SECTION 28 31 00 – FIRE DETECTION AND ALERT NOTIFICATION SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. The Contractor shall secure, and pay for, as part of this contact agreement, the services of a qualified Fire Detection and Alert Notification Contractor to install monitor modules, control modules, manual pull stations, notification appliances, tamper switches (see sprinkler drawings), and auxiliary power supply(s) (APS), and control panels that will connect to the Fire Alarm Control Panel (FACP) via data loop.

B. The extent of the fire detection and alert notification work is shown on the Contract Drawings and contained in the Specifications. This Fire Detection and Alert Notification Contractor shall review all other discipline/subcontractor drawings, specifications, and other documents to become cognizant of the entire extent of his/her work, which are not detailed on the drawings. Submission of a proposal shall be evidence that this Contractor has reviewed all of the Contract Documents and performed all necessary walk downs to determine the complete scope of work.

C. The Fire Detection and Alert Notification Contractor is directed to examine all Contract Drawings in detail. Failure of the Fire Detection and Alert Notification Contractor to examine all areas, which may require special considerations and misinterpretation of the Contract Documents resulting there from, shall be entirely his/her responsibility.

D. Fire detection and alert notification system components shall be installed as mostly shown on the Contract Drawings with design criteria as specified in this Section. However, the Fire Detection and Alert Notification Contractor shall note that this specification requires that the Fire Detection and Alert Notification Contractor must prepare and submit drawings, system schematics and any other documents needed for the procurement of approvals and the provision of complete, functional and approved fire detection and alert notification system. As a result, the Contract Drawings and this Section serve the purpose of indicating design criteria for the Fire Detection and Alert Notification Contractor’s use and guidance in preparing documents required to be submitted for review.

E. The Contract Drawings and specifications form complimentary requirements. Provide work specified and not shown, and work shown and not specified as though explicitly required by both. Although work is not specifically shown or specified, provide supplementary or miscellaneous items, appurtenances, devices, and materials necessary for a sound, secure, complete and approved installation. Completely coordinate work of this specification with work of other trades.

F. The Fire Detection and Alert Notification Contractor is directed to bring to the attention of the General Contractor and/or Fire Protection Engineer, in writing, any discrepancies, and/or matters as they may relate to codes, standards, and recommendation and/or job conditions.

G. The Fire Detection and Alert Notification Contractor shall bring to the attention of the Fire Protection Engineer any conflicts between these drawings and codes or standards for resolution. The Fire Detection and Alert Notification Contractor shall not discuss these matters with the Building or Fire Official without the approval of the Fire Protection Engineer.

H. Should the Fire Detection and Alert Notification Contractor perform any work that does not comply with the requirements of the specifications and applicable Codes, Standards and References,

they shall bear all costs arising in correcting the work to the satisfaction of the Fire Protection Engineer.

I. The Fire Detection and Alert Notification Contractor shall include startup, pre-testing and acceptance testing, and for making all the systems fully operational.

J. The Fire Detection and Alert Notification Contractor will be required to prepare detailed shop drawings as herein before specified. This information, in the form of a single “Package”, shall be submitted to the General Contractor and Fire Protection Engineer for review and approval. Equipment within the “Package” shall bear approval or listing of a testing laboratory approved by the Texas State Board of Insurance, Fire Department and the Owner’s Insurer prior to submission to Fire Protection Engineer for their review.

K. Give all notices, file all plans and other documents, obtain all permits and all licenses, pay all fees and obtain all approvals from all Authorities Having Jurisdiction as required to perform work in accordance with all requirements and with the Specifications and Contract Drawings, all of which are considered a part of these Contract Documents.

1.2 DESCRIPTION OF WORK

A. Provide all required labor, warranty labor, materials, equipment, system programming, testing, submittals and services necessary for a complete and operational fire detection and alert notification system as hereinafter described, and as shown on the engineering drawings.

B. Provide all required reprogramming to Central Fire Alarm System to ensure that the work associated with this project as hereinafter described and as shown on the engineering drawings in incorporated into the Central Fire Alarm System and that the Central Fire Alarm System operates properly.

C. Work shall begin at the source of 120-volt AC power for the fire detection and alert notification panels and may include, but not be limited, to the following:

1. Intelligent/Addressable Fire Detection and Alert Notification Control Panels
2. Networking
3. SLC Circuits
4. Dedicated Power Circuits
5. Initiation Circuits
6. Notification Circuits
7. Control Circuits
8. Monitoring Circuits
9. Releasing Circuits
10. Detection Devices
11. Manual Pull Stations
12. Audible/Visual Appliances
13. Speaker/Visual Appliances
14. Visual Appliances
15. Elevator Recall / Shutdown
16. Controls for Smoke Management
17. HVAC Shutdown
18. Graphic Computer Workstation

D. It is intended that the engineering drawings and specification shall describe and provide for a working installation complete in every detail and all items necessary for such complete installation

shall be provided whether or not specifically mentioned herein or shown on the engineering drawings.

1.3 REFERENCES

A. All work shall be installed in accordance with all applicable codes and referenced design standards:

1. 2015 International Building Code with local amendments
2. 2015 International Fire Code with local amendments
3. 2015 International Mechanical Code with local amendments
4. 2016 NFPA 72, National Fire Alarm and Signaling Code
5. 2014 NFPA 70, National Electrical Code
6. 2016 NFPA 13, Sprinkler Systems
7. ADA - Americans with Disabilities Act
8. DFW Airport Design Criteria Manual, Nov. 2015
9. UL standard 464, Audible Signal Appliances (horn appliances only), latest edition.
10. UL Standard1481, Power Supplies for Fire Protective Signaling Systems, latest edition.
11. UL Standard 1971, signaling Devices for the Hearing Impaired, latest edition.
12. Americans with Disabilities Act Accessibility Guidelines (ADAAG). 1990 edition.
13. Texas Accessibility Code, latest edition
14. American National Standards (ANSI) A117.7, Accessibility Code, latest edition.
15. UFAS-Uniform federal Accessibility Standards, latest edition.
16. Administrative Rules of the Texas Department of Licensing and Regulation 16 Texas Administrative Code, Chapter 74, latest edition-Elevators, Escalators and Related Equipment.
17. Division 27 Specification 27 05 53 Identification for Communications Systems Appendix A Section 4.1

B. If there is a conflict between the applicable codes, referenced design standards, or local amendments and this specification, it is the Contractor’s responsibility to immediately bring the conflict to the Fire Protection Engineer for resolution.

1.4 SYSTEM OPERATION

A. The fire detection and alert notification system substructure shall operate as follows: Initiation circuits shall meet the minimum requirements of Class B. Supervisory circuits shall meet the minimum requirements of Class B. Notification circuits shall meet the minimum requirements of Class B, style 1. Signaling line circuits shall meet the minimum requirements of Class A. Auxiliary circuits, where not installed as signaling line circuits, shall meet the minimum requirements of a Class B notification circuit. Circuits for relay coil operation shall be 24 volt maximum with a separate or integral field collapsing diode.

B. The Network circuit medium between the network nodes shall be a combination of copper conductor and fiber-optic in Class A configuration. All network nodes shall have the capability for local operation of alarm detection, supervisory, occupant notification and control functions if network operation is impaired or disconnected.

C. The control panels and auxiliary power supplies shall receive their power from 120-volt AC dedicated branch circuits. The circuit disconnecting means shall have a red marking, shall be accessible only to authorized personnel, and shall be identified as “FIRE ALARM NOTIFICATION CIRCUIT”. The 24-volt DC power for all system initiation, supervisory, notification and control

circuits shall be provided by the Fire Detection and Alert Notification control panel power supplies or listed auxiliary power supplies.

D. Upon loss of building power, the entire system shall transfer to secondary within ten (10) seconds, and without loss of signals. The system shall operate under secondary power in normal or trouble conditions for twenty-four (24) hours and have sufficient power to support complete alarm condition operation for a subsequent fifteen (15) minutes of evacuation alarm operation at maximum connected load.

E. Activation of any smoke detector, manual pull station or sprinkler waterflow switch will cause the following functions to occur:

1. Activate audible and visible status change indicators, display the system point number, point description, and message associated with the point on the system’s operator terminal.

F. Activation of a sprinkler valve supervisory device will cause the following functions to occur:

1. Activate audible and visible status change indicators, display the system point number, point description, and message associated with the point on the system’s operator terminal.
2. Send a supervisory signal to the FCC.

G. System Operation shall be as follows:

1. Abnormal circuit conditions or devices, as required for the Class and Style of the circuit, shall initiate a "trouble" condition at the control panels for that specific circuit or device. The “trouble” indication shall describe the nature of the condition on the affected circuit or device. The fire detection and alert notification control panel (FACP) shall transmit a "trouble" condition to the DPS office via the network communications connection.
2. Activation of any supervisory device shall initiate a "supervisory" condition at the control panels for that specific device. The "supervisory" indication shall describe the nature of the condition and specific address and alphanumeric description of the device affected. The FACP shall transmit a "supervisory" condition to the DPS office via the network communications connection.
3. Activation of any alarm device shall initiate an "alarm" condition at the control panels for that specific device. The "alarm" indication shall describe the nature of the condition and specific address and alphanumeric description of the device affected. The FACP shall transmit an "alarm" condition to the DPS office via the network communications connection.
4. Initiation of an "alarm" condition shall result in the following functions to be performed by the system:
    a. Initiate an alarm indication on the control panel by tone and illuminate the corresponding device specific alphanumeric LCD description. Manually activating the "Alarm Silence" shall silence the tone at the panel. The alarm alphanumeric display shall remain "On" at the control panel until the condition causing the alarm has been cleared and reset. An additional alarm reported to the panel subsequent to activating the "Alarm Silence" shall reactivate the control panel tone.
    b. When determined by the DFW Fire Department, the speakers and strobes will be manually activated from a 'Drill" switch on the FACP throughout the Terminal. The speakers will be controlled from IED paging system through the "Drill Switch on the FACP and the visual notification appliances will be controlled from the FACP through the "Drill" switch on the FACP.
    c. Manually activating the "Alarm Silence" at the panel, which is only authorized by the DFW Fire Department, shall de-energize the IED paging speakers and the visual notification appliances.
    d. Transmit a specific “alarm” signal to the DPS office through the network communications connection.

5. A manual pull station located in the Comm. Room and labeled as "Sprinkler System Manual Release" shall initiate the alarm condition as described above and initiate sprinkler system release.

1.5 QUALITY ASSURANCE

A. All work shall meet the requirements of the Owner, Architect, Engineer and Authority Having Jurisdiction (AHJ).

B. All equipment and components shall be UL listed for the actual intended use, unless hereinafter specifically excluded from such a listing.

C. Installation and supervision of installation shall be in strict compliance with the requirements of the regulations, licenses, and permits for fire detection and alert notification system installers in this jurisdiction.

D. Installer must have been actively engaged in the business of selling, installing, and servicing fire detection and alert notification systems for at least five (5) years.

E. Installer must be registered with and licensed by the State of Texas as a Fire Alarm Contractor.

F. Installer must be an authorized representative of the Equipment Manufacturer (EM) and have technical factory training specifically for the system proposed.

G. The EM shall have a representative supervise the final connection of devices, wiring, and programming of the control panels. The EM representative shall be National Institute for Certification in Engineering Technologies (NICET) certified as Level II or higher Fire Alarm Protection / Fire Alarm Systems Engineering Technician.

1.6 REGULATORY REQUIREMENTS

A. All work shall meet the requirements of all applicable codes and referenced design standards.

B. No approvals or interpretations of the design documents shall be pursued except through the Engineer.

C. Any work performed prior to the satisfactory review of the shop drawings by the Engineer, approval by the AHJ, and determined to be noncompliant with the contract documents or applicable codes by the Owner or AHJ will be replaced at the Contractors' expense.

D. The system will not be acceptable until final testing and receipt of the Inspection and Testing Form has been obtained.

1.7 SUBMITTALS

A. The engineering drawings will be made available either in electronic or hard copy form. Utilization of these documents for the development of shop drawings and submittals does not relieve any responsibilities of the Contractor.

B. In the submittals, the Contractor must clearly identify all areas and sections of this specification to which they take exception or are not capable of providing.

C. Submittals will be disapproved unless required equipment literature, calculations, and complete shop drawings are submitted together as one package for review.

D. The Fire Protection Engineer and Airport Fire Prevention Bureau shall review and recommend approval, disapproval, or other appropriate recommendations on the Contractor's submittals. This review is to verify conformance to the project specifications and design concepts expressed in the contract documents. The Contractor shall allow sufficient time to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of details and dimensions, or substantiating installation or performance of equipment and systems designed by the Contractor, all of which remain the Contractor's responsibility to the extent required by the contract documents. The Engineer's review shall not constitute approval of safety precautions of construction, means, methods, techniques, sequences of procedures, or approval of a specific assembly.

E. Prior to release of equipment for shipment or installation, submit to the Fire Protection Engineer, DFW ITS Life Safety Department and Airport Fire Prevention Bureau the following:

1. Five (5) sets of shop drawings in addition to the specific quantity required for this project. Three (3) sets of shop drawings to the Fire Protection Engineer and Airport Fire Prevention Bureau, (1) set to DFW ITS Life Safety Department, and (1) electronic set (AutoCAD) copy/file to the Fire Protection Engineer. The three (3) sets of shop drawings for the Airport Fire Prevention Bureau shall be hard, bond type paper. Submittal must be comprehensive of the entire project, complete in all detail, and include, but not be limited to, the following:

    a. Floor plans showing equipment placement, point to point wiring, wiring types and sizes, conduit types and sizes, wiring and raceway routes, and proposed mounting methods for conduit and backboxes. Floor plans shall be CAD generated.
    b. Sequence of Operations (Event Matrix) to include a detailed description of the operation of each system function for all possible alarm conditions.
    c. Riser diagram showing typical wiring connections for each type of device and module.
    d. Supervisory and alarm current calculations for primary power and emergency battery sizing of all control panels and auxiliary power supplies.

        1) Battery calculations shall list the type of devices and modules, quantities, amperage draw for standby and alarm conditions for each device, the total amperage draw for each panel, and each panel's battery amp/hour rating.
        2) The calculated load shall be the design load (summation of current at end of circuit), including all required spare capacity.
        3) The battery capacity used to meet the calculated load shall be a maximum of eighty (80) percent of the amp/hour listed by the manufacturer.

    e. A complete list of all proposed alphanumeric descriptions and their associated point address and circuit number.
    f. Voltage drop calculations for all notification appliance circuits.

        1) Calculations shall follow the voltage drop calculation criteria as outlined in NFPA 72 and UL 864.
        2) Calculations shall use the worst case operating voltage of each control panel or power supply as a starting voltage. The starting voltage shall be 20.4 VDC, unless written documentation is provided confirming that the specific control panel or power supply is capable of maintaining a voltage higher than 20.4 VDC.
        3) Calculations shall use the lowest operating voltage of the notification appliances and the associated increased current draw. The lowest operating voltage shall be the UL standard operating voltage of 16 VDC, unless approved otherwise by the Fire Protection Engineer.

2. Three (3) sets of the manufacturers' literature on all system equipment and system conductors in addition to the specific quantity required for this project.
    a. Literature shall include specification and description of recommended supporting methods, enclosures or boxes, and wiring connections.
    b. The exact components to be utilized on this specific project shall be indicated, by highlighting or arrows, on each data sheet of the equipment literature.
3. One (1) copy each of the qualifications and authorization of the representative of the EM.
4. The Fire Protection Engineer shall review for accuracy all submittals required to be received by the Fire Protection Engineer prior to equipment release or installation. The Owner, Owner's Representative, or design firms retained by the Owner shall not be responsible for any additional costs resulting from replacement of equipment or materials not reviewed prior to installation.

F. After complete review and approval of the shop drawings by the Fire Protection Engineer and Airport Fire Prevention Bureau, the Contractor shall submit all required drawings, manufacturers' literature, calculations and any other materials required by the AHJ to obtain a permit to the appropriate party for review.

G. Forward to the Fire Protection Engineer, in writing, any comments from the AHJ or the Insurance Underwriter within five (5) working days after the receipt of their comments.

1.8 PROJECT RECORD DOCUMENTS

A. The Contractor shall provide and maintain on site an up-to-date record set of approved shop drawing prints which shall be marked to show each and every change made to the fire detection and alert notification system from the original approved shop drawings. This shall not be construed as authorization to deviate from or make changes to the shop drawings approved by the Fire Protection Engineer without written instructions from the Fire Protection Engineer in each case. This set of drawings shall be issued only as a record set. These drawings shall be made available to the Owner, or the Owner's Representative, upon request.

B. The Contractor shall continually document software and programming changes. This documentation shall include:

1. A complete printout of the system prior to the change.
2. A complete printout of the system program subsequent to the change, with all modifications highlighted.
3. A letter prepared and signed by the individual who made the changes, describing each change made and the reason for the change. This letter shall certify that the programmer has personally reviewed and compared the before and after program printout and verified the correctness of the modification(s).
4. An equivalent means performed automatically in computer software, which verified the results of changes made is acceptable.

C. Once the fire detection and alert notification system is put into service, in whole or in part, and the associated building(s) are partially or wholly occupied, no software changes shall be performed without prior written permission of the Owner, or Owner's Representative.

D. Only a certified manufacturer's representative trained in the specific programming software shall make changes to the fire detection and alert notification system software once the system is in service.

E. Each revision to the software shall be identified by a unique version number and date.

F. Prior to final payment for the fire detection and alert notification system and the beginning of the warranty period, submit the following completed project record documents to the Owner's Representative:

1. Copies of all test and inspection reports as required by the AHJ and NFPA 72:

   a. The Record of Completion form shall be in the format as outlined in NFPA 72.
   b. The Inspection and Testing form shall be in the format as outlined in NFPA 72.

2. DFW Airport Fire Marshall shall accept the system and is provided with all permits, licenses, acceptance tests and final acceptance requirements as per NFPA applicable codes and standards. All permits and licenses required to be in the possession of the Owner by the AHJ.
3. Accurate record (as-built) drawings of the complete installation to include, but not be limited to, the information required for the shop drawings. Record drawings of the floor plans shall be AutoCAD generated.
4. Original warranty documents including, but not limited to, those of the EM. Warranty documents shall reference and be binding to the warranty provisions specified in the warranty portion of this specification.
5. Submit to the Engineer a copy of the transmittal to the Owner's Representative for all final complete project record documents.

G. Upon completion of construction, submit the following:

1. Provide one (1) sepia bond reproducible print, two (2) prints, and a set of disks in Electronic Format of the drawings, floor plans with device locations, device addresses, wire routing and wiring diagrams reflecting "as-built" conditions to the Owner.
2. Provide two (2) complete sets of "as-built" data sheets for all system-connected equipment to the Owner.
3. Provide two (2) sets of complete "as-built" software listing of all data files, even programs, print statements, points' lists, etc. to the Owner.
4. Provide one (1) copy of all data files on diskette to the Owner.
5. Provide two (2) sets of customized "as-built" operating manuals to the Owner.
6. Provide one (1) complete set of electronic files of "as-built" drawings and wiring diagrams to the Engineer. Electronic files shall be in AutoCAD.
7. Provide a completed test form which complies with NFPA 72, signed and dated by the fire detection and alert notification system manufacturer or his agent.
8. Provide NFPA 72 completion certificate, signed by the Fire Department.
9. All items of this section shall be provided prior to final payment request.

H. A copy of all software documentation required by this section shall be maintained on-site by the Contractor, in a binder, arranged in chronological order. This binder shall be provided to the Owner's Representative at the completion of the project.

I. Submit to the owner in electronic format, all fire detection and alert notification as-builds.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials factory-packaged in containers or reels and handle in accordance with manufacturer's recommendations. Store in a clean, dry space and protect products from damaging fumes and traffic. Handle materials carefully to avoid damage.

B. Storage space on project site may be limited. Contractor shall coordinate delivery and arrange storage of materials and equipment with the OAR.

C. Components sensitive to damage in a harsh environment shall be stored off-site and delivered as needed.

D. Provide protective covering during construction to prevent damage or entrance of foreign matter.

E. Contractor is responsible for on-site security of tools, test equipment and materials.

F. Replace at no expense to Owner, product damaged during storage, handling or the course of construction.

1.10 PROJECT CONDITIONS

A. Verify conditions on the job site are applicable to this Work. Notify Architect in writing of discrepancies, conflicts, or omissions promptly upon discovery.

B. The Drawings diagrammatically show cabling and arrangements of equipment fitting the space available without interference. If conditions exist which make it impossible to install Work as shown, recommend solutions and/or submit drawings to the Architect for approval, showing how the Work may be installed.

1.11 WARRANTY

A. Repair all defective workmanship or replace all defective materials for a period of one (1) year from the date of acceptance by the Owner's Representative. Workmanship or equipment found to be defective during that period shall be replaced at no additional cost to the Owner.

B. The warranty or any part of the warranty shall not be made void by any required operation or inspection of the system after final completion during the warranty period. The Owner may select qualified firms other than Warrantor to provide required tests and inspections. System testing and inspections will be conducted only by a duly licensed company under contract with the Owner to perform scheduled testing and inspections as required by the AHJ. The Owner may elect to have a representative present at the scheduled testing during the warranty period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Provide a UL-listed point addressable fire alarm control system. Acceptable suppliers are Honeywell.

B. Products for this project shall be of the latest design. Obsolete or discontinued models are not acceptable.

C. All equipment supplied shall be UL listed for the required function.

D. All fire detection and alert notification equipment shall be a product of one system manufacture.

2.2 CONTROL PANELS

A. Provide Honeywell XLS3000 control panels. Provide all modular components necessary to accomplish all system functions. The control panels shall be provided in sufficient quantity as to perform all functions in this specification. The components shall include but not be limited to the following items:

1. System processing that is free of any operational impairments resulting in a change of date through the year 2030.
2. Non-volatile RAM memory that provides for no program loss if a primary and secondary power loss occurs.
3. An integral display with a minimum eighty (80) characters liquid crystal display (LCD). Provide light-emitting diodes (LED) for AC power, system alarm, system trouble, display trouble and disable. The display shall be visible through the control panel cabinet's transparent window. The processor shall be capable of displaying historical log data; current system status information; and all individual device addresses, descriptions and conditions on the integral display.
4. The system shall provide a four hundred (400) event historical log on command of all alarms signals, supervisory signals, trouble signals, monitor point changes-in-state, operator commands and system-initiated control functions.
5. System core shall have processing capability to support the addressable points including the necessary software, programming, and motherboard/expansion card sockets. Each signaling line circuit (SLC) shall support a minimum two hundred fifty (250) addressable points including addressable detection devices, addressable input modules, and/or addressable output modules. No SLC device or module loop shall be assigned more than eighty (80) percent of its point capacity unless approved in writing by the Engineer.
6. System processing capable of supporting initiation data circuits which can be "T-tapped" at any location on the signaling line circuit (SLC). Any additional modules, programming, or circuits required to achieve the specified system capacity shall be provided and installed at no cost to the Owner.
    a. Even though the system is to be capable of "T-tapped" SLC circuits, T-tapping of SLC circuits on this project is unacceptable. All SLC circuits shall be "daisy-chained".
7. Interface for peer-to-peer operation with automatic default to stand-alone mode if failure occurs in any processor, internal connection, or module.
8. Control panels shall be capable of including an interface for supervised remote annunciators.
9. System processing capable of supporting addressable analog smoke detection, addressable analog heat detection, addressable pull stations, addressable monitoring modules, and remote addressable control modules.
10. Capability of controlling the state of contacts located in remote addressable modules, detector base-mounted programmable relays, and outputs on the panel including all necessary hardware and software.
11. Detection of removal, disconnection, or failure of any control panel module.
12. Automatic detector test feature which permits reading and adjusting the sensitivity of all intelligent detectors from the control panel.
13. Provide a "maintenance alert" feature whereby the detector initiates a trouble condition should the units' sensitivity approach the outside limits of the normal sensitivity window.
14. Control panel shall be capable of including an integral module for serial data output (RS-232) to an ASCII based printer. This module shall be in addition to other RS-232 outputs (if any) required for other devices. The contractor shall assure proper operation of the output transmissions.
15. Provide monitoring of the IED PA/VE system to ensure that the IED system supervises each audio/speaker circuit for opens, shorts or grounds with direct shorts not prohibiting

selection of the respective zone. Provide power-limited audible circuits in accordance with NFPA 72 and NFPA 70.

16. Provide power supplies, transformers, batteries, battery chargers and modules required for a complete and operational system. Provide sufficient output power to the devices to perform the specified functions.
17. Power supply capacity shall not exceed eighty (80) percent of its rated (continuous) capacity.
18. Provide a UL listed cabinet with sufficient space and circuit board slots for the specified equipment. The cabinet shall have a hinged door keyed in common with all other keyed devices throughout the system. If multiple cabinets are required in one location, the cabinets shall be located adjacent to each other and match in finish and design.

B. Provide additional control panels as needed that consist of modular components, utilizing solid state programmable microprocessors, to accomplish all system functions. The control panels and any additional control panels shall be provided in sufficient quantity as to perform all functions in this specification. The components shall include but not be limited to the following items:

1. System processing that is free of any operational impairments resulting in a change of date through the year 2030.
2. Non-volatile RAM memory that provides for no program loss if a primary and secondary power loss occurs.
3. An integral display with a minimum eighty (80) characters liquid crystal display (LCD). Provide light-emitting diodes (LED) for AC power, system alarm, system trouble, display trouble and disable. The display shall be visible through the control panel cabinet's transparent window. The processor shall be capable of displaying historical log data; current system status information; and all individual device addresses, descriptions and conditions on the integral display.
4. The system shall provide a four hundred (400) event historical log on command of all alarms signals, supervisory signals, trouble signals, monitor point changes-in-state, operator commands and system initiated control functions.
5. System core shall have processing capability to support the addressable points including the necessary software, programming, and motherboard/expansion card sockets. Each signaling line circuit (SLC) shall support a minimum two hundred fifty (250) addressable points including addressable detection devices, addressable input modules and/or output modules. No SLC device or module loop shall be assigned more than eighty (80) percent of its point capacity unless approved in writing by the Engineer.
6. System processing capable of supporting initiation data circuits which can be "T-tapped" at any location on the signaling line circuit (SLC). Any additional modules, programming, or circuits required to achieve the specified system capacity shall be provided and installed at no cost to the Owner.
    a. Even though the system is to be capable of "T-tapped" SLC circuits, T-tapping of SLC circuits on this project is unacceptable. All SLC circuits shall be "daisy-chained".
7. Interface for peer-to-peer operation with automatic default to stand-alone mode if failure occurs in any processor, internal connection, or module.
8. Control panels shall be capable of including an interface for supervised remote annunciators.
9. System processing capable of supporting addressable digital smoke detection, addressable digital heat detection, addressable pull stations, addressable monitoring modules, and remote addressable control modules.
10. Capability of controlling the state of contacts located in remote addressable modules, detector base-mounted programmable relays, and outputs on the panel including all necessary hardware and software.
11. Detection of removal, disconnection, or failure of any control panel module.

12. Automatic detector test feature which permits reading and adjusting the sensitivity of all intelligent detectors from the control panel.
13. Provide a "maintenance alert" feature whereby the detector initiates a trouble condition should the units' sensitivity approach the outside limits of the normal sensitivity window.
14. Control panel shall be capable of including an integral module for serial data output (RS-232) to an ASCII based printer. This module shall be in addition to other RS-232 outputs (if any) required for other devices. The contractor shall assure proper operation of the output transmissions.
15. Provide monitoring of the IED VE/PA system to ensure that the IED system monitors the supervision of each audio/speaker circuit for opens, shorts or grounds with direct shorts not prohibiting selection of the respective zone. Provide power-limited audible circuits in accordance with NFPA 72 and NFPA 70.
16. Provide power supplies, transformers, batteries, battery chargers and modules required for a complete and operational system. Provide sufficient output power to the devices to perform the specified functions.
17. Power supply capacity shall not exceed eighty (80) percent of its rated (continuous) capacity.
18. Provide a UL listed cabinet with sufficient space and circuit board slots for the specified equipment. The cabinet shall have a hinged door keyed in common with all other keyed devices throughout the system. If multiple cabinets are required in one location, the cabinets shall be located adjacent to each other and match in finish and design.

C. Auxiliary Power Supplies

1. Provide each auxiliary power supply (APS) unit in an individual, single, self-contained, lockable cabinet. Input shall be 120-volt AC nominal with an output of regulated 24 volt DC. Each APS shall be capable of actuation from either a host panel notification circuit or programmed dry contacts. Each APS shall provide a trouble indication to host panel upon loss of AC power or abnormal conditions on individual output circuits. Each APS shall have a minimum of four (4) supervised output notification circuits rated individually at a minimum of two and a half (2.5) amperes available per circuit, with a total output of ten (10.0) amps. The Contractor shall be responsible for all redesign, circuiting, and additional equipment costs to provide the necessary output amperage. Each APS shall have a minimum of twenty (20) percent spare capacity on each circuit.
2. The APS shall operate from a dedicated 120 volt AC or 24 volt DC source with a listed secondary power source conforming to the same alarm and standby time requirements as the FACP.
    a. Acceptable Equipment Suppliers (provided compatibility requirements are met, i.e. synchronization): Honeywell HPFF8
3. Provide a smoke detector above remote power supplies where required.

2.3 FIELD DEVICES

A. Low Voltage Transient Voltage Surge Suppression Modules (TSM)

1. Provide transient voltage surge suppression modules consisting of silicon avalanche suppressor diode (SASD) technology. Modules shall be designed, manufactured and installed in accordance with UL 497B, the National Electrical Code, and the manufacturer’s instructions.
2. Performance specifications shall include a Response Time of less than five (5) nanoseconds.

B. Monitor Modules

1. Provide addressable monitor modules where required to interface with contact alarm devices, or to connect a supervised zone of conventional initiating devices (any normally open dry contact device) to an intelligent SLC loop.
2. The module shall include a unique internal identification code that is factory installed and programmed into the control panel through a mapping process which the control panel shall use to identify the type of device. Flash status/power LED under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel. The LED may be placed into steady illumination by the control panel, indicating that an alarm condition has been detected.
3. Provide an automatic test feature to permit functional testing of the device from the main control panel. Indicate results of the test on the LCD display at the control panel.
4. Monitor modules with multiple input contact connections are acceptable if each input is capable of independent programming and functional operation.

C. Control/Relay Modules

1. Provide addressable control/relay modules where required to interface with a dry contact (Form C) relay. Provide power for the relay actuation from the intelligent SLC loop.
2. Minimum rating of Form C contacts shall be two (2.0) amperes at 24 volts and one half (0.5) amperes at 120 volts AC.
3. The module shall include a unique internal identification code that is factory installed and programmed into the control panel through a mapping process which the control panel shall use to identify the type of device. Flash status LED under normal conditions, indicating that the control module is operational and in regular communication with the control panel. The LED may be placed into steady illumination by the control panel, indicating that an alarm condition has been detected.
4. Control/relay modules with multiple output contact connections are acceptable if each output is capable of independent programming and functional operation.
5.

D. Signal Modules

1. Provide addressable signal modules where required to interface with audible or visual notification appliances, or to connect a supervised zone of conventional indicating appliances (any 24 volt DC polarized notification appliance) to an intelligent SLC loop. Provide notification appliance power through a separate loop from the main control panel or from supervised remote power supplies.
2. The Minimum rating of the output current shall be one and a half (1.5) amperes at 24 volts and one half (0.5) amperes at 120 volts AC.
3. The module shall include a unique internal identification code that is factory installed and programmed into the control panel through a mapping process LED under normal conditions, indicating that the control module is operational and in regular communication with the control panel. The LED may be placed into steady illumination by the control panel, indicating that an alarm condition has been detected.

E. Isolation Modules (When used)

1. Provide isolation modules to automatically isolate wire-to-wire shorts on an SLC loop. The isolation module shall limit the number of modules or detectors that may render inoperative by a short circuit fault on the SLC loop. Upon a wire-to-wire short circuit the isolation module shall automatically disconnect the shorted circuit from the SLC loop. Upon a correction of the wire-to-wire short, the isolation module shall automatically re-connect the isolated circuit to the SLC loop.
2. The isolation module shall not require any address-setting means and its operation shall be totally automatic. It shall not be necessary to replace or reset the isolation module after its normal operation. Flash status/power LED under normal conditions, indicating that the

isolation module is operation and in regular communication with the control panel. The LED may be placed into steady illumination indicating a short circuit has been detected and isolated.

F. Intelligent Photoelectric Smoke Detectors

1. Provide analog photoelectric type smoke detectors with the capability to send data, on command, to the control panel representing the analog level of smoke density.
2. Provide a "maintenance alert" feature whereby the detector initiates a trouble condition should the units' sensitivity approach the outside limits of the normal sensitivity window.
3. The detector shall include a unique internal identification code for each detector that is factory installed and programmed into the control panel through a mapping process which the control panel can use to identify the type and precise location of the detector.
4. Provide dual alarm and power/status LED's. Flash status LED's under normal conditions, indicating that the detector is operational and in regular communication with the control panel. Both LED's may be placed into steady illumination by the control panel, indicating that an alarm condition has been detected and verified.
5. Provide a low profile design modular detector head with twist-lock base.

G. Conventional Heat Detectors

1. Provide conventional type heat detectors with the ability to be monitored by the control panel.
2. Provide conventional fixed temperature and rate-of-rise heat detectors. The fixed temperature rating shall be one hundred thirty-five (135) or one hundred ninety (190) degrees Fahrenheit. The rate-of-rise temperature detection shall be fifteen (15) degrees Fahrenheit per minute.
3. Provide a low-profile design with a removable twist-lock base and screw mounting terminals.
4. The detector shall be designed with an external drop away heat collector for visual confirmation of activation.
5. Heat detectors used in conjunction with elevator control shall activate prior to water-flow from the corresponding automatic sprinklers. Coordinate the heat detector response time index (RTI) with the sprinkler system.

H. Intelligent Thermal Detectors

1. Provide analog thermal fixed temperature and rate-of-rise detectors utilizing dual electronic thermostats to measure temperature levels in its chamber. The detector shall be capable of sending data, on command, to the control panel representing the analog temperature level.
2. The fixed temperature rating shall be one hundred thirty-five (135) degrees Fahrenheit. The rate-of-rise temperature detection shall be fifteen (15) degrees Fahrenheit per minute.
3. The detector shall include a unique internal identification code for each detector that is factory installed and programmed into the control panel through a mapping process which the control panel can use to identify the type and precise location of the detector.
4. Provide dual alarm and power/status LED's. Flash status LED's under normal conditions, indicating that the detector is operational and in regular communication with the control panel. Both LED's may be placed into steady illumination by the control panel, indicating that an alarm condition has been detected and verified.
5. Provide a low-profile design modular detector head with twist-lock base.
6. Heat detectors used in conjunction with elevator control shall activate prior to water-flow from the corresponding automatic sprinklers. Coordinate the heat detector response time index (RTI) with the sprinkler system.

I. Intelligent Detector Base

1. Provide a UL listed low profile twist-lock detector base with screw terminals. Provide an output connection in the base to connect an external remote alarm LED.
2. Detector base shall be capable of connecting to the control panel.
3. Provide supervision as required by NFPA 72 and the manufacturer’s equipment literature.

J. Intelligent Photoelectric Smoke Detectors for Duct Applications

1. Provide duct mounted analog photoelectric type smoke detectors with the capability to send data, on command, to the control panel representing the analog level of smoke density.
2. Provide detectors operating in air velocities of zero (0) fpm to four thousand (4,000) fpm without adverse effects on detector sensitivity.
3. Provide a "maintenance alert" feature whereby the detector initiates a trouble condition should the unit's sensitivity approach the outside limits of the normal sensitivity window.
4. Provide a molded plastic enclosure with integral conduit knockouts. Provide housing with gasket seals to insure proper seating of the housing to the associated ductwork. Provide sampling tubes that extend across the width of the duct and in compliance with the manufacturer’s installation recommendations.
5. The detector shall include a unique internal identification code for each detector that is factory installed and programmed into the control panel through a mapping process which the control panel can use to identify the type and precise location of the detector.
6. Provide dual alarm and power/status LED's. Flash status LED's under normal conditions, indicating that the detector is operational and in regular communication with the control panel. Both LED's may be placed into steady illumination by the control panel, indicating that an alarm condition has been detected and verified.
7. Provide a low profile design modular detector head with twist-lock base.
8. Remote test stations, where required, shall consist of a key operated switch and indicating LED. The remote test station shall be listed for use with the duct smoke detector.
9. Provide a separate addressable control/relay module for any associated control functions.

K. Flame Detectors

1. Provide triple-channel IR flame detectors with the ability to be monitored by the control panel.
2. The flame detector shall have a spectral sensitivity of 185nm to 260 nm. The field of view shall be at least 120-degress conical.
3. The detector shall operate on 24 volts DC and may be either two-wire or four-wire operation. The fire alarm contractor shall provide all circuits required for operation of the detector whether or not the circuit is shown on the engineering drawings. The detector shall report all alarms and troubles to the FACP.
4. Provide addressable input modules in sufficient quantity to provide addresses for the detector as required by the specifications and as shown on the engineering drawings. Modules shall be provided in sufficient quantity to transmit trouble and alarm conditions.
5. Install flame detectors in accordance with the manufacturers documented instructions and with NFPA 72.

L. Projected Beam Smoke Detectors

1. Provide projected beam smoke detectors with the ability to be monitored by the control panel.
2. The maximum protection range between transmitter and associated receiver shall be not less than three hundred (300) feet. The detector transmitters and receivers shall operate on 24 volts DC and may be either two-wire or four-wire operation. The fire alarm contractor shall provide all circuits required for operation of the detector whether or not the circuit is shown on the engineering drawings. The detector shall include a calibrated test filter,

necessary mounting brackets, alignment LED's and automatic gain compensation for dust build-up. The detector shall report all alarms and troubles to the FACP.

3. Provide addressable input modules in sufficient quantity at the transmitters and receivers to provide addresses for the transmitters and receivers as required by the specifications and as shown on the engineering drawings. Modules shall be provided in sufficient quantity to transmit trouble and alarm conditions.
4. Install all beam smoke detectors in accordance with the manufacturers documented instructions and NFPA 72.
5. Remote test stations, where required, shall consist of a key operated switch and indicating LED. The remote test station shall be listed for use with the projected beam smoke detector.
6.

M. Addressable Manual Pull Stations

1. Provide dual action type manual pull stations. Manual pull stations shall be designed that upon activation, shall initiate a change of status at the control panel. The manual pull stations shall not be automatically resettable and shall include a visible indication of the manual pull station being activated.
2. The unit shall include a unique internal identification code that is factory installed and programmed into the control panel through a mapping process which the control panel can use to identify the type of device. Monitoring devices when used shall be located in the manual station's back box.
3. Construct of hi-impact red molded Lexan or die-cast metal with instructions for station operation in raised white letters.
4. Where possible, provide flush mounting of pull stations. Surface mounting of pull stations will be allowed if flush mounting is not possible. Semi-flush mounted stations shall mount on a standard electrical box.

N. Visual Notification Appliances - Wall Mounted

1. Provide visual notification appliances operable at 24-volt DC and polarized supervision. The appliances shall utilize a high intensity solid state xenon strobe tube with associated lens/reflector system. The appliances shall be constructed of high-impact white thermoplastic, shall indicate "ALERT", shall not include the "Running Man" symbol, and shall be UL listed for wall mounted applications.
2. Where possible, provide flush mounting of appliances. Where surface mounting is necessary, provide a decorative backbox skirt covering the appliance backbox.
3. Provide synchronization of all visual notification appliances. The synchronization modules shall be capable of synchronizing appliances with candela ratings ranging from 15 cd to 185 cd.

O. Audible/Visual Notification Appliances - Wall Mounted

1. Provide solid state electronic audible notification appliances with integral visual notification appliance operable at 24-volt DC and polarized supervision. The appliances shall utilize a high intensity solid state xenon strobe tube with associated lens/reflector system. The appliances shall be constructed of high-impact white thermoplastic, shall be labeled "ALERT", shall not include the "Running Man" symbol, and shall be UL listed for wall mounted applications.
2. Where possible, provide flush mounting of appliances. Where surface mounting is necessary, provide a decorative backbox skirt covering the appliance backbox.
3. Provide synchronization of all audible and visual notification appliances. Provide a synchronized temporal pattern audible tone producing a minimum sound pressure level of seventy-five (75) dB reverberant per UL 464 using the A-weighted scale (dBA). The

synchronization modules shall be capable of synchronizing appliances with candela ratings ranging from 15 cd to 185 cd.

4. Do not install horn strobes in areas that are designed for voice evacuation messaging.

P. Speaker/Visual Notification Appliances - Wall Mounted

1. Provide speaker notification appliances UL listed for Fire Protective Service and capable of producing both tone alerts and voice communication instructions. The appliances shall include a built-in field selectable matching transformer rated for both 25 and 70.7 volt RMS with selectable power taps from 1/4 watt to 2 watts and screw terminal connection points.
2. The speaker notification appliances shall have a frequency response of 400 to 4000 Hz and circuitry for speaker/line supervision. The appliances shall be capable of a sound pressure level of seventy-five (75) dB measured at a setting of one (1) watt at ten (10) feet using the A-weighted scale (dBA).
3. Provide four (4) inch square speaker assembly with white molded of high impact thermoplastic.
4. Provide visual notification appliances operable at 24 volt DC and polarized supervision. The appliances shall utilize a high intensity solid state xenon strobe tube with associated lens/reflector system. The appliances shall be constructed of high-impact white thermoplastic, shall be labeled “ALERT”, shall not include the “Running Man” symbol, and shall be UL listed for wall mounted applications.
5. Where possible, provide flush mounting of appliances. Where surface mounting is necessary, provide a decorative backbox skirt covering the appliance backbox.
6. Provide synchronization of all visual notification appliances. The synchronization modules shall be capable of synchronizing appliances with candela ratings ranging from 15 cd to 185 cd.

Q. Visual Notification Appliances - Ceiling Mounted

1. Provide visual notification appliances operable at 24 volt DC and polarized supervision. The appliances shall utilize a high intensity solid state xenon strobe tube with associated lens/reflector system. The appliances shall be constructed of high-impact white thermoplastic, shall indicate “ALERT”, shall not include the "Running Man" symbol, and shall be UL listed for ceiling mounted applications.
2. Where possible, provide flush mounting of appliances. Where surface mounting is necessary, provide a decorative backbox skirt covering the appliance backbox.
3. Provide synchronization of all visual notification appliances. The synchronization modules shall be capable of synchronizing appliances with candela ratings ranging from 15 cd to 185 cd.

R. Audible/Visual Notification Appliances - Ceiling Mounted

1. Provide solid state electronic audible notification appliances with integral visual notification appliance operable at 24 volt DC and polarized supervision. The appliances shall utilize a high intensity solid state xenon strobe tube with associated lens/reflector system. The appliances shall be constructed of high-impact white thermoplastic, shall indicate “ALERT”, shall not include the “Running Man” symbol, and shall be UL listed for ceiling mounted applications.
2. Where possible, provide flush mounting of appliances. Where surface mounting is necessary, provide a decorative backbox skirt covering the appliance backbox.
3. Provide synchronization of all audible and visual notification appliances. Provide a synchronized temporal pattern audible tone producing a minimum sound pressure level of seventy-five (75) dB reverberant per UL 464 using the A-weighted scale (dBA). The synchronization modules shall be capable of synchronizing appliances with candela ratings ranging from 15 cd to 185 cd.
4. Do not install horn strobes in areas designed for voice evacuation messaging.

S. Speaker/Visual Notification Appliances - Ceiling Mounted

1. Provide speaker notification appliances UL listed for Fire Protective Service and capable of producing both tone alerts and voice communication instructions. The appliances shall include a built-in field selectable matching transformer rated for both 25 and 70.7 volt RMS with selectable power taps from 1/4 watt to 2 watts and screw terminal connection points.
2. The speaker notification appliances shall have a frequency response of 400 to 4000 Hz and circuitry for speaker/line supervision. The appliances shall be capable of a sound pressure level of seventy-five (75) dB measured at a setting of one (1) watt at ten (10) feet using the A-weighted scale (dBA).
3. Provide four (4) inch round speaker assembly molded of high impact white thermoplastic.
4. Provide visual notification appliances operable at 24-volt DC and polarized supervision. The appliances shall utilize a high intensity solid state xenon strobe tube with associated lens/reflector system. The appliances shall be constructed of high-impact white thermoplastic, shall indicate “ALERT”, shall not include the “Running Man” symbol, and shall be UL listed for ceiling mounted applications.
5. Where possible, provide flush mounting of appliances. Where surface mounting is necessary, provide a decorative backbox skirt covering the appliance backbox.
6. Provide synchronization of all visual notification appliances. The synchronization modules shall be capable of synchronizing appliances with candela ratings ranging from 15 cd to 185 cd.

T. Exterior Water Flow Audible/Visual Notification Appliances - Wall Mounted

1. Provide solid state electronic audible notification appliances with integral visual notification appliance operable at 24-volt DC and polarized supervision. The appliances shall utilize a high intensity solid state xenon strobe tube with associated lens/reflector system. The appliances shall be constructed of high-impact red thermoplastic, shall indicate “FIRE”, and shall be UL listed for wall mounted applications.
2. Where possible, provide flush mounting of appliances. Where surface mounting is necessary, provide a decorative backbox skirt covering the appliance backbox.
3. Provide synchronization of all audible and visual notification appliances. Provide a synchronized temporal pattern audible tone producing a minimum sound pressure level of seventy-five (75) dB reverberant per UL 464 using the A-weighted scale (dBA). The synchronization modules shall be capable of synchronizing appliances with candela ratings ranging from 15 cd to 185 cd.
4. Provide appliances UL listed for outdoor (weatherproof) application.
5. Provide mounting on backboxes UL listed for outdoor (weatherproof) application and for use with the appliances.

U. Weatherproof Visual Notification Appliances - Wall Mounted

1. Provide visual notification appliances operable at 24-volt DC and polarized supervision. The appliances shall utilize a high intensity solid state xenon strobe tube with associated lens/reflector system. The appliances shall be constructed of high-impact white thermoplastic, shall be labeled “ALERT”, shall not include the “Running Man” symbol, and shall be UL listed for wall mounted applications.
2. Where possible, provide flush mounting of appliances. Where surface mounting is necessary, provide a decorative backbox skirt covering the appliance backbox.
3. Provide synchronization of all visual notification appliances. The synchronization modules shall be capable of synchronizing appliances with candela ratings ranging from 15 cd to 185 cd.
4. Provide appliances UL listed for outdoor (weatherproof) application.
5. Provide mounting on backboxes UL listed for outdoor (weatherproof) application and for use with the appliances.

V. Weatherproof Audible/Visual Notification Appliances - Wall Mounted

1. Provide solid state electronic audible notification appliances with integral visual notification appliance operable at 24-volt DC and polarized supervision. The appliances shall utilize a high intensity solid state xenon strobe tube with associated lens/reflector system. The appliances shall be constructed of high-impact white thermoplastic, shall be labeled “ALERT”, shall not include the “Running Man” symbol, and shall be UL listed for wall mounted applications.
2. Where possible, provide flush mounting of appliances. Where surface mounting is necessary, provide a decorative backbox skirt covering the appliance backbox.
3. Provide synchronization of all audible and visual notification appliances. Provide a synchronized temporal pattern audible tone producing a minimum sound pressure level of seventy-five (75) dB reverberant per UL 464 using the A-weighted scale (dBA). The synchronization modules shall be capable of synchronizing appliances with candela ratings ranging from 15 cd to 185 cd.
4. Provide appliances UL listed for outdoor (weatherproof) application.
5. Provide mounting on backboxes UL listed for outdoor (weatherproof) application and for use with the appliances.

W. Auxiliary Relays

1. Provide relays for all auxiliary control interface. Provide heavy duty type rated up to ten (10) amps at 24-volt DC. Provide with NEMA I dust cover assembly and DPDT contacts.
2. Relays shall be mounted within three (3) feet of the controlled circuit or device.

X. Computer Workstation

1. Provide a desktop computer workstation that is compatible with and UL Listed for use with Honeywell XLS-3000 system. The workstation shall include a liquid crystal display (LCD) monitor with a nineteen (19) inch diagonal screen and a keyboard with full typewriter-style capability, as well as special keys to emulate all front panel controls. Connect the LCD monitor to communicate with the control panel using a fully supervised interface complying with Electrical Industries Association Standard RS-232.

2.4 CONDUCTORS

A. Wiring shall be in accordance with local, state, National Electrical Code and the ICC Electrical Code.

B. SLC conductors shall be Honeywell 4408 or 4608.

C. Notification Alarm Circuit conductor(s) shall be #12 AWG, THHN stranded.

D. Conductors for wet locations shall be as follows:

1. Types RHW, TW, THW, THHW, THWN, XHHW or other type listed for use in wet locations.
2. Type listed for direct burial.

E. All electrical characteristics (conductor-to-conductor capacitance, DC resistance, etc.) of the fire detection and alert notification conductors shall meet the requirements of the selected EM for the intended application.

F. All speaker circuits will be not less than #12 AWG, THHN, 600 volts, solid, copper conductors.

G. Wire used for 120 VAC power circuits shall be minimum size of 12 AWG stranded copper conductors, with THHN insulation.

H. Wire used for point addressable, signaling line circuits, shall be a minimum size of 14 AWG solid copper conductor, UL listed for fire alarm system use and labeled FPL.

2.5 FIBER-OPTIC CABLE

A. General

1. All fire detection and alert notification system fiber-optic cable shall be as follows:
    a. Fiber-optic cable that has scrapes, nicks, gouges, optical imperfections, or surface imperfections shall not be used.
    b. Single-mode nonconductive, loose tube, optical fiber cable that complies with ICEA S-83-596 for mechanical properties for indoor cable and ICEA S-87-640 for outdoor cable.
    c. Composed of dielectric materials and properly rated (i.e. plenum/riser/general purpose for the application.
    d. Meet the TIA-568-B.3 for performance specifications and TIA-492CAAB, zero water peak cable.
    e. Listed and labeled by an NRTL acceptable to the authority having jurisdiction as complying with UL 1651, and NEC for the following types:
        1) Type OFNP for NEC-defined plenum applications or any other application complying with NFPA 262.
        2) Type OFNR or OFNP for riser complying with UL 1666.
        3) Type OFNG/OFN for any applications other than plenum or riser.
    f. Maximum attenuation of 0.40dB/km at 1310 nm, 0.30dB/km at 1550 nm and a modal bandwidth of dispersion unshifted, matched clad, zero water peak.
    g. Jacket shall be yellow and the cordage, fiber, unit and group color complying with TIA-598-B with the fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches (1000 mm).
    h. Strengthened utilizing only aramid yarn capable of supporting a short-term tensile load of four hundred (400) pounds without stretching.
    i. Capable of bend radii as small as 20x outside cable diameter (under installation load) and 10x outside cable diameter (long term load). The bend radius shall not be less than two (2) inches.
    j. Capable of minimum crush resistance of eight hundred fifty (850) pounds per inch.
    k. In metal conduit.
    l. Continuous between control panels or between intermediary terminal cabinets.
    m. Approved by the fire detection and alert notification equipment manufacturer.
2. All connections shall be accessible for inspection and servicing and shall be clearly identified on the contractor record drawings.

B. Terminations

1. The terminal ends of all fiber-optic cable shall be field connectorized.
2. All fiber-optic cable connectors shall be as recommended by the fire detection and alert notification system manufacturer.
3. Terminations shall maintain a tolerance of 0.1 µm from flush as not to attenuate the fiber-optic signal.
4.

C. Fiber-Optic Patch Cords

1. Patch cords shall be factory made single-mode, duplex style, with 8.3 micron core diameter/125 micron cladding diameter that are yellow in color.
2. Cladding shall be covered by aramid yarn and OFNR jacket with LC style connectors and ceramic ferrules. Specialty use patch cords shall have a jacket suitable for the intended use.
3. Provide one (1) duplex patch cord that is sized for the routing requirements for each Fiber-Optic Patch Panel termination pair.

D. Installation

1. Before installation, each individual fiber-optic cable shall be tested (while on the reel) for length and transmission anomalies with an optical time domain reflectometer (OTDR).
2. Fiber-optic cable shall be installed in a method as not to damage or crack the core or the protective coating of the fiber-optic cable. At no time shall more than four hundred (400) pounds of tension be placed on any fiber-optic cable/strength member while it is being pulled through conduit.
3. Fiber-optic cable shall be pulled with hand power only. If power winches or mechanical advantage devices are used to pull cable, approval must be obtained from the Owner's Representative and the Engineer. Additionally, a tensionometer must be used to ensure that maximum tension is not exceeded. Torsion shall be avoided by the use of a swivel at the cable end.
4. Any fiber-optic cable installed underground or outside an environmentally controlled area shall be listed for such use as well as for wet locations and shall be protected by rigid conduit.

E. Testing

1. For fiber-optic cable testing purposes, minimum launch power for the fiber-optic cable from the fiber-optic medium card shall be 109.5 µW (-8.6 dBm). The maximum value for the minimum input sensitivity of the receiver is 1.0 µW (-30 dBm).
2. After installation, all fiber-optic cable strand segments (i.e. no splices or terminations) shall be tested for bi-directional attenuation, 850 nanometers (nm)/1300 nm. Using these values in addition to connector loss values, the contractor shall insure that maximum attenuation will not be exceeded once all cross-connects are made.
3. The contractor shall review all end faces of field terminated connectors with a fiber inspection scope following the final polish. Connector end faces with hackles, scratches, cracks, chips, or surface pitting shall be rejected and repolished or replaced if repolishing will not remove the end face surface defects. The minimum viewing magnification shall be 100x.

2.6 CONDUIT/RACEWAY

A. The following raceway types shall be permitted:

1. EMT conduit (3/4 inch minimum).
2. RIGID conduit (3/4 inch minimum).
3. Non-Metallic conduit for wet locations (3/4 inch minimum).
4. Metal clad cable is permitted in concealed spaces for horizontal fire detection and alert notification branch circuits and connections to devices and fixtures.

B. All raceway types shall be new. Installing used raceway is unacceptable.

C. Using existing raceway is unacceptable without prior written permission of the Engineer or Owner's Representative.

D. Boxes, supports, and other accessories for the raceway installation shall be listed for the intended application.

E. All wiring shall be installed in conduit.

F. Install fire detection and alert notification system wire in conduit or approved raceway, parallel to existing building structure when possible.

G. All riser wiring and wiring between floors shall be installed in conduit.

H. Strap or bundle all cables and wires inside equipment enclosures and terminal cabinets, parallel to the enclosure sides.

I. All EMT conduit fittings shall be compression type. All rigid conduit fitting shall be threaded with plastic inserts.

J. Flexible conduit and associated junction boxes connecting sprinkler water flow and supervisory switches shall be water resistant.

K. All fire alarm conduit and junction boxes shall be RED in color. Flexible conduit between fire alarm junction boxes and device mounting boxes that are less than six (6) feet in length are not required to be RED. Device mounting boxes are not required to be RED.

PART 3 - EXECUTION

3.1 COORDINATION WITH OTHER TRADES

A. Coordinate closely with all other trades to expedite construction, accurately interface with related systems and avoid interferences.

3.2 INSTALLATION / APPLICATION

A. Furnish and install all control wiring, raceway and outlet boxes for the fire detection and alert notification system.

B. Furnish and install all backboxes, equipment and devices for the fire detection and alert notification system.

1. Backboxes shall be of the exact type recommended by the EM as shown on the equipment and device submittals.
2. Backboxes shall be installed per the manufacturer's installation recommendations.
3. Devices and equipment must be installed by personnel legally permitted and currently licensed to install the devices and equipment. The cost of installation, warranty of installation and equipment, coordination of the installation, and supervision of the installation are responsibilities of the Contractor.

C. All fire detection and alert notification junction boxes, pull boxes, cable splices and terminal cabinets shall be accessible, painted red and clearly marked “Fire Alarm”. The Contractor shall comply with any local codes or AHJ requirements for circuit identification. Any access panels required for the accessibility to the junction boxes, pull boxes, cable splices and terminal cabinets shall be the responsibility of the Fire Detection and Alert Notification Contractor.

D. All wiring conductors and conduits shall be installed in a neat and workmanlike manner at right angles to the building walls, floors and ceilings, and supported from the building structure at intervals compliant with NEC requirements.

E. All wiring conductors for the fire detection and alert notification system shall be installed in conduit.

F. All wiring conductors shall be tagged at all junction points and shall test free from grounds or crosses between conductors.

G. Power-limited wiring conductors shall not be installed in conduits with electric light, power Class 1, non-power-limited fire alarm and medium power network-powered broadband communications circuits.

H. Fire detection and alert notification cabling shall not be painted.

I. Conduits shall enter the control panel enclosures only in the approved locations, as identified in the EM installation instructions.

J. Flexible Metal Conduit (FMC) is allowed to be installed between the junction boxes, conduit body, or other conduit termination and the device back box only in accessible ceilings. FMC shall not exceed 6-feet in length without prior approval from the Engineer of Record and DFW IT for the specific location. FMC shall be securely fastened in place and supported in one of the following methods:

1. By an approved means from building structure within 12-inches of each box, conduit body, or other conduit termination and shall be supported and secured at intervals not to exceed 4 1/2 ft. Hanger assemblies used to support the FMC shall be installed in accordance with the manufacturers published instructions.
2. By an approved means from building structure at the mid-point of the FMC at a minimum to ensure the FMC and connectors do not separate under normal operation of the building. Hanger assemblies used to support the FMC shall be installed in accordance with the manufacturers published instructions.

K. Existing systems being replaced, or their operations abandoned shall be removed immediately after the new fire detection and alert notification system is accepted by the Owner. All fire detection and alert notification equipment, equipment backboxes, accessible conduit and wiring shall be removed. Conduit and wiring that cannot be removed shall be marked “Abandoned”. All fire detection and alert notification equipment (excluding backboxes, conduit, scrap wiring, and other equipment not strictly related to the demolished fire detection and alert notification system) shall be turned over to the Owner’s Representative.

L. Install all hangers, clamps, conduit, and backboxes for the fire detection and alert notification system prior to the application of fireproofing on structural members. The hangers, clamps, conduit, and backboxes for the fire detection and alert notification system shall be installed on the edge of any beam requiring fireproofing. Backboxes shall be fastened to the flange of the beam utilizing beam clamps and shall not be attached directly to the beam. Verify the locations of all fireproofing, prior to the installation of any fire detection and alert notification conduit or backboxes.

M. Any damage to fireproofing on the building structure as a result of the fire detection and alert notification system installation shall be repaired by a qualified Fireproofing Contractor. All damage and repair of fireproofing shall be reported to and coordinated through the General Contractor. The Fire Detection and Alert Notification Contractor shall be responsible for all fireproofing repairs at no additional cost to the Owner.

N. Intelligent loop circuits shall be provided with adequate junction boxes, be expandable, and provide a means for connection to the loop in the junction box.

O. Conduits shall enter panels from the sides or bottom. Where flexible conduits are used to connect device loop wiring to alarm devices, the Contractor shall use ½ inch flexible conduit.

P. Exhaust fans shall include a remote Hand-Off-Auto (H-O-A) switch on each fan unit that is provided by the Electrical Contractor for Fire Department use. The remote H-O-A switch shall be mounted in a NEMA 4 enclosure with a hinged door that is a minimum of 8-inches by 8-inches by 8-inches deep. The H-O-A switch/NEMA 4 enclosure shall be located adjacent to the exhaust fan's combination starter disconnect. The NEMA enclosure shall include a cam type lock installed in the hinged door for securing the enclosure door that is capable of accepting a small format interchangeable core. Key lock receiver shall be a 7-pin small format interchangeable core. Coordinate with Fire Prevention Bureau and Planning on the Red Lock Core Requirements.

3.3 EQUIPMENT MOUNTING

A. The control panels and auxiliary power supplies shall be surface mounted with no operational parts which may require maintenance mounted greater than seventy-two (72) inches above the finished floor. The control panel annunciator shall be mounted so that no switch, manually operated device, display or LED is greater than sixty (60) inches above the finished floor.

B. Duct detectors shall be mounted in the return air duct of HVAC units. Duct detectors shall be mounted in such a way as to obtain a representative sample of the airstream. Detectors shall be accessible for cleaning and shall be mounted in accordance with the manufacturer's instructions and NFPA standards. Coordinate placement and connect all circuits.

C. Remote test stations shall be mounted in proximity of the associated device or unit, where visible in normally occupied areas, not higher than seventy-two (72) inches above the finished floor and with the final locations acceptable to the AHJ.

D. All HVAC equipment shutdown shall be initiated by relays integral to the addressable control modules. Relays shall be mounted within three (3) feet of the motor controller or control circuit of the affected equipment / BAS controllers. Provide cabling and wiring connections to HVAC shutdown controls. Final terminations to HVAC shutdown controls are by mechanical or controls contractor. Provide any required intermediate relays for connections to HVAC shutdown controls.

E. Heat detectors in elevator machine rooms, elevator shafts, and elevator pits shall be mounted within twenty-four (24) inches of the adjacent automatic sprinkler head.

F. Smoke detectors shall be mounted on the underside of the ceiling or deck, and shall be located more than three (3) feet from air supply diffusers.

G. Smoke, heat, and duct detectors shall not be installed until after the construction clean-up of all trades is complete and final. Detectors that have been installed prior to final clean-up by all trades shall be cleaned or replaced in accordance with NFPA 72.

H. Manual pull stations shall be securely mounted with the operable part of the manual pull station no greater than forty-eight (48) inches above the finished floor (AFF) for frontal wheelchair access and 54 inches AFF for side access as measured to the pull lever.

I. Wall mounted audible/visual, speaker/visual and visual appliances shall be flush mounted with their bottoms at eighty (80) inches above the finished floor or six (6) inches below the ceiling,

whichever is lower. Wall mounted horns or speakers shall be mounted a minimum of 90 inches AFF.

J. Ceiling mounted audible/visual, speaker/visual and visual appliances shall be mounted with their visual lenses having an unobstructed line of site in all directions. Exact locations of appliances shall be sufficiently distant from vertical surfaces and hanging items to permit maximum viewing from all directions.

K. Weatherproof audible/visual notification appliances shall be surface mounted at the fire department connection on the building exterior and with the final location as acceptable to the AHJ

L. Devices and appliances shall not be supported by ceiling tiles. Devices and appliances must be attached to backbox supported by the ceiling grid.

M. All initiating devices and addressable modules shall be mounted in a location accessible for testing and maintenance.

N. Provide a label for each initiating device indicating the specific address for that device. The label shall include the node number, loop number and device number where applicable. The label shall be located on the base of all detectors and the cover plates of addressable modules

3.4 PAINTING AND PATCHING

A. All fire detection and alert notification junction boxes, pull boxes, conduit, cable splices and terminal cabinets shall be thoroughly cleaned, removing all dirt, oil, etc. and made ready to receive paint.

B. All penetrations of fire rated assemblies (wall or floor construction) shall be firestopped to preserve the original fire resistance and smoke tight integrity of the assembly. All firestopping methods shall be UL listed Through Penetration Firestop Systems or otherwise approved by the Owner, Architect, Engineer, and AHJ. Specific firestop assembly shall be identified at the penetration location with a sticker or other approved identification means.

3.5 SYSTEM TESTS

A. All test and inspections specified in this section shall be reported in writing and submitted in accordance with this specification section.

B. The system shall meet all the requirements of the listed applicable codes and the requirements of the AHJ. The system tests and test documents, including those required for and by the approved remote monitoring station, shall meet the requirements of the AHJ.

C. Provide one hundred (100) percent initial acceptance testing of the entire fire detection and alert notification system prior to the required AHJ acceptance testing. Before requesting the AHJ acceptance testing, furnish a written statement to the Owner’s Representative indicating that the system has been installed in accordance with the approved documents and tested in accordance with the manufacturer’s specifications and the applicable NFPA requirements. The Record of Completion shall be completed and submitted as part of the written statement.

D. All testing, inspection and retesting required for certification and required for all warranty work or replacements shall meet the requirements of the AHJ. This certification, inspection, or testing shall be completed at no additional cost to the Owner.

E. Provide the testing date in writing to the Owner a minimum of two (2) weeks before the date. The Owner may elect to have a representative present for testing.

F. The fire detection and alert notification system will not be acceptable until final testing and receipt of the testing certificates have been obtained.

END OF SECTION 28 31 00