as indicated on the Contract Drawings and as required by the National Electrical Code for the quantity and sizes of wires to be installed in the conduit. Do not use conduit sized less than 1/2 in. unless specified otherwise.
- B. No more than one, three-phase circuit or three, single phase circuits may be placed in a single conduit, unless specifically noted on the drawings as such.
- C. Conceal conduits from view in all areas except mechanical and electrical rooms and crawl spaces. Should it appear necessary to expose any conduit:
  - 1. Bring it to the attention of the Engineer immediately and obtain Engineer's approval for location of exposed conduit.
  - 2. Rearrange the work to facilitate an approved installation.
- D. Install conduits at elevations to maintain headroom and at locations to avoid interference with other work requiring grading of piping, the structure, finished ceiling, walls, access panels, etc. Avoid crossing other work.

- E. To prevent displacement, securely support conduits to be concealed in the building structure and installed in advance of other work. Carefully lay out conduits installed within the structure, such as floors, beams, and walls to avoid densities excessive for the construction.
- F. Ream, remove burrs, and swab inside conduits before pulling in conductors.
- G. Cap or plug conduits with standard manufactured accessories as soon as the conduits have been permanently installed in place.
- H. Make bends and offsets in 1 in. and smaller conduits with approved bending devices. Do not install conduits, which have had their walls crushed, deformed or their surface finish damaged due to bending.
- I. Where space conditions prohibit the use of standard ells, elbows, and conduits, use cast ferrous alloy fittings of such forms and dimensions as best suited for the application.
- J. Make conduit joints mechanically tight, electrically continuous, and watertight. Pitch conduits in areas where moisture may subsequently be present in a manner to avoid creating moisture traps; where unavoidable, provide junction box with drain fitting at conduit low point.
- K. Install insulated throat threaded hubs on conduits entering enclosures without threaded hubs in wet and damp locations.
- L. Install and neatly rack exposed conduits parallel with and perpendicular to building walls. Provide space for 25% additional conduit. Do not install exposed diagonal conduit runs.
- M. Route and suspend conduits crossing expansion joints to permit expansion, contraction, and deflection utilizing approved fittings to prevent damage to the building, conduits, and supporting devices.
- N. Do not install conduits exposed on the roof unless approval is obtained prior to installation.
- O. Route conduit through roof openings for piping and duct-work where possible; otherwise, route through roof penetration system as specified in Section 26 05 27 SEALING OF PENETRATIONS.
- P. Do not place conduits in close proximity to equipment, systems and service lines, such as hot water supply and return lines, steam pipes, which could be detrimental to the conduit and its contents. Maintain a minimum of 3 in. separation, except in crossing, which shall be a minimum 1 in.
- Q. Install escutcheons on sight exposed conduits passing through interior floors, walls, and ceilings in finished spaces
- R. Install fire seals on conduits passing through fire-rated partitions, floors and ceiling.
- S. Install through-wall seals on conduits passing through exterior walls or use standard galvanized steel pipe sleeves, diameters 1/2 in. greater than the outside diameter of the sleeved conduit and fill the annular space with mastic.

- T. Install sleeves for conduits passing through interior floors.
- U. Install insulated throat grounding bushings on conduits stubbed through slabs and foundations into electrical enclosures.
- V. Provide grounding of conduits, fittings and accessories. Refer to grounding section of specifications.
- W. Branch Circuits:
  - 1. Install rigid metal conduit in damp and wet locations, in concrete slabs, and where exposed in crawl space.
  - 2. Install electrical metallic tubing where concealed by building structure and where exposed in mechanical and electrical equipment rooms.
  - 3. Exterior to the building and below grade, bury Schedule 40 nonmetallic conduit, where permitted by the authorities having jurisdiction. If not permitted, use rigid steel conduit in accordance with installation requirements stated below. Exterior to the building and above grade, use rigid steel conduit and for elbows and bends greater than 30 degrees regardless of whether conduit is above or below grade. Wrap buried metal conduit portions with .020-inch thick self-sticking, anti-corrosive PVC pipe wrapping tape. Wrap tape half-lapped continuously around metal portions.
  - 4. Install flexible metal conduit where specified above and where permitted by the authorities having jurisdiction. Use liquid tight flexible metal conduit in damp and wet locations, where exposed in mechanical and electrical equipment rooms, and in kitchen and shop areas. Limit flexible conduit to a length of 6 ft. maximum unless specifically instructed otherwise, in writing, by the Engineer.

## OUTLET BOXES

# PART 1 - GENERAL

# 1.1 DESCRIPTION

- A. Refer to Section 26 05 10 GENERAL REQUIREMENTS FOR ELECTRICAL WORK.
- B. Provide labor, materials, services, equipment and appliances required in conjunction with the installation of outlet boxes as indicated in the Contract Documents.

# 1.2 SUBMITTALS

A. Manufacturer's Data: Submit copies of manufacturer's specifications for products to be used.

# PART 2 - PRODUCTS

# 2.1 OUTLET BOXES

- A. Sheet Metal Outlet Boxes: ANSI/NEMA OS 1; galvanized steel, with 1/2 in. male fixture studs where required.
- B. Cast Boxes: Cast metal, deep type, gasketed cover, threaded hubs. Use cast boxes for damp and outdoor installation.
- C. Provide boxes with plaster ring where required. Boxes for installation in masonry walls shall be special square corner masonry type.
- D. Furnish boxes with proper covers and device plates.
- E. Cast Metal Boxes for Outdoor and Wet Location Installations: NEMA 250; Type 4 and Type 6, flat-flanged, surface-mounted junction box, UL listed as rain tight. Cast metal box and cover with ground flange, neoprene gasket, and stainless steel cover screws.

# PART 3 - EXECUTION

## 3.1 COORDINATION OF BOX LOCATIONS

- A. Provide electrical boxes as shown on the Drawings, and as required for splices, taps, wire pulling, equipment connections and code compliance.
- B. The locations of equipment and outlets shown on the Contract Documents are approximate. Check and verify exact locations in the field. Coordinate installation with the Engineer and with the work under other divisions of the specifications.
- C. Unless otherwise noted, location of outlet boxes, measured to centerline of box, shall be as follows:

# EQUIPMENT OR OUTLETS

Fire Alarm Pull Stations Fire Alarm Audible or Audible/Visual Devices ELEVATION (ABOVE FINISHED FLOOR) 3 feet - 10 inches 6 feet - 8 inches to bottom of device

- D. Locate and install boxes to allow access. Where installation is inaccessible, coordinate locations and sizes of required access doors in accordance with other sections of the specifications.
- E. Locate and install to maintain headroom and to present a neat appearance.

# 3.2 OUTLET BOX INSTALLATION

- A. Locate boxes in masonry walls to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat openings for boxes.
- B. Provide knockout closures for unused openings.
- C. Use multiple-gang boxes where multiple devices are shown to be installed together; do not use sectional boxes. Provide barriers to separate wiring of different voltage systems.
- D. Install boxes in walls without damaging wall insulation.
- E. Coordinate mounting heights and locations of outlets mounted above counters, benches and back splashes.
- F. Provide recessed outlet boxes in finished areas; secure boxes to interior wall and partition studs, accurately positioning to allow for surface finish thickness. Use stamped steel stud bridges for flush outlets in hollow stud wall, and adjustable steel channel fasteners for flush ceiling outlet boxes.
- G. Align wall-mounted outlet boxes for switches, thermostats and similar devices.

# SECTION 28 31 06

#### INTELLIGENT REPORTING FIRE DETECTION SYSTEM

#### PART 1 - GENERAL

#### 1.1 DESCRIPTION

- A. This specification document provides the requirements for the installation, programming and configuration of a complete digital protocol addressable fire alarm system. This system shall include, but not be limited to, system cabinet, power supply, built in Signaling Line Circuit (SLC), 80 character LCD annunciator, six programmable "Flexput" circuits, built in dual line Digital Communicator associated peripheral devices, batteries, wiring, conduit and other relevant components and accessories required to furnish a complete and operational Life Safety System.
- B. The facility shall have an emergency voice alarm communication system. Digitally stored message sequences shall notify the building occupants that a fire or life safety condition has been reported. Message generator(s) shall be capable of automatically distributing up to eight (8) simultaneous, unique messages to appropriate audio zones within the facility based on the type and location of the initiating event. The Fire Command Center (FCC) shall also support Emergency manual voice announcement capability for both system wide or selected audio zones, and shall include provisions for the system operator to override automatic messages system wide or in selected zones.

## 1.2 SUMMARY

- A. Provide all labor, materials, supervision, tools, services, equipment and incidentals necessary for complete and operational systems as specified under this division and as shown on the Contract Drawings.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections and Division 26 Specification Sections, apply to this Division.
- C. The Contract Documents are to relay minimum design intent. It is the Contractor's responsibility to provide a complete approved and operable system.

## 1.3 WORK INCLUDED

- A. General Requirements
  - 1. The Contractor shall furnish and install a complete 24 VDC, electrically supervised, analog addressable fire alarm system as specified herein and indicated on the drawings. The system shall include but not be limited to all control panels, power supplies, initiating devices, audible and visual notification appliances, alarm devices, and all accessories required by all applicable Codes to provide a complete operating fire alarm system.
- B. Labeling
  - 1. All fire alarm system equipment shall be listed for its intended purpose and be compatibility listed to assure the integrity of the complete system.

- C. Basic Performance
  - 1. Alarm, trouble and supervisory signals from all intelligent reporting devices shall be encoded on NFPA Style 4 (Class B) Signaling Line Circuits (SLC).
  - 2. Device Circuits (IDC) shall be wired Class A (NFPA Style D) as part of an address-able device connected by the SLC Circuit.
  - 3. Notification Appliance Circuits (NAC) shall be wired Class A (NFPA Style Z) as part of an addressable device connected by the SLC Circuit.
  - 4. On Style 6 or 7 (Class A) configurations a single ground fault or open circuit on the system Signaling Line Circuit shall not cause system malfunction, loss of operating power or the ability to report an alarm.
  - 5. Alarm signals arriving at the FACP shall not be lost following a primary power failure (or outage) until the alarm signal is processed and recorded.
  - 6. Speaker circuits may be controlled by NAC outputs built into the amplifiers, which shall function as addressable points on the Digital Audio Loop.
  - 7. NAC speaker circuits shall be arranged such that there is a minimum of one speak-er circuit per floor of the building or smoke zone which ever is greater.
  - 8. Audio amplifiers and tone generating equipment shall be electrically supervised for normal and abnormal conditions.
  - 9. NAC speaker circuits and control equipment shall be arranged such that loss of any one (1) speaker circuit will not cause the loss of any other speaker circuit in the system. Two-way emergency telephone communication circuits shall be supervised for open and short circuit conditions. Speaker circuits shall be arranged such that there is a minimum of one speaker circuit per smoke zone. Speaker circuits shall be electrically supervised for open and short circuit, it shall not be possible to activate that circuit.
  - 10. Audio amplifiers and tone generating equipment shall be electrically supervised for abnormal conditions. Digital amplifiers shall provide built-in speaker circuits, field configurable as four Class B (Style Y), or two Class A (Style Z) circuits.
  - 11. Digital amplifiers shall be capable of storing up to two minutes of digitally recorded audio messages and tones. The digital amplifiers shall also be capable of supervising the connection to the associated digital message generator, and upon loss of that connection shall be capable of one of the following system responses:
    - a. The digital amplifier shall automatically broadcast the stored audio message.
    - b. The digital amplifier shall switch to a mode where a local bus input on the digital amplifier will accept an input to initiate a broadcast of the stored message. This bus input shall be connected to a NAC on a local FACP for the purpose of providing an alternate means of initiating an emergency message during a communication fault condition.
    - c. Speaker circuits shall be either 25 VRMS or 70VRMS. Speaker circuits shall have 20% space capacity for future expansion or increased power output re-quirements.
    - d. Two-way emergency telephone (Fire Fighter Telephone) communication shall be supported between the Audio Command Center and up to seven (7) remote Fire Fighter's Telephone locations simultaneously on a telephone riser.
    - e. Means shall be provided to connect FFT voice communications to the speaker circuits in order to allow voice paging over the speaker circuit from a tele-phone handset.

f. The digital audio message generator shall be of reliable, non-moving parts, and support the digital storage of up to 32 minutes of tones and emergency messages, shall support programming options to string audio segments together to create up to 1000 messages, or to loop messages and parts of messages to repeat for predetermined cycles or indefinitely.

# 1.4 RELATED WORK:

- A. 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:
  - 1. Duct smoke detectors shall be furnished, wired and connected by the electrical Contractor. The HVAC Contractor shall furnish necessary duct opening and mount the duct smoke detectors.
  - 2. Section 26 05 33 CONDUITS.
  - 3. Section 26 05 19 WIRES AND CABLES.
  - 4. Elevator recall control circuits to be provided by the elevator control equipment.
  - 5. Sprinkler waterflow and supervisory switches provided by Plumbing Contractor, but wired and connected by the Electrical Contractor.

# 1.5 STANDARDS

- A. The fire alarm equipment and installation shall comply with the current provisions of the following standards and shall be listed for it's intended purpose and be compatibility listed to insure integrity of the complete system:
  - 1. National Electric Code, Article 760
  - 2. National Fire Protection Association Standards:
    - a. NFPA 72 National Fire Alarm Code
    - b. NFPA 101 Life Safety Code
    - c. NFPA 13 Sprinkler Systems
    - d. NFPA 70 National Electric Code
    - e. NFPA 92A Smoke Control Systems
    - f. Local and State Building Codes
    - g. Local Authorities Having Jurisdiction
  - 3. Underwriters Laboratories Inc.
    - a. All equipment shall be approved by Underwriters Laboratories, Inc. for its intended purpose, listed as power limited by Underwriters Laboratories, Inc., for the following standards as applicable:
      - 1) UL 864 UOJZ Control units for Fire Protective Signaling Systems
      - 2) UL 268 Smoke Detectors for Fire Protective Signaling Systems
      - 3) UL 268A Smoke Detectors for Duct Applications
      - 4) UL 217 Smoke Detectors for Single Stations
      - 5) UL 521 Heat Detectors for Fire Protective Signaling Systems
      - 6) UL 228 Door Holders for Fire Protective Signaling Systems
      - 7) UL 464 Audible Signaling Appliances
      - 8) UL 1638 Visual Signaling Appliances
      - 9) UL 38 Manually Activated Signaling Boxes
      - 10) UL 346 Waterflow indicators for Fire Protective Signaling Systems
      - 11) UL 1481 Power Supplies for Fire Protective Signaling Systems
      - 12) UL 228 Door Holders for Fire Protective Signaling Systems

- 13) UL 464 Audible Signaling appliances
- 14) UL 1638 Visual Signaling appliances
- 15) UL 38 Manually Activated Signaling Boxes
- 16) UL 346 Waterflow indicators for Fire Protective Signaling systems
- 17) UL 1481 Power Supplies for Fire Protective Signaling systems
- 18) UL 1711 Amplifiers for Fire Protection Signaling Systems
- 19) UL 1971 Visual Notification Appliances
- 20) UL 2017 Standard for General-Purpose Signaling Devices and Systems
- b. Texas Accessibility Standards (TAS)

# 1.6 GENERAL REQUIREMENTS

## A. Submittals

- 1. The Contractor shall submit three (3) complete sets of documentation within thirty (30) calendar days after award of the purchase order. Indicated in the document will be the type, size, rating, style, catalog number, manufacturer's names, photos, and /or catalog data sheets for all items proposed to meet these specifications. The proposed equipment shall be subject to the approval of the Architect/Engineer and no equipment shall be ordered or installed on the premises without that approval.
- NOTE: DOCUMENTATION Submittal of shop drawings shall contain at least three (3) copies of original manufacturer specification and installation instruction sheets. Subsequent information may be copies. All equipment and devices on the shop drawings to be furnished under this contract shall be clearly marked in the specification sheets.
- 3. Suppliers qualifications shall be submitted indicating years in business, service policies, warranty definitions, NICET certification, completion of factory training program and a list of similar installations.
- 4. Contractor qualifications shall be supplied indicating years in business and prior experience with installations that include the type of equipment that is to be supplied.
- 5. The Contractor shall provide hourly Service Rates, performed by a factory trained technician for this installed Life Safety System with the submittal. Proof of training and authorization shall be included with the submittal. These hourly service rates shall be guaranteed for a 1-year period.
- 6. Contract close-out Submittals
  - a. Deliver three (3) copies of the following to the Owner's representative within Thirty (30) days of system acceptance. The closeout submittals shall include:
    - 1) Installation and Programming manuals for the installed life safety system.
    - 2) Point to point diagrams of the entire life safety system as installed. This shall include all connected smoke detectors and addressable field modules.
    - 3) All drawings shall reflect device address as verified in the presence of the engineer and/or end user.
- 7. Warranty
  - a. Warranty all materials, installation and workmanship for a one (1) year period, unless otherwise specified. A copy of the manufacturer warranty shall be provided with the close out documentation.
- 8. Products
  - a. This life safety system specification shall be conformed to in its entirety to ensure that the installed and programmed life safety system will accommodate all of the requirements and operations required by the building Owner. Any specified item or operational feature not specifically addressed prior to the bid date will be required to be met without exception.

- b. Submission of product purported to be equal to those specified herein will be considered as possible substitutes only when all of the following requirements have been met:
  - Any deviation from the equipment, operations, methods, design or other criteria specified herein shall be submitted in detail to the specifying Architect or Engineer a minimum of ten (10) working days prior to the scheduled submission of bids. Each deviation from the operation detailed in these specifications shall be documented in detail, including page number and section number, which lists the system function for which the substitution is being proposed.

# 9. General Equipment and Materials Requirements

a. All equipment furnished for this project shall be new and unused. All components shall be designed for uninterrupted duty. All equipment, materials, accessories, devices and other facilities covered by this specification or noted on the contract drawings and installation specification shall be best suited for the intended use and shall be provided by a single manufacturer. If any of the equipment provided under this specification is provided by different manufacturers, then that equipment shall be "Listed" as to its compatibility by Underwriters Laboratories (UL), if such compatibility is required by UL standards.

# PART 2 – PRODUCTS

- 2.1 GENERAL
  - A. Main FACP or network node shall be a NOTIFIER Model NFS2-3030 and shall contain a microprocessor based Central Processing Unit (CPU) and power supply. The CPU shall communicate with and control the following types of equipment used to make up the system: intelligent addressable smoke and thermal (heat) detectors, addressable modules, printer, annunciators, and other system controlled devices.
  - B. In conjunction with intelligent Loop Control Modules and Loop Expander Modules, the main FACP shall perform the following functions:
    - 1. Supervise and monitor all intelligent addressable detectors and monitor modules connected to the system for normal, trouble and alarm conditions.
    - 2. Supervise all initiating signaling and notification circuits throughout the facility by way of connection to addressable monitor and control modules.
    - 3. Detect the activation of any initiating device and the location of the alarm condition. Operate all notification appliances and auxiliary devices as programmed. In the event of CPU failure, all SLC loop modules shall fallback to degrade mode. Such degrade mode shall treat the corresponding SLC loop control modules and associ-ated detection devices as conventional two-wire operation. Any activation of a detector in this mode shall automatically activate associated Notification Appliance Circuits.
  - C. The FACP shall be capable of communicating on Noti-Fire-Net over a Local Area Network (LAN) or Wide Area Network (WAN) utilizing a peer-to-peer, inherently regenerative communication format and protocol. The network shall support communication speed up to 100 Mb and support up to 200 panels / nodes per network.
  - D. The control panel shall be capable of expansion via up to 10 SLC loops. Each module shall support up to 318 analog/addressable devices for a maximum system capacity of 3180 points. The Fire Alarm Control Panel shall include a full featured operator interface control and annunciation panel that shall include a backlit 640-character liquid crystal display,

individual, color coded system status LEDs, and a keypad for the control of the fire alarm system. Said LCD shall also support graphic bit maps capable of displaying the company name and logo of either thpany.

- E. All programming or editing of the existing program in the system shall be achieved without interrupting the alarm monitoring functions of the fire alarm control panel.
- F. The FACP shall be able to provide the following software and hardware features:
  - Pre-signal and Positive Alarm Sequence: The system shall provide means to cause alarm signals to only sound in specific areas with a delay of the alarm from 60 to up to 180 seconds after start of alarm processing. In addition, a Positive Alarm Sequence selection shall be available that allows a 15-second time period for acknowledging an alarm signal from a fire detection/initiating device. If the alarm is not acknowledged within 15 seconds, all local and remote outputs shall automatically activate immediately.
  - 2. Smoke Detector Pre-alarm Indication at Control Panel: To obtain early warning of incipient or potential fire conditions, the system shall support a programmable option to determine system response to real-time detector sensing values above the pro-grammed setting. Two levels of Pre-alarm indication shall be available at the control panel: alert and action.
  - 3. Alert: It shall be possible to set individual smoke detectors for pre-programmed pre-alarm thresholds. If the individual threshold is reached, the pre-alarm condition shall be activated.
  - 4. Action: If programmed for Action and the detector reaches a level exceeding the pre-programmed level, the control panel shall indicate an action condition. Sounder bases installed with either heat or smoke detectors shall automatically activate on action Pre-Alarm level, with general evacuation on Alarm level.
  - 5. The system shall support a detector response time to meet world annunciation re-quirements of less than 3 seconds.
  - 6. Device Blink Control: Means shall be provided to turn off detector/module LED strobes for special areas.
  - NFPA 72 Smoke Detector Sensitivity Test: The system shall provide an automatic smoke detector test function that meets the sensitivity testing requirements of NFPA 72.
  - 8. Programmable Trouble Reminder: The system shall provide means to automatically initiate a reminder that troubles exist in the system. The reminder will appear on the system display and (if enabled) will sound a piezo alarm.
  - 9. Online or Offline programming: The system shall provide means to allow panel programming either through an off-line software utility program away from the panel or while connected and on-line. The system shall also support upload and down-load of programmed database and panel executive system program to a Personal Computer/laptop. A single change to one CPU database shall not require a data-base download to other CPUs.
  - 10. History Events: The panel shall maintain a history file of the last 4000 events, each with a time and date stamp. History events shall include all alarms, troubles, operator actions, and programming entries. The control panels shall also maintain a 1000 event Alarm History buffer, which consists of the 1000 most recent alarm events from the 4000 event history file.

- 11. Smoke Control Modes: The system shall provide means to perform FSCS mode Smoke Control to meet NFPA-92A and 90B and HVAC mode to meet NFPA 90A.
- 12. The system shall provide means for all SLC devices on any SLC loop to be auto programmed into the system by specific address. The system shall recognize specific device type ID's and associate that ID with the corresponding address of the device.
- 13. Passwords and Users: The system shall support two password levels, master and user. Up to 9 user passwords shall be available, each of which may be assigned access to the programming change menus, the alter status menus, or both. Only the master password shall allow access to password change screens.
- 14. Block Acknowledge: The system shall support a block Acknowledge for Trouble Conditions
- 15. Sensitivity Adjust: The system shall provide Automatic Detector Sensitivity Adjust based on Occupancy schedules including a Holiday list of up to 15 days.
- 16. Environmental Drift Control: The system shall provide means for setting Environ-mental Drift Compensation by device. When a detector accumulates dust in the chamber and reaches an unacceptable level but yet still below the allowed limit, the control panel shall indicate a maintenance alert warning. When the detector accumulates dust in the chamber above the allowed limit, the control panel shall indicate a maintenance urgent warning.
- 17. Custom Action Messages: The system shall provide means to enter up to 100 custom action messages of up to 160 characters each. It shall be possible to assign any of the 100 messages to any point.
- 18. Local Mode: If communication is lost to the central processor the system shall pro-vide added survivability through the intelligent loop control modules. Inputs from devices connected to the SLC and loop control modules shall activate outputs on the same loop when the inputs and outputs have been set with point programming to participate in local mode or when the type codes are of the same type: that is, an input with a fire alarm type code shall activate an output with a fire alarm type code.
- 19. Read status preview enabled and disabled points: Prior to re-enabling points, the system shall inform the user that a disabled device is in the alarm state. This shall provide notice that the device must be reset before the device is enabled thereby avoiding activation of the notification circuits.
- 20. Custom Graphics: When fitted with an LCD display, the panel shall permit uploading of a custom bit-mapped graphic to the display screen.
- 21. Multi-Detector and Cooperating Detectors: The system shall provide means to link one detector with up to two detectors at other addresses on the same loop in coop-erative multi-detector sensing. There shall be no requirement for sequential ad-dresses on the detectors and the alarm event shall be a result of all cooperating de-tectors chamber readings.
- 22. ACTIVE EVENT: The system shall provide a Type ID called FIRE CONTROL for purposes of air-handling shutdown, which shall be intended to override normal op-erating automatic functions. Activation of a FIRE CONTROL point shall cause the control panel to (1) initiate the monitor module Control-by-Event, (2) send a message to the panel display, history buffer, installed printer and annunciators, (3) shall not light an indicator at the control panel, (4) Shall display ACTIVE on the LCD as well a display a FIRE CONTROL Type Code and other information specific to the device.
- 23. NON-FIRE Alarm Module Reporting: A point with a type ID of NON-FIRE shall be available for use for energy management or other non-fire situations. NON-FIRE point

operation shall not affect control panel operation nor shall it display a message at the panel LDC. Activation of a NON-FIRE point shall activate control by event logic but shall not cause any indication on the control panel.

- 24. Mass Notification Override: The system shall be UL 2572 listed for Mass Notification and shall be capable, based on the Risk Analysis, of being programmed so that Mass Notification/Emergency Communications events take precedence over fire alarm events.
- 25. Security Monitor Points: The system shall provide means to monitor any point as a type security.
- 26. One-Man Walk Test: The system shall provide both a basic and advanced walk test for testing the entire fire alarm system. The basic walk test shall allow a single operator to run audible tests on the panel. All logic equation automation shall be suspended during the test and while annunciators can be enabled for the test, all shall default to the disabled state. During an advanced walk test, field-supplied output point programming will react to input stimuli such as CBE and logic equations. When points are activated in advanced test mode, each initiating event shall latch the input. The advanced test shall be audible and shall be used for pull station veri-fication, magnet activated tests on input devices, input and output device and wiring operation/verification.
- 27. Control By Event Functions: CBE software functions shall provide means to pro-gram a variety of output responses based on various initiating events. The control panel shall operate CBE through lists of zones. A zone shall become listed when it is added to a point's zone map through point programming. Each input point such as detector, monitor module or panel circuit module shall support listing of up to 10 zones into its programmed zone map.
- 28. Permitted zone types shall be general zone, releasing zone and special zone. Each output point (control module, panel circuit module) can support a list of up to 10 zones including general zone, logic zone, releasing zone and trouble zone. It shall be possible for output points to be assigned to list general alarm. Non-Alarm or Su-pervisory points shall not activate the general alarm zone.
- 29. 1000 General Zones: The system shall support up to 1000 general purpose soft-ware zones for linking inputs to outputs. When an input device activates, any general zone programmed into that device's zone map will be active and any output device that has an active general zone in its map will be active. It shall also be possible to use general zone as arguments in logic equations.
- 1000 Logic Equations: The system shall support up to 1000 logic equations for AND, OR, NOT, ONLY1, ANYX, XZONE or RANGE operators that allow conditional I/O linking. When any logic equation becomes true, all output points mapped to the logic zone shall activate.
- 31. 100 trouble equations per device: The system shall provide support for up to 100 trouble equations for each device, which shall permit programming parameters to be altered, based on specific fault conditions. If the trouble equation becomes true, all output points mapped to the trouble zone shall activate.
- 32. Control-By-Time: A time based logic function shall be available to delay an action for a specific period of time based upon a logic input with tracking feature. A latched version shall also be available. Another version of this shall permit activation on specific days of the week or year with ability to set and restore based on a 24 hour time schedule on any day of the week or year.

- 33. Multiple agent releasing zones: The system shall support up to 10 releasing zones to protect against 10 independent hazards. Releasing zones shall provide up to three cross-zone and four abort options to satisfy any local jurisdiction requirements.
- 34. Alarm Verification, by device, with timer and tally: The system shall provide a user-defined global software timer function that can be set for a specific detector. The timer function shall delay an alarm signal for a user-specified time period and the control panel shall ignore the alarm verification timer if another alarm is detected during the verification period. It shall also be possible to set a maximum verification count between 0 and 20 with the "0" setting producing no alarm verification. When the counter exceeds the threshold value entered, a trouble shall be generated to the panel.
- G. Network Communication
  - 1. The FACP shall be capable of communicating on Noti-Fire-Net over a Local Area Network (LAN) or Wide Area Network (WAN) utilizing a peer-to-peer, inherently re-generative communication format and protocol. The network shall support com-munication speed up to 100 Mb and support up to 200 panels/nodes per network.
- H. Central Processing Unit
  - The Central Processing Unit shall contain and execute all control-by-event (includ-ing Boolean functions including but not limited to AND, OR, NOT, ANYx, and CROSSZONE) programs for specific action to be taken if an alarm condition is de-tected by the system. Such control-by-event programs shall be held in non-volatile programmable memory, and shall not be lost with system primary and secondary power failure.
  - 2. The Central Processing Unit shall also provide a real-time clock for time annotation, to the second, of all system events. The time-of-day and date shall not be lost if system primary and secondary power supplies fail.
  - 3. The CPU shall be capable of being programmed on site without requiring the use of any external programming equipment. Systems that require the use of external programmers or change of EPROMs are not acceptable.
  - 4. The CPU shall provide an EIA-232 interface between the fire alarm control panel and the UL Listed Electronic Data Processing (EDP) peripherals.
  - 5. The CPU shall provide two EIA-485 ports for the serial connection to annunciation and control subsystem components.
  - 6. The EIA-232 serial output circuit shall be optically isolated to assure protection from earth ground.
- I. Display
  - 1. The system display shall provide a 640-character backlit alphanumeric Liquid Crystal Display (LCD). It shall also provide eleven Light-Emitting-Diodes (LEDs) that indicate the status of the following system parameters: AC POWER, FIRE ALARM, PREALARM, SECURITY, SUPERVISORY, SYSTEM TROUBLE, OTHER EVENT, SIGNALS SILENCED, POINT DISABLED, CONTROLS ACTIVE, and CPU FAILURE.
  - 2. The system display shall provide a keypad with control capability to command all system functions, entry of any alphabetic or numeric information, and field pro-gramming. Two different password levels with up to ten (one Master and nine User) passwords shall be accessible through the display interface assembly to prevent unauthorized system control or programming.

- J. Loop (Signaling Line Circuit) Control Module:
  - 1. The Loop Control Module shall monitor and control a minimum of 318 intelligent ad-dressable devices. This includes 159 intelligent detectors (Ionization, Photoelectric, or Thermal) and 159monitor or control modules.
  - 2. The Loop Control Module shall contain its own microprocessor and shall be capable of operating in a local/degrade mode (any addressable device input shall be capable of activating any or all addressable device outputs) in the unlikely event of a failure in the main CPU.
  - 3. Each Loop shall be capable of operating as a NFPA Style 4 (Class B) circuit.
  - 4. The SLC interface board shall receive analog or digital information from all intelligent detectors and shall process this information to determine whether normal, alarm, or trouble conditions exist for that particular device. Each SLC Loop shall be isolated and equipped to annunciate an Earth Fault condition. The SLC interface board software shall include software to automatically maintain the detector's de-sired sensitivity level by adjusting for the effects of environmental factors, including the accumulation of dust in each detector. The analog information may also be used for automatic detector testing and the automatic determination of detector maintenance requirements.
- K. Digital Voice Command Center
  - 1. The Digital Voice Command Center located with the FACP, shall contain all equipment required for all audio control, emergency telephone system control, signaling and supervisory functions. This shall include speaker zone indication and control, telephone circuit indication and control, digital voice units, microphone and main telephone handset.
  - 2. Function: The Voice Command Center equipment shall perform the following func-tions:
    - a. Operate as a supervised multi-channel emergency voice communication system.
    - b. Operate as a two-way emergency telephone system control center.
    - c. Audibly and visually annunciate the active or trouble condition of every speaker circuit and emergency telephone circuit.
    - d. Audibly and visually annunciate any trouble condition for digital tone and voice units required for normal operation of the system.
    - e. Provide all-call Emergency Paging activities through activation of a single control switch.
    - f. As required, provide vectored paging control to specific audio zones via dedicated control switches.
    - g. Provide a factory recorded "library" of voice messages and tones in standard WAV. File format, which may be edited and saved on a PC running a current Windows® operating system.
    - h. Provide a software utility capable of off-line programming for the DVC operation and the audio message files. This utility shall support the creation of new programs as well as editing and saving existing program files. Uploading or downloading the DVC shall not inhibit the emergency operation of other nodes on the fire alarm network.
    - i. Support an optional mode of operation with four analog audio outputs capable of being used with UL 864 fire-listed analog audio amplifiers and SLC controlled switching.
    - j. The Digital Voice Command shall be modular in construction, and shall be capable of being field programmable without requiring the return of any components to the manufacturer and without requiring use of any external comput-ers or other programming equipment.
- k. The Digital Voice Command and associated equipment shall be protected against unusually high voltage surges or line transients.
- L. Power Supply:
  - 1. The Main Power Supply shall operate on 120/240 VAC, 50/60 Hz, and shall provide all necessary power for the FACP.
  - 2. The Main Power Supply shall provide the required power to the CPU using a switching 24 VDC regulator and shall incorporate a battery charger for 24 hours of standby power using dual-rate charging techniques for fast battery recharge.
  - 3. The Main Power Supply shall provide a battery charger for 24 hours of standby using dual-rate charging techniques for fast battery recharge. The supply shall be capable of charging batteries ranging in capacity from 7-200 amp-hours within a 48-hour period.
  - 4. The Main Power Supply shall provide a very low frequency sweep earth detect circuit, capable of detecting earth faults.
  - 5. The Main Power Supply shall be power-limited per UL864 requirements.
  - 6. The Main Power Supply shall communicate power supply, line voltage, battery status and charger status to the local LCD display. Any abnormal condition shall be annunicated and logged to the system alarm history log.
  - Addressable Charger Power SupplyThe auxiliary addressable power supply is a remote 24 VDC power supply used to power Notification Devices and field devices that require regulated 24 VDC power NOTIFIER model # ACPS-610
  - 8. The addressable power supply for the fire detection system shall provide up to a minimum of 6.0 amps of 24 volt DC regulated power for Notification Appliance Circuit (NAC) power or 10.0 amps of 24 volt DC general power. The power supply shall have an additional 0.5 amp of 24 VDC auxiliary power for use within the same cabinet as the power supply. It shall include an integral charger designed to charge 12 200 amp hour batteries.
  - The addressable power supply shall provide four individually addressable Notification Appliance Circuits that may be configured as Class "A" or Class "B" circuits. All circuits shall be power-limited per UL 864 requirements.
  - 10. The addressable power supply shall provide built-in synchronization for certain Notification Appliances on each circuit without the need for additional synchronization modules. The power supply's output circuits shall be individually selected for synchronization. A single addressable power supply shall be capable of supporting both synchronized and non-synchronized Notification Devices at the same time.
  - 11. The addressable power supply shall operate on 120 or 240 VAC, 50/60 Hz.
  - 12. The interface to the power supply from the Fire Alarm Control Panel (FACP) shall be via the Signaling Line Circuit (SLC) or other multiplexed means Power supplies that do not use an intelligent interface are not suitable substitutes. The required wiring from the FACP to the addressable power supply shall be a single unshielded twisted pair wire.
  - 13. The addressable power supply shall supervise for battery charging failure, AC power loss, power brownout, battery failure, NAC loss, and optional ground fault detection. In the event of a trouble condition, the addressable power supply shall report the incident and the applicable address to the FACP via the SLC.
  - 14. The addressable power supply shall have an AC Power Loss Delay option. If this option is utilized and the addressable power supply experiences an AC power loss,

reporting of the incident to the FACP will be delayed. A delay time of zero, two, eight or sixteen hours shall be programmable.

- 15. The addressable power supply shall have an option for Canadian Trouble Reporting and this option shall be programmable.
- 16. The addressable power supply mounts in either the FACP backbox or it's own dedicated surface mounted backbox with cover.
- 17. Each of the power supply's four output circuits shall be programmed for Notification Appliance Circuit or General Purpose 24 VDC power. Any output circuit shall be able to provide up to 2.5 amps of 24 VDC power.
- 18. The addressable power supply's output circuits shall be individually supervised when they are selected to be either a Notification Appliance Circuit when wired Class "A" or by the use of and end-of-line resistor. When the power supply's output circuit is selected as General 24 VDC power, the circuit shall be individually super-vised when an end-of-line relay is used.
- 19. When selected for Notification Appliance Circuits, the output circuits shall be indi-vidually programmable for Steady, March Time, Dual Stage or Temporal.
- 20. When selected as a Notification Appliance Circuit, the output circuits of the ad-dressable power supply shall have the option to be coded by the use of a universal zone coder.
- 21. The addressable power supply shall interface and synchronize with other power supplies of the same type. The required wiring to interface multiple addressable power supplies shall be a single unshielded, twisted pair wire.
- 22. An individual or multiple interfaced addressable power supplies shall have the option to use an external charger for battery charging. Interfaced power supplies shall have the option to share backup battery power.
- M. Audio Amplifiers
  - 1. The Audio Amplifiers will provide Audio Power for distribution to speaker circuits.
  - 2. Multiple audio amplifiers may be mounted in a single enclosure, either to supply incremental audio power, or to function as an automatically switched backup amplifier(s).
  - 3. The audio amplifier shall include an integral power supply, and shall provide built-in LED indicators for the following conditions:
    - a. Earth Fault on DAP A (Digital Audio Port A)
    - b. Earth Fault on DAP B (Digital Audio Port B)
    - c. Audio Amplifier Failure Detected Trouble
    - d. Active Alarm Bus input
    - e. Audio Detected on Aux Input A
    - f. Audio Detected on Aux Input B
    - g. Audio Detected on Firefighter's Telephone Riser
    - h. Receiving Audio from digital audio riser
    - i. Short circuit on speaker circuit 1
    - j. Short circuit on speaker circuit 2
    - k. Short circuit on speaker circuit 3
    - I. Short circuit on speaker circuit 4
    - m. Data Transmitted on DAP A
    - n. Data Received on DAP A
    - o. Data Transmitted on DAP B
    - p. Data Received on DAP B

- q. Board failure
- r. Active fiber optic media connection on port A (fiber optic media applications)
- s. Active fiber optic media connection on port B (fiber optic media applications)
- t. Power supply Earth Fault
- u. Power supply 5V present
- v. Power supply conditions Brownout, High Battery, Low Battery, Charger Trouble
- 4. The audio amplifier shall provide the following built-in controls:
  - a. Amplifier Address Selection Switches
  - b. Signal Silence of communication loss annunciation Reset
  - c. Level adjustment for background music
  - d. Enable/Disable for Earth Fault detection on DAP A
  - e. Enable/Disable for Earth Fault detection on DAP A
  - f. Switch for 2-wire/4-wire FFT riser
- 5. Adjustment of the correct audio level for the amplifier shall not require any special tools or test equipment.
- 6. Includes audio input and amplified output supervision, back up input, and automatic switch over function, (if primary amplifier should fail).
- 7. System shall be capable of backing up digital amplifiers.
- 8. One-to-one backup shall be provided by either a plug-in amplifier card or a designated backup amplifier of identical model as the primary amplifier.
- 9. One designated backup amplifier shall be capable of backing up multiple primary amplifiers mounted in the same or adjacent cabinets.
- 10. Multi-channel operation from a single amplifier shall be supported by the addition of an optional plug-in amplifier card.
- N. Audio Message Generator (Prerecorded Voice)/Speaker Control:
  - 1. Each initiating zone or intelligent device shall interface with an emergency voice communication system capable of transmitting a prerecorded voice message to all speakers in the building.
  - 2. Actuation of any alarm initiating device shall cause a prerecorded message to sound over the speakers. The message shall be repeated four (4) times. Pre- and post-message tones shall be supported.
  - 3. A built-in microphone shall be provided to allow paging through speaker circuits.
  - 4. System paging from emergency telephone circuits shall be supported.
  - 5. The audio message generator shall have the following indicators and controls to allow for proper operator understanding and control:
    - a. Lamp Test
    - b. Trouble
    - c. Off-Line Trouble
    - d. Microphone Trouble
    - e. Phone Trouble
    - f. Busy/Wait
    - g. Page Inhibited
    - h. Pre/Post Announcement Tone
- O. Controls with associated LED Indicators:
  - 1. Speaker Switches/Indicators

- a. The speaker circuit control switches/indicators shall include visual indication of active and trouble status for each speaker circuit in the system.
- b. The speaker circuit control panel shall include switches to manually activate or deactivate each speaker circuit in the system.
- 2. Emergency Two-Way Telephone Control Switches/Indicators
  - a. The emergency telephone circuit control panel shall include visual indication of active and trouble status for each telephone circuit in the system.
  - b. The telephone circuit control panel shall include switches to manually activate or deactivate each telephone circuit in the system.
- P. Remote Transmissions:
  - 1. Provide local energy or polarity reversal or trip circuits as required.
  - 2. The system shall be capable of operating a polarity reversal or local energy or fire alarm transmitter for automatically transmitting fire information to the fire department.
  - 3. Provide capability and equipment for transmission of zone alarm and trouble signals to remote operator's terminals, system printers and annunciators.
  - 4. Transmitters shall be compatible with the systems and equipment they are connected to such as timing, operation and other required features.
- Q. Field Programming
  - 1. The system shall be programmable, configurable and expandable in the field without the need for special tools, laptop computers, or other electronic interface equipment. There shall be no firmware changes required to field modify the system time, point information, equations, or annunciator programming/information.
  - 2. All field defined programs shall be stored in non-volatile memory.
- R. Specific System Operations
  - 1. Smoke Detector Sensitivity Adjust: A means shall be provided for adjusting the sensitivity of any or all addressable intelligent detectors in the system from the system keypad. Sensitivity range shall be within the allowed UL window and have a minimum of 9 levels.
  - 2. Alarm Verification: Each of the intelligent addressable smoke detectors in the system may be independently selected and enabled to be an alarm verified detector. The alarm verification delay shall be programmable from 0 to 60 seconds and each detector shall be able to be selected for verification. The FACP shall keep a count of the number of times that each detector has entered the verification cycle. These counters may be displayed and reset by the proper operator commands.
- S. System Point Operations:
  - 1. Any addressable device in the system shall have the capability to be enabled or disabled through the system keypad or video terminal.
  - 2. System output points shall be capable of being turned on or off from the system keypad or the video terminal.
  - 3. Point Read: The system shall be able to display the following point status diagnostic functions without the need for peripheral equipment. Each point shall be annunciated for the parameters listed:
    - a. Device Status.
    - b. Device Type.

- c. Custom Device Label.
- d. Software Zone Label.
- e. Device Zone Assignments.
- f. Analog Detector Sensitivity.
- g. All Program Parameters.
- 4. System History Recording and Reporting: The fire alarm control panel shall contain a history buffer that will be capable of storing up to 4000 system events. Each of these events will be stored, with time and date stamp, until an operator requests that the contents be either displayed or printed. The contents of the history buffer may be manually reviewed; one event at a time, and the actual number of activations may also be displayed and or printed. History events shall include all alarms, troubles, operator actions, and programming entries.
- 5. The history buffer shall use non-volatile memory. Systems which use volatile memory for history storage are not acceptable.
- 6. Automatic Detector Maintenance Alert: The fire alarm control panel shall automatically interrogate each intelligent system detector and shall analyze the detector responses over a period of time.
- 7. If any intelligent detector in the system responds with a reading that is below or above normal limits, then the system will enter the trouble mode, and the particular Intelligent Detector will be annunciated on the system display, and printed on the optional system printer. This feature shall in no way inhibit the receipt of alarm conditions in the system, nor shall it require any special hardware, special tools or computer expertise to perform.
- 8. The system shall include the ability (programmable) to indicate a "pre-alarm" condition. This will be used to alert maintenance personal when a detector is at 80% of its alarm threshold in a 60 second period.

#### 2.2 ADDRESSABLE DEVICES

- A. General
  - 1. Addressable devices shall provide an address-setting means using rotary decimal switches. Addressable devices that require the address be programmed using a programming utility are not an allowable substitute.
  - 2. Addressable devices shall use simple to install and maintain decade, decimal address switches. Devices shall be capable of being set to an address in a range of 001 to 159.
  - 3. Addressable devices, which use a binary-coded address setting method, such as a DIP-switch, are not an allowable substitute. Addressable devices that require the address be programmed using a special tool or programming utility are not an allowable substitute.
  - 4. Detectors shall be intelligent (analog) and addressable, and shall connect with two wires to the fire alarm control panel Signaling Line Circuits.
  - 5. Addressable smoke and thermal detectors shall provide dual alarm and power/polling LEDs. Both LEDs shall flash green under normal conditions, indicating that the detector is operational and in regular communication with the control panel, and both LEDs shall be placed into steady red illumination by the control panel, indicating that an alarm condition has been detected. If required, the LED flash shall have the ability to be removed from the system program. An output connection shall also be provided in the base to connect an external remote alarm LED.

- 6. The fire alarm control panel shall permit detector sensitivity adjustment through field programming of the system. The panel on a time-of-day basis shall automatically adjust sensitivity.
- 7. Using software in the FACP, detectors shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance. The detectors shall be listed by UL as meeting the calibrated sensitivity test requirements of NFPA Standard 72.
- 8. The detectors shall be ceiling-mount and shall include a separate twist-lock base with tamper proof feature. Base options shall include a sounder base with a built-in (local) sounder rated at 85 DBA minimum, a relay base and an isolator base designed for Style 7 applications. The system shall also support an intelligent programmable sounder base, the programmable sounder base shall be capable of providing multiple tones based on programming and at a minimum be capable of providing a Temp-4 tone for CO (Carbon Monoxide) activation and a Temp-3 tone for fire activations and be capable of being synchronized with other programmable sounder bases and common area notification appliances; 85 DBA minimum.
- 9. Detectors shall also store an internal identifying type code that the control panel shall use to identify the type of device (ION, PHOTO, THERMAL).
- 10. Detectors will operate in an analog fashion, where the detector simply measures its designed environment variable and transmits an analog value to the FACP based on real-time measured values. The FACP software, not the detector, shall make the alarm/normal decision, thereby allowing the sensitivity of each detector to be set in the FACP program and allowing the system operator to view the current analog value of each detector.
- 11. Addressable devices shall store an internal identifying code that the control panel shall use to identify the type of device.
- 12. A magnetic test switch shall be provided to test detectors and modules. Detectors shall report an indication of an analog value reaching 100% of the alarm threshold.
- Addressable modules shall mount in a 4-inch square (101.6 mm square), 2-1/8 inch (54 mm) deep electrical box. An optional surface mount Lexan enclosure shall be available.
- B. Addressable Manual Fire Alarm Box (manual station)
  - 1. Addressable manual fire alarm boxes shall, on command from the control panel, send data to the panel representing the state of the manual switch and the addressable communication module status;NOTIFIER model # NBG-12LX. They shall use a key operated test-reset lock, and shall be designed so that after actual emergency operation, they cannot be restored to normal use except by the use of a key.
  - 2. All operated stations shall have a positive, visual indication of operation and utilize a key type reset.
  - 3. Manual fire alarm boxes shall be constructed of Lexan with clearly visible operating instructions provided on the cover. The word FIRE shall appear on the front of the stations in raised letters, 1.75 inches (44 mm) or larger.
- C. Intelligent Photoelectric Smoke Detector: The intelligent photoelectric smoke detector shall be NOTIFIER model # FSP-851 and shall use the photoelectric (light-scattering) principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the analog level of smoke density.

- D. Intelligent VIEW® Laser Photo Smoke Detector: The intelligent laser photo smoke detector shall be a spot type detector, NOTIFIER model # FSL-751, that incorporates an extremely bright laser diode and an integral lens that focuses the light beam to a very small volume near a receiving photo sensor. The scattering of smoke particles shall activate the photo sensor.
  - 1. The laser detector shall have conductive plastic so that dust accumulation is reduced significantly.
  - 2. The intelligent laser photo detector shall have nine sensitivity levels and be sensitive to a minimum obscuration of 0.02 percent per foot.
  - 3. The laser detector shall not require expensive conduit, special fittings or PVC pipe.
  - 4. The intelligent laser photo detector shall support standard, relay, isolator and sounder detector bases.
  - 5. The laser photo detector shall not require other cleaning requirements than those listed in NFPA 72. Replacement, refurbishment or specialized cleaning of the detector head shall not be required.
  - 6. The laser photo detector shall include two bicolor LEDs that flash green in normal operation and turn on steady red in alarm.
- E. Intelligent Ionization Smoke Detector: The intelligent ionization smoke detector shall be NOTIFIER model # FSI-851 and shall use the dual-chamber ionization principal to measure products of combustion and shall, on command from the control panel, send data to the panel representing the analog level of products of combustion.
- F. Intelligent Multi Criteria Acclimating Detector: The intelligent multi-criteria Acclimate® Plus™ detector shall be an addressable device, NOTIFIER model # FAPT-851, that is designed to monitor a minimum of photoelectric and thermal technologies in a single sensing device. The design shall include the ability to adapt to its environment by utilizing a built-in microprocessor to determine its environment and choose the appropriate sensing settings. The detector design shall allow a wide sensitivity window, no less than 1 to 4% per foot obscuration. This detector shall utilize advanced electronics that react to slow smoldering fires and thermal properties all within a single sensing device.
  - 1. The microprocessor design shall be capable of selecting the appropriate sensitivity levels based on the environment type it is in (office, manufacturing, kitchen etc.) and then have the ability to automatically change the setting as the environment changes (as walls are moved or as the occupancy changes).
  - 2. The intelligent multi criteria detection device shall include the ability to combine the signal of the thermal sensor with the signal of the photoelectric signal in an effort to react hastily in the event of a fire situation. It shall also include the inherent ability to distinguish between a fire condition and a false alarm condition by examining the characteristics of the thermal and smoke sensing chambers and comparing them to a database of actual fire and deceptive phenomena.
- G. Intelligent Thermal Detectors: The intelligent thermal detectors shall be NOTIFIER FSTseries addressable devices rated at 135 degrees Fahrenheit (58 degrees Celsius) and have a rate-of-rise element rated at 15 degrees F (9.4 degrees C) per minute. A high heat thermal detector rated at 190 degrees Fahrenheit shall also be available. The thermal detectors shall connect via two wires to the fire alarm control panel signaling line circuit.

- H. Intelligent Duct Smoke Detector: The smoke detector housing shall accommodate an in-telligent photoelectric detector that provides continuous analog monitoring and alarm verification from the panel. When sufficient smoke is sensed, an alarm signal is initiated at the FACP, and appropriate action taken to change over air handling systems to help prevent the rapid distribution of toxic smoke and fire gases throughout the areas served by the duct system. The Intelligent Duct Smoke Detector shall support the installation of addressable Photoelectric detector capable or being tested remotely. The Intelligent Duct Detector housing shall be model # DNR(W) and the remote test capable photoelectric smoke detector shall be NOTIFIER model # FSP-851R.
- I. IntelliQuad<sup>™</sup> Advanced Multi-Criteria Intelligent Detector
  - Intelligent multi-criteria fire detector shall be a NOTIFIER model number FSC-851. Smoke detector shall be an addressable intelligent multi-criteria smoke detector. The detector shall be comprised of four sensing elements, including a photoelectric (light-scattering) particulate sensor, an electrochemical carbon monoxide (CO) sensor, a daylight-filtered infrared sensor and solid state thermal sensor(s) rated at 135°F (57.2°C). The device shall be able to indicate distinct smoke and heat alarms.
  - 2. The intelligent multi-criteria detection device shall include the ability to combine the signal of the photoelectric signal with other sensing elements in an effort to react quickly in the event of a fire situation. It shall also include the inherent ability to distinguish between a fire condition and a nuisance alarm condition. The product design shall be capable of selecting the appropriate sensitivity levels based on the environment type chosen by user in which it is installed (office, manufacturing, kitchen etc.) and then have the ability to automatically change the setting as the environment changes.
  - 3. The detector shall be capable of automatically adjusting its sensitivity by means of drift compensation and smoothing algorithms. The detector shall be capable of automatically adjusting its sensitivity by means of drift compensation and smoothing algorithms. The device shall provide unique signals to indicate when 20% of the drift range is remaining, when 100% of drift range is used, and when there is a chamber fault to show unit requires maintenance.
  - 4. The detector shall indicate CO trouble conditions including 6 months of sensor life remaining and sensor life has expired. The detector shall indicate a combined signal for any of the following: low chamber trouble, thermistor trouble, CO self test failure, IR self test failure, and freeze warning.
  - 5. The detectors shall provide address-setting means on the detector head using rotary switches. Because of the possibility of installation error, systems that use binary jumpers or DIP switches to set the detector address are not acceptable. The detectors shall also store an internal identifying code that the control panel shall use to identify the type of detector. Systems that require a special programmer to set the detector address (including temporary connection at the panel) are labor intensive and not acceptable. Each detector occupies any one of at least 99 possible addresses on the signaling line circuit (SLC) loop. It responds to regular polls from the system and reports its type and status.
  - 6. The detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself (by activating a switch) or initiated remotely on command from the control panel. There are three test methods: functional magnet, smoke entry aerosol, or direct heat method.

- 7. The detectors shall provide two LEDs to provide 360° visibility. The LEDs are placed into steady red illumination by the control panel indicating that an alarm condition has been detected. An output connection shall also be provided in the base to connect an external remote alarm LED, sounder base, and / or relay base (optional accessories). The external remote alarm can be interconnected to other sounder or relay bases for activating all devices in a space via a single alarming unit.
- 8. Two LEDs on the sensor are controlled by the panel to indicate sensor status. Coded signals, transmitted from the panel, can cause the LEDs to blink, latch on, or latch off. Refer to the control panel technical documentation for sensor LED status operation and expected delay to alarm.
- 9. The detectors shall be ceiling-mount and shall be plug-in mounted into a twist-lock base. These detectors shall be constructed of off-white UV resistant polymer and shall be detachable from the mounting base to simplify installation, service and maintenance. Mounting base wiring connections shall be made by means of SEMS screws. The detector shall allow pre-wiring of the base and the head shall be a plug-in type. Mounting base shall be mounted on junction box which is at least 1.5 inches (3.81 cm) deep. Mounting base shall be available to mount to standard junction boxes. Suitable boxes include:
  - a. 4.0" (10.16 cm) square box with and without plaster ring.
  - b. 4.0" (10.16 cm) octagonal box.
  - c. 3.5" (8.89 cm) octagonal box.
  - d. Single-gang box.
- 10. 1Meets Agency Standards
  - a. ANSI/UL 268 -Smoke Detectors for Fire Alarm Signaling Systems
  - b. CAN/ULC-S529- Smoke Detectors for Fire Alarm Systems
  - c. FM 3230-3250- Smoke Actuated Detectors for Automatic Fire Alarm Signal-ing
- J. IntelliQuad™ PLUS Advanced Multi-Criteria Intelligent Fire/CO Detector
  - 1. Advanced Multi-Criteria Fire/CO detector shall be NOTIFIER model # FCO-851 and shall be an addressable advanced multi-criteria smoke detector with a separate signal for carbon monoxide (CO) detection per UL 2075 standards.
  - The detector shall be comprised of four sensing elements, including a photoelectric (light-scattering) particulate sensor, an electrochemical CO sensor, a daylight-filtered infrared (IR) sensor and solid state thermal sensor(s) rated at 135°F (57.2°C). The device shall be able to indicate distinct smoke and heat alarms.
  - 3. The advanced multi-criteria detection device shall include the ability to combine the signal of the photoelectric signal with other sensing elements in order to react quickly in the event of a fire situation. It shall also include the inherent ability to distinguish between a fire condition and a nuisance alarm condition. The detector shall be capable of selecting the appropriate sensitivity levels based on the environment type (office, manufacturing, kitchen, etc.) in which it is installed, and then have the ability to automatically change the setting as the environment changes.
  - 4. The CO detector component shall be capable of a functional gas test using a canned test agent to test the functionality of the CO sensing cell.
  - 5. The detector shall be capable of automatically adjusting its sensitivity by means of drift compensation and smoothing algorithms. The device shall provide unique signals to indicate when 20 percent of the drift range is remaining, when 100 percent of drift range is used, and when there is a chamber fault to show the unit requires maintenance.

- The detector shall indicate CO trouble conditions, including six months of sensor life remaining and sensor life has expired. The detector shall indicate a combined signal for any of the following: low chamber trouble, thermistor trouble, CO self test failure, IR self test failure, and freeze warning.
- 7. The detector shall provide address-setting means on the detector head using rotary switches. Because of the possibility of installation error, systems that use binary jumpers or DIP switches to set the detector address are not acceptable. The detector shall also store an internal identifying code that the control panel shall use to identify the type of detector. Systems that require a special programmer to set the detector address (including temporary connection at the panel) are labor intensive and not acceptable. Each detector occupies any one of at least 159 possible addresses on the signaling line circuit (SLC) loop. It responds to regular polls from the system and reports its type and status.
- 8. The detector shall provide a test means whereby it will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself (by activating a switch) or initiated remotely on command from the control panel. There shall be four test methods: functional magnet, smoke entry aerosol, carbon monoxide aerosol or direct heat method.
- 9. The detector shall provide two LEDs to provide 360° visibility. The LEDs shall be placed into steady red illumination by the control panel indicating that an alarm condition has been detected. An output connection shall also be provided in the base to connect an external remote alarm LED. The detector must be capable of connecting to a sounder base that provides both temporal 3 and temporal 4 patterns for fire and CO alarm.
- 10. Two LEDs on the sensor shall be controlled by the panel to indicate sensor status. Coded signals, transmitted from the panel, shall cause the LEDs to blink, latch on, or latch off. Refer to the control panel technical documentation for sensor LED status operation and expected delay to alarm.
- 11. The detector shall be plug-in mounted into a twist-lock base. The detector shall be constructed of off-white, UV-resistant polymer and shall be detachable from the mounting base to simplify installation, service and maintenance. Mounting base wiring connections shall be made by means of SEMS screws. The detector shall allow pre-wiring of the base and the head shall be a plug-in type. The mounting base shall be mounted on a junction box that is at least 1.5 inches (3.81 cm) deep. The mounting base shall be available to mount to standard junction boxes. Suitable boxes include:
  - a. 4.0" (10.16 cm) square box with and without plaster ring.
  - b. 4.0" (10.16 cm) octagonal box.
  - c. 3.5" (8.89 cm) octagonal box.
  - d. Single-gang box.
  - e. Double-gang box
- 12. Meets Agency Standards
  - a. ANSI/UL 268 -Smoke Detectors for Fire Alarm Signaling Systems
  - b. CAN/ULC-S529- Smoke Detectors for Fire Alarm Systems
  - c. FM 3230-3250- Smoke Actuated Detectors for Automatic Fire Alarm Signaling
  - d. UL 2075 Gas and Vapor Detector and Sensors Systems Connected
- K. Intelligent Addressable Aspiration Detector: The intelligent aspiration detector shall be NOTIFIER model # FSA-8000 an addressable aspiration detector that communicates directly with the fire alarm control panel via the SLC communication protocol, no modules or high level interfaces shall be required. The fire alarm control panel shall support up to thirty one intelligent aspiration detectors per SLC loop. The aspiration detector shall have dual source (blue LED and infrared laser) optical smoke detection for a wide range of fire

detection with enhanced immunity to nuisance particulates. The FACP shall be capable of monitoring and annunciating up to five smoke event thresholds and eleven trouble conditions. Each event threshold shall be capable of being assigned a discrete type ID at the FACP.

- L. Intelligent Addressable Reflected Beam Detector
  - The intelligent single-ended reflected beam smoke detector shall connect with two wires to the fire alarm control panel signaling line circuit (SLC). The detectors shall consist of a transmitter/receiver unit and a reflector and shall send data to the panel representing the analog level of smoke density. The detector shall be capable of being tested remotely via a keyswitch; NOTIFIER model # FSB-200. Model # FSB-200S shall be equipped with an integral sensitivity test feature.
- M. M.Addressable Dry Contact Monitor Module
  - Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional alarm initiating devices (any N.O. dry contact device) to one of the fire alarm control panel SLCs. The addressable monitor module shall be NOTIFIER model # FMM-1 (Class A or B) or FMM-101 (Class B)
  - 2. The IDC zone shall be suitable for Style D/Class A or Style B/Class B operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.
  - 3. For difficult to reach areas, the monitor module shall be available in a miniature package and shall be no larger than 2-3/4 inch (70 mm) x 1-1/4 inch (31.7 mm) x 1/2 inch (12.7 mm). This version need not include Style D or an LED.
  - 4. For multiple dry contact monitoring a module shall be available that provides 10 Style B or 5 Style D input circuits; NOTIFIER model # XP10-M.
- N. Two Wire Detector Monitor Module
  - 1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional 2-wire smoke detectors or alarm initiating devices (any N.O. dry contact device); NOTIFIER model # FZM-1.
  - 2. The IDC zone may be wired for Class A or B (Style D or Style B) operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.
  - For multiple 2-wire smoke detector circuit monitoring a module shall be available that provides 6 Style B/Class A or 3 Style D/Class B input circuits; NOTIFIER model # XP6-MA.
- O. Addressable Control Module
  - 1. Addressable control modules shall be provided to supervise and control the operation of one conventional circuit of compatible Notification Appliances, 24 VDC powered, polarized audio/visual notification appliances; NOTIFIER model # FCM-1
  - 2. The control module NAC may be wired for Style Z or Style Y (Class A/B) with a current rating of 2 Amps for Style Z and 3 Amps for Style Y;
  - 3. Audio/visual power shall be provided by a separate supervised circuit from the main fire alarm control panel or from a supervised UL listed remote supply.
  - For multiple circuit control a module shall be available that provides 6 Style Y (Class B) or 3 Style Z (Class A) control circuits; NOTIFIER model # XP6-C.

- P. Addressable Releasing Control Module
  - 1. An addressable FlashScan releasing module shall be available to supervise and control compatible releasing agent solenoids; NOTIFIER model # FCM-1-REL.
  - 2. The module shall operate on a redundant protocol for added protection.
  - 3. The module shall be configurable for Style Z or Style Y (Class A/B) and support one 24 volt or two 12 volt solenoids.Add FMM-4-20
- Q. Addressable 4-20 mA module shall be available to monitor industry-standard, linear-scale, 4-20 mA protocol sensors. The module converts the sensor output to communication protocol that can be interpreted by the FACP for monitoring and display; NOTIFIER model # FMM-4-20.
  - 1. The module shall support programming of up to five programmable event thresholds.
  - The System shall be FM 6320 (Factory Mutual) approved as a Gas Detection system when employed with the FMM-4-20 monitor module and industry standard 4-20 mA gas detectors.
- R. Addressable Relay Module:
  - 1. Addressable Relay Modules shall be available for HVAC control and other network building functions; NOTIFIER model # FRM-1.
  - 2. The module shall provide two form C relays rated at up to 3 Amps resistive and up to 2.0 Amps inductive.
  - 3. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to insure that 100% of all auxiliary devices energize at the same time on the same pair of wires;
  - 4. For multiple relay control a module shall be available that provides 6 programmable Form-C relays; NOTIFIER model # XP6-R.
- S. Addressable Two-In / Two-Out Monitor/Relay Module:
  - 1. An addressable Two-In / Two-Out module shall be available; NOTIFIER model # FDRM-1.
  - 2. The two-in/two-out module shall provide two Class B/Style B dry-contact input circuits and two independent Form-C relays rated at up to 3 Amps resistive and up to 2.0 Amps inductive.
- T. Isolator Module: Isolator modules shall be provided to automatically isolate wire-to-wire short circuits on an SLC Class A or Class B branch. The isolator module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the SLC loop segment or branch. At least one isolator module shall be provided for each floor or protected zone of the building; NOTIFIER model # ISO-X.
  - 1. If a wire-to-wire short occurs, the isolator module shall automatically open-circuit (disconnect) the SLC. When the short circuit condition is corrected, the isolator module shall automatically reconnect the isolated section.
  - 2. The isolator module shall not require address-setting, and its operations shall be totally automatic. It shall not be necessary to replace or reset an isolator module after its normal operation.

- 3. The isolator module shall provide a single LED that shall flash to indicate that the isolator is operational and shall illuminate steadily to indicate that a short circuit condition has been detected and isolated.
- U. Serially Connected Annunciator Requirements
  - The annunciator shall communicate to the fire alarm control panel via an EIA 485 (multi-drop) two-wire communications loop. The system shall support two 6,000 ft. EIA-485 wire runs. Up to 32 annunciators, each configured up to 96 points, may be connected to the connection, for a system capacity of 3,072 points of annunciation.
  - 2. An EIA-485 repeater shall be available to extend the EIA-485 wire distance in 3,000 ft. increments. The repeater shall be UL864 approved.
  - Each annunciator shall provide up to 96 alarm and 97 trouble indications using a long-life programmable color LED's. Up to 96 control switches shall also be available for the control of Fire Alarm Control Panel functions. The annunciator will also have an "ONLINE" LED, local piezo sounder, local acknowledge and lamp test switch, and custom zone/function identification labels.
  - 4. The annunciator may be field configured to operate as a "Fan Control Annunciator". When configured as "Fan Control," the annunciator may be used to manually control fan or damper operation and can be set to override automatic commands to all fans/dampers programmed to the annunciator.
  - 5. Annunciator switches may be programmed for System control such as, Global Acknowledge, Global Signal Silence, Global System Reset, and on/off control of any control point in the system.
  - 6. An optional module shall be available to utilize annunciator points to drive EIA-485 driven relays. This shall extend the system point capacity by 3,072 remote contacts.
  - 7. The LED annunciator shall offer an interface to a graphic style annunciator and provide each of the features listed above
- V. SpectrAlert Advance Speakers
  - The Speaker appliance shall be System Sensor SpectrAlert Advance model Speaker. The speaker shall be listed to UL 1480 for Fire Protective Signaling Systems. It shall be a dual-voltage transformer speaker capable of operation at 25.0 or 70.7 nominal Vrms. The speaker shall have a frequency range of 400 to 4,000 Hz and shall have an operating temperature between 32°F and 120°F. It shall mount to a 4 x 4 x 2 1/8-inch back box.
  - 2. A universal mounting plate shall be used for mounting ceiling and wall speaker products. The notification appliance circuit and amplifier wiring shall terminate at the universal mounting plate.
  - 3. Speakers shall be plug-in and shall have the ability to check wiring continuity via a shorting spring on the universal mounting plate. The shorting spring shall also provide tamper resistance via an open circuit if the device is removed. Speaker design shall isolate speaker components to reduce ground fault incidents.
  - 4. The speaker shall have power taps (from ¼ watt to 2 watts) and voltage that are selected by rotary switches. All models shall have a maximum sound output of 86 dB at 10 feet and shall incorporate an open back construction.
  - 5. All notification appliances shall be backward compatible.

## PART 3 - EXECUTION

## 3.1 WIRING

- A. Installer's Responsibilities
  - 1. The installer shall coordinate the installation of the fire alarm equipment.
  - 2. Re-use existing conductors and pathways where possible.
  - 3. All conductors and wiring shall be installed according to the manufacturer's recommendations.
  - 4. It shall be the installer's responsibility to coordinate with the supplier, regarding the correct wiring procedures before installing any conduits or conductors.

#### 3.2 INSTALLATION OF SYSTEM COMPONENTS

- A. System components shall be installed in accordance with the latest revisions of the appropriate NFPA pamphlets, the requirements contained herein, National Electrical Code, local and state regulations, the requirements of the fire department and other applicable authorities having jurisdiction (AHJ).
- B. All wire used on the fire alarm system shall be U.L. Listed as fire alarm protection signaling circuit cable per National Electrical Code, Articles 760.
- C. All conduit, junction boxes, conduit supports and hangers shall be concealed in finished areas and may be exposed in unfinished areas. Smoke detectors shall not be installed prior to the system programming and test period. If construction is ongoing during this period, measures shall be taken to protect smoke detectors from contamination and physical damage.
- D. All fire detection and alarm system devices, control panels and remote annunciators shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas.
- E. Provide smoke detector in each elevator lobby and at the top of the hoistway with conduit to elevator control panel for interface with elevator control system. Connect smoke detectors to fire alarm system. Provide auxiliary contacts with smoke detectors.
- F. Where elevator shafts are sprinklered, provide heat detector(s) in the elevator hoistway with conduit to elevator control panel for interface with elevator control system. Connect heat detector(s) to fire alarm system. Provide auxiliary contacts with heat detector(s). Activation of heat detector(s) shall signal elevator control panel to disconnect main line power supply to elevator.
- G. Provide control relays to automatically and immediately shut down all central air supply systems and systems serving means of egress in a nursing facility upon activation of the fire alarm system.
- H. Provide pre-signal connection to elevator controller.
- I. Label wiring at terminations, pull, junction and outlet boxes.

J. Provide one 3/4-inch conduit from the fire alarm control panel to the nearest telephone backboard or terminal cabinet location for tie-in to central station.

## 3.3 WARRANTY AND FINAL TEST

- A. General
  - 1. The Contractor shall warrant all equipment and wiring free from inherent mechanical and electrical defects for one year (365 days) from the date of final acceptance.

#### B. Final Test

- 1. Before the installation shall be considered completed and acceptable by the awarding authority, a test of the system shall be performed as follows:
  - a. The service of a competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment shall be provided to technically supervise and participate during all of the adjustments and tests for the system. All testing shall be in accordance with NFPA 72.
  - b. The Contractor's job foreman, a representative of the Owner, and the fire department shall operate every building fire alarm device to ensure proper operation and correct annunciation at the control panel.
  - c. At least one half of all tests shall be performed on battery standby power.
  - d. Where application of heat would destroy any detector, it may be manually activated.
  - e. The communication loops and the indicating appliance circuits shall be opened in at least two (2) locations per circuit to check for the presence of correct supervision circuitry.
- 2. When the testing has been completed to the satisfaction of both the Contractor's job foreman and Owner, a notarized letter cosigned by each attesting to the satisfactory completion of said testing shall be forwarded to the Owner and the fire department.
- 3. The Contractor shall leave the fire alarm system in proper working order, and, without additional expense to the Owner, shall replace any defective materials or equipment provided by him under this contract within one year (365 days) from the date of final acceptance by the awarding authority.
- 4. Prior to final test the fire department shall be notified in accordance with local requirements.
- 5. Check presence, audibility and intelligibility of tone at all alarm notification devices
- C. As Built Drawings, Testing, and Maintenance Instructions
  - 1. As Built Drawings
    - a. A complete set of reproducible "as-built" drawings showing installed wiring, color coding, and wire tag notations for exact locations of all installed equipment, specific interconnections between all equipment, and internal wiring of the equipment shall be delivered to the Owner upon completion of system.
  - 2. Operating and Instruction Manuals
    - a. Operating and instruction manuals shall be submitted prior to testing of the system. Three (3) complete sets of operating and instruction manuals shall be delivered to the Owner upon completion. User operating instructions shall be provided prominently displayed on a separate sheet located next to the control unit in accordance with U.L. Standard 864.

3. Refer to Division 01 - PROJECT CLOSEOUT.

# 3.4 INSTRUCTION

- A. Instruction shall be provided as required for operating the system. Hands-on demonstrations of the operation of all system components and the entire system including program changes and functions shall be provided.
- B. The Contractor and/or the systems manufacturer's representatives shall provide a typewritten "Sequence of Operation."

# END OF SECTION