

SECTION 16721 - FIRE ALARM SYSTEMS

PART 1: GENERAL

1.01 WORK INCLUDED:

- A. This specification outlines the requirements for an automatic addressable fire detection and alarm system. The new addressable system shall include all building areas (rental). Base Bid will include core systems as required by the Fire Marshall and City Code Officers.
- B. The work described in this specification consists of all labor, materials, equipment and services necessary and required to complete and test the automatic fire detection and alarm system. Any material not specifically mentioned in this specification or not shown on drawings but required for proper performance and operation shall be furnished and installed.

1.02 RELATED WORK

- A. Section 13935 - Wet Pipe Sprinkler System
- B. Section 16000 - Basic Electrical Requirements

1.03 REQUIREMENTS

- A. This installation shall be made in accordance with the drawings, specification and the following:
  - 1. National Electrical Code Article 760
  - 2. National Fire Protection Association Standard (NFPA)
    - No. 72 (Protective Signaling Systems)
    - No. 72E (Automatic Fire Detectors)
    - No. 90A Installation of Air Conditioning and Ventilating Systems
  - 3. Local Codes and Authorities Having Jurisdiction
  - 4. Underwriters Laboratories Inc. (UL) publications:
    - No. 38 Manually Actuated Signaling Boxes
    - No. 50 Cabinets and Boxes
    - No. 217 Single and Multiple Station Smoke Detectors
    - No. 228 Door Closers-Holders for Fire Protective Signaling Systems
    - No. 268 Smoke Detectors for Fire Protective Signaling Systems
    - No. 268A Smoke Detectors for Duct Applications
    - No. 464 Audible Signaling Appliances

No. 521 Heat Detectors for Fire Protective Signaling Systems

No. 864 Control Units for Fire Protective Signaling Systems

No. 1481 Power Supplies for Fire Protective Signaling Systems

No. 1638 Visual Signaling Appliances

5. The Americans with Disabilities Act (ADA) – New 16 “ADA” apartments and public access areas of the complex.

6. American National Standards Institute (ANSI)

No.17.1 Safety Code for Elevators and Escalators

- B. Wiring requirements for shielding certain conductors from others or routing in separate raceways shall be as recommended by the manufacturer's documentation.
- C. The system including all components shall be listed by Underwriters Laboratories, Inc. for use as a fire protective signaling system.

#### 1.04 GENERAL

- A. The Contractor shall furnish and install complete and ready for operation an automatic fire detection and alarm system including control panel, detectors, annunciators, manual stations, alarm devices, wiring, components, appurtenances and accessories, and all wiring and connections to devices furnished by others.
- B. The system and components shall be supplied by one manufacturer of established reputation and experience who shall have produced similar apparatus for a period of at least three (3) years and who shall be able to refer to similar installations rendering satisfactory service.
- C. All references to model numbers and other pertinent information herein is intended to establish minimum standards of performance, quality and construction, and is based upon equipment designed and manufactured by Pyrotronics, or approved equal by FCI, Notifier, Autocall, or pre-approved equal as addressed through bidding addendum. It is not the intent of these specifications to eliminate competitive equipment.
- D. Any equipment proposed as equal to that specified herein shall conform to the standards herein, and the manufacturer must supply proof of having produced similar equipment, now giving satisfactory service. In addition, the Contractor must obtain the Architect/Engineer's or Owner's approval in writing ten (10) working days prior to bidding equipment other than as specified. The manufacturer's name, model numbers, and three copies of working drawings and engineering data sheets shall be submitted for approval. Included in the submittal shall be a written statement from the manufacturer of the substituted equipment that it does in fact equal the features, functions, and performance of the specified equipment.

#### 1.05 SPECIAL CONDITIONS

- A. The manufacturer or his authorized distributor shall confirm that within reasonable distance of the job site there is an established agency which stocks a full complement of parts and offers service during normal working hours on all equipment to be furnished, and that the agency will supply parts without delay and at reasonable cost.
- B. All material and equipment shall be new and unused.

- C. All individual components and composite systems shall be designed for continuous operation without undue heating or change in rated values, and shall be properly fused.

1.06 SYSTEM DESCRIPTION AND FUNCTION

- A. The automatic fire detection and alarm system shall consist of main control panel, alarm communications system control, along with remote annunciator, detection devices and manual stations wired in accordance with the schedule on the drawings and shall function as specified herein.
- B. The system shall be capable of being expanded at any time up to the predetermined maximum capacity of the system.
- C. The system shall be capable of being programmed in the field, by a non-computer trained person, via the optional system printer. All programmed information shall be stored in non-volatile memory.
- D. The system shall be capable of operating both addressable and non-addressable ionization, thermal and photoelectric detecting devices, manual stations and water-flow switches.
- E. The control panel shall provide power, annunciation, supervision and control for the fire detection and alarm system. The control panel shall be modular in construction, and contain equipment meeting the requirements of Part 2 of this specification as necessary to operate according to the schedule in this specification and applicable drawings. The system shall be designed such that alarm indications override trouble condition. The panel shall be capable of measuring the sensitivity of the addressable ionization and photoelectric detectors connected to it.
- F. External circuit supervision shall not require additional wires other than the pair used for detection or alarm (only two wires shall be used from the control panel to each loop of initiating devices and two wires for the audible devices). These two wires shall provide both supervision and alarm signals. There shall be no loss of supervision for Class "B" wired addressable devices. Class "A" supervision shall be provided by adding an additional pair of wires.
- G. The system shall be a coded, zoned, electrically supervised, low-voltage fire alarm system.
- H. The system shall function as follows when any public or non-residential area or duct detector, manual station or water-flow switch operates:
  - 1. Audio/sound indicating appliances to notify the standard evacuation.
  - 2. Emergency alarm communication system and appliances to notify evacuation.
  - 3. Automatically notify fire department, Owner's security contractor, central station, etc. Provide dual channel communicator.
  - 4. Display individual detector and/or zone number on alpha-numeric display with optional user defined message.
  - 5. Light an indicating lamp on the device initiating the alarm.
  - 6. Shut down the HVAC system and operate dampers as shown on the schedule.
  - 7. There shall be no limit, other than maximum system capacity, as to the number of

addressable devices which may be in alarm simultaneously.

1.07 SUBMITTALS

A. In accordance with Section 01340 - Shop Drawings, Product Data and Samples, furnish the following:

1. Shop Drawings:

- a. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
- b. Include ratings, power requirements, battery calculations, dimensions, mounting, equipment, device arrangement, complete wiring diagrams, connection diagrams with terminal identification, material and description of operation.
- c. Show main graphic annunciator layout, riser diagram and auxiliary functions.

2. Manuals:

- a. Submit simultaneously with the shop drawings, companion copies of complete operating and maintenance manuals including technical data sheets, wiring diagrams, and information for ordering replacement parts.
- b. Two weeks prior to final inspection, deliver four copies of final updated operating and maintenance manuals to the Owner. Each manual shall contain, but not be limited to the following:
  - 1) A statement of guarantee including date of termination and name and phone number of the person to be called in the event of equipment failure.
  - 2) Complete, simple, comprehensive, step-by-step, testing instructions giving recommended and required testing frequency of all equipment, methods for testing each individual piece of equipment and a complete trouble shooting manual explaining what might be wrong if a certain malfunction occurs and explaining how to test the primary internal parts of each piece of equipment, shall be delivered to the Owner upon completion of the system.
  - 3) Maintenance instructions shall be complete, easy to read, understandable, and shall provide the following information:
    - a) Instruction on replacing any components of the system, including internal parts.
    - b) Instructions on periodic cleaning and adjustment of equipment with a schedule of these functions.
    - c) A complete list of all equipment and components with information as to the address and phone number of both the manufacture and local supplier of each item.
  - 4) A complete set of reproducible as-builts, showing installed

wiring and 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 the system.

A copy of the as-built print shall be submitted to the fire department prior to final acceptance.

- c. Individual factory issued manuals shall contain all technical information on each piece of equipment installed. In the event such manuals are not obtainable from the factory, it shall be the responsibility of the Contractor to compile and include them. Advertising brochures or operational instructions shall not be used in lieu of the required technical manuals.

- 3. Certifications: Submit certification of fire alarm operator tests.

1.08 WARRANTY

- A. All equipment and systems shall be warrantied by the Contractor for a period of one year following acceptance. The warranty shall include parts, labor, prompt field services, pick-up and delivery.
- B. Provide one year testing and maintenance, (minimum of two inspections) which shall consist of:
  - 1. Regularly and systematically examining all detectors, manual stations, panels, relays, pressure switches and accessories pertaining to the system.
  - 2. Regularly and systematically examine, adjust and clear all the electrical and mechanical components of water flow switches.
  - 3. Tests and written reports which certify that all initiating devices have been tested and which indicate the result of the inspection test as required by the authority having jurisdiction.
- C. The system supplier shall offer, complete with cost, a test and maintenance agreement providing the same service as described in para. B. to commence after expiration of test and maintenance included in this contract.

1.09 Instruction:

- A. Furnish the services of a competent instructor for not less than two (2) four-hour periods for instructing personnel in the operation and maintenance of the system.

PART 2: PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. All units of equipment shall be manufactured by Pyrotronics, or approved equal.

2.02 MATERIALS AND EQUIPMENT

- A. All materials, equipment, accessories, devices and other facilities and appurtenances covered by these specifications or noted on the contract drawings and on the Contractor's approved working drawings and installation specifications shall be new, best

suited for its intended use and shall conform to applicable and recognized standards for their use. All equipment shall be the standard cataloged products of a single manufacturer.

B. Control Equipment

1. The control panel shall provide power, annunciation, supervision and control for the detection and alarm system. The control panel shall be modular in construction, and contain all modules necessary to operate according with this section and applicable drawings. The system shall be capable of reading and displaying at the control panel, the sensitivity of remote addressable ionization and photoelectric detection devices. Individual addressable detection device alarm threshold shall be adjustable from the control panel. The detection system shall remain 100% operational and capable of responding to an alarm condition while in the routine maintenance mode. Addressable detection devices shall be individually identified by the system, and any quantity of addressable detection devices shall be in alarm at any time up to the total number connected to the system.
2. The control panel shall be capable of supporting non-addressable as well as addressable detection devices.
3. The panel annunciator shall be a 32 character alpha-numeric display, which shall provide an optional user definable message associated with each detection device or zone.
4. Dynamic supervision of system electronics, wiring, detection devices and software shall be provided by the control system. Failure of system hardware or wiring shall be indicated by type and location on the alpha-numeric annunciator. Software and processor operation shall be monitored by an independent hardware watchdog, which will indicate their failure. The system shall provide fail safe operation, i.e., incoming alarms shall automatically override all other modes of operation, and the panel shall automatically return to normal operating mode from any operator initiated mode.
5. Ground-fault detection shall be provided for all initiating and audible circuits. All system modules shall be capable of operation in any unused panel location. Lamp test capability shall be provided to test all visual panel indicators and associated software. Provisions shall be made for remote trouble and remote alarm silencing switches. The control panel shall be equipped with a silence before reset feature, designed to prevent accidental system reset during an alarm condition.
6. The system alarm lamp shall flash upon receipt of any alarm condition. Acknowledgement of the alarm by operation of the silence switch shall silence the audible alarm and cause the alarm lamp to light steadily. Receipt of subsequent alarms shall cause the audible devices to resound and the alarm lamp to flash.
7. The system trouble lamp shall flash and an integral trouble buzzer shall sound upon the occurrence of any trouble condition. Acknowledgement of the trouble condition by operation of the silence switch shall silence the audible alarm and cause the trouble lamp to light steadily. Receipt of subsequent troubles shall cause the trouble buzzer to resound and the trouble lamp to flash.
8. Individual input and output device addressability as well as remote sensitivity measurement shall all be performed on the same pair of wires. Wiring may be

Class "A" or "B". When Class "B" wiring is used, no special wiring sequence shall be required on addressable device circuits, an unlimited number of wiring branches shall be permitted with no loss of supervision. The system shall be capable of having all addressable devices in alarm simultaneously.

9. The service mode shall permit the arming and disarming of individual detection or output devices as well as manually operating output devices. Status of these devices shall be displayed upon command from the control panel. The panel shall automatically return to normal mode in the event the panel remains unattended in the service mode.
10. The panel shall be capable of receiving and processing alarms even when in the service mode.
11. The control shall operate from a three wire 120 VAC supply, or when so configured 120 VAC and internal 24V back-up battery. All power connections whether AC or DC shall be separately fused within the control. Light emitting diodes (LED's) shall be included to indicate (green) system power, (yellow) trouble, and (red) alarm; trouble and alarm shall also be annunciated on an alpha-numeric display which will give device number and location plus diagnosis of trouble. Momentary contact switches shall provide for Locate, Next Alarm, Next Trouble, Acknowledge/Silence and Reset. An audible device shall sound within the control for alarm or trouble. This device shall have two (2) distinct sounds, and shall be silenceable by the acknowledge/silence switch. Alarms shall override any trouble condition.
12. The control power supply shall be capable of powering up to 960 addressable early warning detectors and at least four (4) audible signal circuits. All system expansion modules shall interconnect through a card edge connector and shall require no inter-module wiring.
13. The control shall be capable of measuring and adjusting the sensitivity of detectors. An alpha-numeric display shall be provided to display custom messages and give readings of detector sensitivity, detector by detector. Each device on an addressable initiating circuit shall be checked continuously to include the following: sensitivity, response, opens, shorts, ground faults, functionality and status.
14. The control shall report the failure of a device's transmitting component(s), open or shorted, on an addressable initiating circuit. The device shall be recognized and identified by location within the circuit to the specific device, and all other devices on the circuit shall continue to function properly.
15. The control shall report, by specific device number, any device removed from an addressable initiating circuit and all other devices shall continue to function.
16. The control shall allow changing the status of configured circuits (arming or disarming and changing status of relays). If any change in status degrades system operation as configured, a trouble condition shall be reported and remain until system operation again meets configured status.
17. The control shall perform multiple operations at the same time. These operations shall include but not be limited to timed functions and multiple configured sequences.
18. The control shall support a printer terminal. This terminal shall be used for permanent records of the Control's status and detector chamber voltages, and

- shall also be capable of system control as configured.
19. The control shall allow for expansion and shall also be configurable without system interwiring.
  20. The control shall allow for up to two hundred field programmable changes by non-computer trained personnel.
  21. The system shall provide a hard copy written record of all alarms, troubles, and system activity by means of full carriage width terminal to print detection device designations and location messages on a single line of up to 128 characters wherein 32 are reserved for device or zone custom identification.
  22. New unacknowledged alarms and troubles shall be distinctively displayed on both the visual display and the printer and differentiated from previous alarm and troubles.
  23. The system shall automatically indicate the total quantity of alarms and of troubles which have occurred prior to reset at the control unit.
  24. No alarm or trouble indication shall be resettable until it has been acknowledged. It shall not be possible to reset the system until all alarms have been acknowledged.
  25. It shall be possible to display up to 127 alarms and up to 127 trouble indications, one at a time, on the digital annunciator and as a list on a printer.
  26. The digital annunciator shall be capable of listing, upon request:
    - a. Alarms with time, date and location.
    - b. Troubles with time, date and location.
    - c. Status of output functions, "on" or "off".
    - d. Sensitivity of addressable smoke detectors.
    - e. Detection device number, type and location.
    - f. Status of remote relays, "on" or "off".
    - g. Acknowledgement time and date.
    - h. Signal silence time and date.
    - i. Reset time and date.
  27. The system shall be capable of:
    - a. Counting the number of addressable detectors within a "zone" which are in alarm.
    - b. Counting "zones" which are in alarm.
    - c. Counting the number of addressable detectors which are in alarm on the system.



- d. Differentiating among types of addressable detectors such as smoke detectors, manual stations, water-flow switches, thermal detectors.
  - e. Assigning priorities to types of detectors, zones or groups of detectors.
  - f. Cross-zonings.
28. Control functions shall be assigned on the basis of system initiation patterns of detection devices such as "anding" zones, counting zones, counting devices, "anding" groups, and "anding" types of detection devices.
29. Control functions shall be assigned on the basis of time of day, day of week, and with a holiday schedule of up to thirty (30) holidays per year. Each addressable detection device shall report its condition to the system control unit every four (4) seconds in a manner such that failure of the connections to or internal electronics of the device will result in a trouble signal which identifies the specific device involved.
30. Addressable dual chamber ionization and photoelectric type smoke detector sensitivity shall be reported at the control panel when requested. The electronic readout of detector sensitivity shall be equivalent to sensitivity readings made with a meter for a non-addressable detector, but shall be read at the control panel digital annunciator.
31. It shall be possible to change the detector sensitivity from the control panel within maximum and minimum values as defined by the UL listing of the detectors.
32. The system shall be capable of listing detector chamber voltage settings on the printer for permanent record.
33. Water-flow switches, air duct smoke detectors, tamper switches, OS and Y valves, manual stations, and thermal detectors shall be equipped with an electronic address device which shall be supervised identically as addressable detectors.
34. Water-flow switch alarm operation and automatic sprinkler system supervisory switches shall be wired and annunciated in conformance with the National Fire Code.
35. A trouble signal shall be initiated for each addressable device for which the automatic sensitivity measurement is too insensitive.
36. The system shall be capable of operating conventional two-wire, Class "B" detector circuits terminated on end-of-line devices or Class "A", field selectable, detector circuits and connected in series/parallel per the manufacturer's recommendations. These non-addressable detector circuits shall be capable of operating interchangeable, plug-in detectors of the following types: dual chamber ionizations, photoelectric, flame, and rate anticipation thermal as well as manual stations and non-plug-in thermals of any type.
37. Alarm and troubles from non-addressable detector circuits (zones) shall be annunciated and cause output functions in the same manner as addressable detection devices including a location message for each zone.
38. The supervised and powered parallel output circuits shall be capable of use as audible signal circuits, fire extinguishing release circuits, municipal tie, remote

- station connection or general alarm release service. They shall be capable of providing 1.5 amp at 24 VDC.
39. Provide control relays in the fire alarm control unit having dry contacts rated 120 VAC 5 amp inductive as required.
  40. Remote relays located on detector bases or double gang outlets throughout the building shall be controlled in the same manner as panel mounted relays.
  41. The system power supply shall be provided with an integral uninterruptable power source or UPS. This UPS shall provide continuous power to the system in the event of a commercial power failure. Transfer from commercial to standby power shall be instantaneous to insure proper processor operation, and indicated by flashing the system power LED. Batteries shall be sized to provide 60 hours of standby operation followed by 10 minutes of alarm. A dual rate battery charger shall be provided which is capable of recharging the batteries to 80% capacity in 12 hours. Loss of commercial power shall be annunciated as a system trouble. System trouble shall be indicated for over or under voltage conditions, blown fuse or disconnected batteries. The system shall visually and audibly indicate operation from standby power. The system shall automatically restart upon the return of power. No operator intervention shall be required.
  42. The control panel enclosure shall be earth tones in color, suitable for surface or semi-flush mounting. A locked door shall be provided to limit access to individuals authorized access to the panel.
  43. All modules shall be plug-in, dynamically supervised and easily replaceable. Field wiring shall be connected to the panel with removable multi-conductor connectors to facilitate rapid removal and replacement of both the module and wiring for ease of servicing the panel.
  44. Visual indicators shall be long life LED's. Modules capable of initiating a system trouble shall display individual trouble indications on the alpha-numeric annunciator.
  45. Addressable Input Module:
    - a. Addressable/programmable initiating circuits shall be provided by a Pyrotronics Addressable Input Module, Model INX. The module shall be system interconnected by a card edge connector, and shall be operable by the control unit.
    - b. Each initiating circuit shall consist of a two (2) wire circuit, allowing multiple T-taps, and not requiring any end of line device for supervision. Each initiating circuit shall accommodate up to thirty (30) addressable/programmable initiating devices. Each circuit shall be capable of Class "A" or Class "B" wiring.
    - c. Upon activation of any addressable/programmable device installed in the circuit, the system shall automatically report the status of the device and initiate the sequence of operations specified for that device, i.e., alarm, local, general, reporting, trouble reporting only, etc. Alarm shall have priority over trouble. Trouble conditions shall be reported to include the device number, location and type of trouble.
    - d. All addressing initiating devices on all circuits may be in alarm at the same time and perform the sequences of operation prescribed by the

system configuration. If there are more than 127 alarms the message "more than 127 alarms" will appear and any alarms after 127 will still have all of their required functions performed.

- e. The initiating circuits shall maintain complete reporting of device status while in trouble, due to any addressable device having its active transmitting component fail, open or shorted.
- f. The initiating circuits shall detect a line break and provide information to the control panel allowing the user to determine between which two (2) devices the break has occurred.
- g. The Model INX module shall be Underwriters Laboratories, Inc. listed.

46. Zone input Module:

- a. Detection line circuit monitoring shall be provided by a Pyrotechnics Zone Input Module, Model ZNX. This module shall be system interconnected by a card edge connector and shall be operable by the XL3 control unit. Connection of field wiring shall be by screw terminals on a card edge connector.
- b. Each circuit shall be capable of Class "A" or "B" wiring. Class "B" a 50ufd 50V capacitor end-of-line device shall be required. Each zone shall accommodate up to thirty (30) Pyrotechnics ionization or photoelectric detectors, or five (5) Pyrotechnics flame detectors as well as any quantity of shorting type contact devices.
- c. Upon actuation of any detector or device installed in a zone circuit, that particular zone shall lock into alarm and the zone identification and location shall be annunciated at the XL3 control unit. Zone troubles such as opens shall be annunciated at the XL3 control unit, giving zone identification and trouble description. Alarm information and transmission shall have priority over trouble.
- d. The Model ZNX module shall be Underwriters Laboratories, Inc. listed.

47. Programmable Signal Module:

- a. An output circuit for operation of DC audible devices, leased line or city tie, or halon release shall be provided by Programmable Signal Module, Model SPX. This module shall be system interconnected by a card edge connector, and shall be operable by the XL3 control unit.
- b. Upon command by the XL3 control unit, the output circuits will respond as configured. Leased line or city tie circuits shall be limited energy outputs. All signal circuits shall require and be fitted with an end-of-line device. The output current shall be at least 1.5 amps per circuit and each circuit shall be fused separately.
- c. The module shall be supervised by the XL3 control unit for open and shorted circuits. Open circuits shall report trouble only and respond with circuit identification. A shorted circuit shall respond in a similar manner. Each output circuit shall be individually fused with replaceable fuses.
- d. Output circuits may be user controlled. If such control degrades system

configuration, a trouble condition shall be reported.

- e. The Model SPX module shall be Underwriters Laboratories, Inc. listed.

48. Programmable Supplementary Relay Module:

- a. For control of air handling units and elevators there shall be provided a Pyrotronics Programmable Supplementary Relay Module, Model POX. It shall contain four independent relays, fitted with form "C" contacts, rated at 120 VAC, 5 amps inductive, Pyrotronics Model POX.

C. Alarm Initiating Devices:

1. General:

- a. All addressable and non-addressable ionization, photoelectric and thermal detectors shall be capable of being intermixed on the same control panel. All detection devices shall contain an integral alarm LED. All addressable detectors shall be individually identifiable by zone.

2. Addressable Ionization Smoke Detector:

- a. The addressable ionization type product of combustion detector shall be listed by Underwriters Laboratories, Inc. The detector shall be a plug-in, twist/lock unit. The detector shall contain two ionization chambers and solid state indicator lamp. The reference chamber shall compensate against sensitivity changes due to changes in environmental temperature, humidity and barometric pressure. The sensing chamber shall be open to the outside elements through a protective cover which will permit products of combustion to enter, while preventing foreign matter from entering and causing unwanted alarms.
- b. The addressable detector sensitivity shall be individually adjustable from the control panel. It shall also be possible to accurately measure the addressable detector's sensitivity from the control panel. Relative sensitivity measurements providing no readout of discrete sensitivity will not be considered as being equivalent.
- c. The addressable ionization detector shall be dynamically supervised, indicating a trouble condition at the control panel when the detector is unable to sense a fire condition due to both internal and external operating conditions or malfunctions.
- d. The detector mounting base shall be of the twist/lock type with screw terminals for field wiring. Pigtails or in-line connectors shall not be permitted. It shall be possible to secure the detector in the base with a concealed locking mechanism to prevent unauthorized removal. When locked in its base, detector removal shall require a special unlocking tool. The addressable ionization products of combustion detector shall be a Pyrotronics Model DI-X3.

3. Addressable Photoelectric Smoke Detector:

- a. The addressable photoelectric smoke detector shall be listed by Underwriters Laboratories, Inc. The detector shall contain a long life light emitting diode (LED) as its light source, and photo diode as a light

receiver. An automatic gain control circuit shall be provided to maintain correct sensitivity by compensating for detector aging and dirt accumulation. The detector shall be a plug-in twist/lock unit which allows for easy connection to its mounting base.

- b. It shall be possible to adjust and/or electronically measure the sensitivity of each individual addressable detector from the control panel. Relative sensitivity or manual test methods which check the detector at the maximum allowable obscuration will not be considered as being equivalent.
  - c. The addressable photoelectric detector shall provide complete supervision of the detector optics. The detector shall be supervised for complete failure of the LED light source or a critical reduction in the light output of the LED caused by excessive dirt which could not normally be compensated for by the automatic gain control circuit. The detector mounting base shall be of the twist/lock type with screw terminals. Pigtails or in-line connectors shall not be permitted. It shall be possible to secure the detector in the base with a concealed locking mechanism to prevent unauthorized removal. Detector removal shall require a special unlocking tool. The addressable photoelectric smoke detector shall be a Pyrotronics Model PEX-3000.
4. ~~The addressable thermal detectors~~ shall be of the rate compensated fixed temperature type and shall be listed by Underwriters Laboratories, Inc. The addressable thermal detectors shall be individually annunciated on the control panel. The addressable thermal detectors shall contain an integral alarm lamp. The addressable thermal detector shall be Pyrotronics DT-X3-135.
  5. ~~The intelligent interface module~~ shall be listed by Underwriters Laboratories, Inc. This unit is designed to provide an interface for direct shorting contact devices to the XL3's Addressable Input Model INX. This unit is used with water flow switch, tamper switch and OS and Y valves. The addressable/programmable interface module shall be a Pyrotronics Model TRI-2, TRI-2R, or TRI-2D as required.
  6. ~~The addressable manual fire pull station~~ shall be listed by Underwriters Laboratories, Inc. The addressable manual fire station shall be non-coded and shall operate on any addressable detection circuit. The addressable manual fire station shall be individually annunciated on the control panel. The addressable manual station shall be a Pyrotronics Model MSX-2.
  7. ~~The air duct smoke detector~~ shall be listed by Underwriters Laboratories, Inc. The air duct detector shall operate on a cross-sectional air sampling principle to overcome stratification and the skin effect. The air duct detector shall consist of a standard addressable/non-addressable ionization/photoelectric detector mounted in an air duct sampling assembly and sampling tube that protrudes across the duct of the ventilating system. The air duct detector shall retain the features of the addressable/non-addressable ionization/photoelectric detector, and be installed in the ventilating duct as indicated in the manufacturer's instructions. The air duct detector shall be a Pyrotronics AD-3 with the appropriate non-addressable or addressable detector, provide remote alarm indicator/test/key switch for fire department testing and control.
  8. Waterflow Switch: See Section 13930 – Wet Pipe Sprinkler System.
  9. Supervisory Device and Tamper Switch: See Section 13930 - Wet Pipe Sprinkler

System.

- D. Alarm Indicating Devices
1. Visual Unit: Pyrotronics Model SVMT-F (Flush) strobe.
  2. Alarm Strobe/Horns shall be of the polarized 24 VDC type. The mechanisms shall contain an aerospace grade aluminum diaphragm, blued, tempered and polished armature, and tungsten contact points, all housed in a die-cast frame and grill assembly. The alarm horn shall be UL listed with multi-tapered intensity level control. The alarm horn shall be a Pyrotronics Model EHM-D (Flush), EHM-E (Surface).
  3. Audio/Visual Unit shall be mounted on a semi-flush visual unit with back box.
- E. Pull Station Enclosure shall be 8" x 6" x 6", NEMA 1, with mounting plate, hinged cover and lock (lock to be furnished by Owner, to be installed by the Contractor, shall be suitable for flush or semi-flush mounting, painted red with 5/8" high white letters reading "Fire Alarm Pull Station").
- F. Remote Annunciators:
1. Furnish and install remote annunciators as shown on plans. The annunciators shall be capable of being flush or surface mounted for indoor applications. The unit shall be capable of having a remote key reset feature. Removal of the front cover shall provide easy access.
  2. The remote annunciators shall have the following options:
    - a. Supervised remote trouble indication.
    - b. Key operated remote alarm reset.
    - c. Key operated remote alarm silence with resound feature.

PART 3: EXECUTION

3.01 INSTALLATION

- A. Control and other panels shall be mounted with sufficient clearance for observation and testing. All fire alarm junction boxes must be clearly marked for easy identification. All wiring shall be in conduit, EMT thin-wall or other approved methods. Flexible connectors shall be used for all devices mounted in suspended lay-in ceiling panels. All conduit, mounting boxes, junction boxes and panels shall be securely hung and fastened with appropriate fittings to insure positive grounding throughout the entire system.
- B. No wiring other than that directly associated with fire alarm detection, alarm or auxiliary fire protection functions shall be permitted in fire alarm conduits. Wiring splices are to be avoided to the extent possible, and if needed they must be made only in junction boxes and shall be crimp connected. Transposing or changing color coding of wires shall not be permitted. Wire nut-type connections are not acceptable. All conductors in conduit containing more than one wire shall be labeled on each end with "E-Z markers" or equivalent. Conductors in cabinets shall be carefully formed and harnessed so that each drops off directly opposite to its terminal. Cabinet terminals shall be numbered and coded. All controls, function switches, etc., shall be clearly labeled on all equipment panels.
- C. All wiring shall be checked and tested to insure that there are no grounds, opens or

shorts.

- D. Check to see that the duct smoke detectors shut down the ventilation equipment.
- E. Installation shall be in accordance with the NEC Article 760, and as shown on the drawings.
- F. Installation shall be as shown on the drawings and on the manufacturer's wiring diagrams, and shall be performed under the supervision of a factory-trained representative.
- G. All pull boxes, junction boxes, etc., shall be painted red. Conduit shall be painted with a 2" wide red stripe at 5'-0" intervals.
- H. Wire the roof top unit starter coils in series with the duct detector relay contacts (one contact for the supply fan) to shut down the unit if duct detector alarms.
- I. All wiring shall be color-coded and tagged and shall be checked for continuity, short circuiting, and resistance to ground.
- J. Provide all necessary mounting brackets or duct modifications required for mounting the duct smoke detectors.
- K. A factory-trained technician shall be present during final inspection and shall instruct the Owner in system operation.
- L. The Contractor shall coordinate the programming of the system with the Owner. Room designations shall be as shown on the drawings or as furnished by the Owner.
- M. Furnish fire alarm code cards. Cards shall be red with white letters. The card stock shall be approximately 1/32" thick, smooth bright white finish on one side, matte finish on the other side, accept printing ink.
- N. Pull stations shall be mounted in pull station enclosures. If semi-flush enclosures are used, the space between the enclosure and wall shall be sealed with grout or other approved methods.

### 3.02 TESTS AND REPORTS

- A. Provide the service of a competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment to technically supervise and participate during all of the adjustments and tests for the system. Make all adjustments and tests in the presence of the Owner's Representative.
- B. When the systems have been completed and prior to the final inspection, furnish testing equipment and perform the following tests in the presence of the Owner's Representative.
  - 1. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity and insulation.
  - 2. Test the insulation on all installed cable and wiring by standard methods as recommended by the equipment manufacturer.
  - 3. Open fire alarm detector circuits to see if trouble signal actuates.
  - 4. Ground fire alarm station detector and verify response of trouble signals.
  - 5. Test the remote annunciator to see if it functions properly.

6. Check code transmission of all fire detection devices.
  7. Check installation, supervision, operation and sensitivity of smoke detectors as recommended by the manufacturer to ascertain that they will avoid false alarm signals and will function as specified.
  8. Check to see that the duct smoke detectors shut down the ventilation equipment.
  9. Perform any other tests recommended by the equipment manufacturer.
  10. Connections to Fire Department Master Box.
- C. The Contractor shall perform all electrical and mechanical tests required by the equipment manufacturer's certification form. In addition, he shall measure and adjust each of the smoke detectors to the maximum stable sensitivity setting. This must be performed with the detector at its operational location and under normal operational environmental conditions in the area. Bench settings are not acceptable. All test and report costs shall be in the Contract price. A check-out report shall be prepared by the installation technicians and submitted in triplicate, one copy of which will be registered with the equipment manufacturer. The report shall include, but not be limited to:
1. A complete list of equipment installed and wired.
  2. Indication that all equipment is properly installed and functions and conforms with these specifications.
  3. Test of individual zones as applicable.
  4. Serial numbers, locations by zone and model number for each installed detector.
  5. Voltage (sensitivity) settings for each ionization and photoelectric detector as measured in place with the HVAC system operating.
  6. Response time on thermostats and flame detectors (if used).
  7. Technician's name, certificate number and date.
- D. After completion of all the tests and adjustments listed above, the Contractor shall submit the following information to the Architect/Engineer:
1. "As-built" conduit layout diagrams including wire color code and/or tag number.
  2. Complete "as-built" wiring diagrams.
  3. Detailed catalog data on all installed system components.
  4. Copy of the test report described in Para. C above.
- E. Final tests and inspection shall be held in the presence of Architect/Engineer's representatives and to their satisfaction. The Contractor shall supply personnel and required auxiliary equipment for this test without additional cost.
- F. The completed smoke detection system shall be tested to ensure that it is operating properly. This test will consist of exposing the installed units to a standard fire test. Failure of the devices to detect the smoke within required time shall be considered a failure of the system and all detectors in that system shall be readjusted or replaced. Acceptance



of the system shall also require a demonstration of the stability of the system. This shall be adequately demonstrated if the system operates for a ninety (90) day test period without any unwarranted alarms. Should an unwarranted alarm(s) occur, the Contractor shall readjust or replace the detector(s) and begin another ninety (90) day test period. As required by the Architect/Engineer, the Contractor shall recheck the detectors using the fire test after each readjustment or replacement of detectors. This test shall not start until the Owner has obtained beneficial use of the building under test.

- G. If the requirements provided in the paragraph above are not completed within one (1) year after beginning the test described therein, the Contractor shall replace the system with another acceptable manufacturer and the process repeated until acceptance of the equipment by the Owner's Representative.

\*\*\*END OF SECTION\*\*\*