

SECTION 26 72 20 - POINT ADDRESSIBLE FIRE ALARM

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide all labor, materials, tools, and equipment required for the complete installation of work called for in the Contract Documents

1.2 DESCRIPTION OF WORK

- A. This section includes minimum requirements for the following:
 - 1. Fire Alarm Control Panel
 - 2. Fire Alarm Remote Processing Unit
 - 3. Remote Annunciator Panel
 - 4. Monitor Modules
 - 5. Control Modules
 - 6. Input Modules
 - 7. Manual Pull Stations
 - 8. Photoelectric Smoke Detectors
 - 9. Ionization Duct Smoke Detectors
 - 10. Fixed Temperature Heat Detectors
 - 11. Audible/Visual Signal Devices
 - 12. Visual Signal Devices
 - 13. Digital Communicator

1.3 QUALITY ASSURANCE

- A. All raceways shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the Owner's Representative. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based upon the acceptable manufacturers listed. Where "approved equal" is stated, equipment shall be equivalent in every way to that of the equipment specified and subject to approval.
- B. Materials specified herein shall comply with the applicable requirements of:
 - 1. The following Articles of the National Electric Code (NFPA 70)
 - a) Article 760 - Fire Alarm Systems
 - 2. The following National Fire Protection Agency (NFPA) standards:
 - a) NFPA 72 - National Fire Alarm Code
 - b) NFPA 90A - Installation of Air Conditioning and Ventilating Systems
 - c) NFPA 101 - Life Safety Code
 - 3. The following U.L. Standards:
 - a) UL 864/UOJZ,APOU - Control Units for Fire Protective Signaling

Systems

- b) UL 268 - Smoke Detectors for Fire Protective Signaling Systems
- c) UL 268A - Smoke Detectors for Duct Applications
- d) UL 521 - Heat Detectors for Fire Protective Signaling Systems
- e) UL 228 - Door Holders for Fire Protective Signaling Systems
- f) UL 464 - Audible Signaling Appliances
- g) UL 1638 - Visual Signaling Appliances
- h) UL 38 - Manually Activated Signaling Boxes
- i) UL 346 - Waterflow Indicators for Fire Protective Signaling stems
- j) UL 1481 - Power Supplies for Fire Protective Signaling Systems

1.4 SUBMITTALS

- A. Provide standard product data for all equipment indicating the type, size, rating, style, catalog number, and listing of the equipment.
- B. Provide calculations for sizing all batteries and power supplies.
- C. Provide standard wiring diagrams for all devices
- D. Provide a complete riser diagram indicating types of devices, number of initiation and signal loop circuits, class of wiring system, and type of wiring

1.5 SYSTEM DESCRIPTION

- A. Point addressable fire alarm system with manual and automatic initiation devices.
- B. System shall be supervised to continuously monitor the integrity of the circuit conductors and power supplies.
- C. Performance of the fire alarm system circuits shall be in accordance with Class B, Style B operation for Initiating Device Circuits (IDC) and Class B, Style Y operation for Notification Appliance Circuits (NAC's).
- D. The fire alarm control panel shall permit on-site programming to accommodate facility expansions, renovations, or fire alarm system modifications. All memory shall be non-volatile.
- E. The control panel shall have 24 VDC output power supplies for notification appliance circuits. System shall be capable of adding additional power supplies as required to power all notification appliances.

F. Summary Reports:

1. The Fire Alarm Control Panel shall be capable of displaying and printing summary reports. The summary reports shall include:
 - a) A list of all alarm points not in their normal state.
 - b) A list of all points in the system, including their current status.
 - c) A list of data for all control by event programs.
 - d) A list of data for all time initiated programs.

G. Alarm Priority:

1. Alarms shall be processed at three levels of priority:
 - a) Fire alarms shall have the highest priority.
 - b) Other alarms that require interaction by the attendant shall have the second level of priority.
 - c) Monitored points which do not require interaction by the attendant shall be the lowest level of priority.

H. System Access:

1. Access to the system shall be controlled by at least three levels of security to prevent programming modifications by unauthorized personnel.
 - a) The lowest level of access, shall permit the attendant to view the system display, print alarms and perform life safety control by event functions. The Attendant has minimal access to the system functions.
 - b) The mid-level access shall permit the attendant to change user programmable parameters.
 - c) The highest level of access shall permit the modification of system software. This level shall be accessed only by a qualified representative of the equipment manufacturer.

1.6 SEQUENCE OF OPERATION

- A. Upon an abnormal condition on the fire alarm system, the appropriate LED (alarm, supervisory, or trouble) shall flash. The panel audible alarm shall pulse for alarm conditions and sound steadily for trouble or supervisory conditions. All abnormal events shall be logged into the database, along with the date and time.
- B. Operation of any alarm initiating device shall cause the following to happen:
 1. Sound all alarm signals throughout the building in a temporal Code.
 2. Activate all visual strobe lights throughout the building.

3. Display the points in alarm on the LCD display at the fire alarm control panel and at all remote alarm annunciator panels and print at all system printers. The visual indication shall remain until the alarm condition is reset.
 4. Notify the UL listed central station via the dial up digital communicator.
 5. Operate alarm relay contacts to shut down all supply fans in the system. All smoke dampers shall close 30 seconds after their respective fan systems have shut down.
 6. Operate alarm relay contacts to initiate the elevator capture sequence.
 7. Operate alarm relay contacts to release all magnetically held doors throughout the building.
 8. Subsequent initiating alarms shall repeat the respective sequence of operations.
- C. Operation of any sprinkler system supervisory device shall cause the following to happen:
1. Sound a district pulsed audible alarm at the fire alarm control panel.
 2. Flash the yellow common trouble LED.
 3. Display the points in alarm on the LCD display at the fire alarm control panel and at all remote alarm annunciator panels and point at all system printers. The visual indication shall remain until the alarm condition is reset.
 4. Notify the UL listed central station via the dial up digital communicator.
 5. Subsequent supervisory alarms shall repeat the respective sequence of operations.
- D. The Fire Alarm System wiring and power supplies shall be electrically supervised and report trouble conditions to the fire alarm control panel. Any opens, shorts or grounds on the system wiring shall cause the following to happen:
1. Sound a distinct pulsed audible alarm at the fire alarm control panel.
 2. Flash the yellow common trouble LED.
 3. Display the points in alarm on the LCD display at the fire alarm control panel and at all remote alarm annunciator panels and point at all system printers. The visual indication shall remain until the alarm condition is reset.
 4. Notify the UL listed Central Station via the dial up digital communicator.
 5. Subsequent trouble alarms shall repeat the respective Sequence of Operation.

- E. Alarm Silencing:
 - 1. Pressing the "Alarm Silence" button shall cause all notification appliances to be deactivated. A yellow LED located in the fire alarm control panel shall illuminate to indicate the alarm has been silenced.

PART 2 - PRODUCTS

2.1 FIRE ALARM CONTROL PANEL

- A. Modular in construction to allow easy expandability.
- B. Enclosure:
 - 1. Surface mounted, steel with enamel finish.
 - 2. Hinged, lockable door with viewing window.
 - 3. Sized to house power supplies, batteries, and charger.
- C. Controls shall provide switches to reset, lamp test, walk test, drill, and silence alarm and trouble signals.
- D. Indicators shall include power on, system trouble, zone disabled, alarm silenced, alarm, ground fault, and indicating appliance circuit trouble.
- E. LCD Display
 - 1. Membrane construction with four line by 20 character LCD display.
 - 2. 40 characters reserved for user programmable messages.
 - 3. Four pairs of display keys for selection of event display by type (alarm, supervisory, trouble, or monitor) and forward/backward scrolling through event listing.
- F. The control panel shall be completely supervised, site programmable, and expandable to minimum 380 detectors or initiating devices. Notification appliance power supplies shall be expandable from one to four power supplies.
- G. All system memory shall be stored in non-volatile memory.
- H. The system shall utilize digital communications to supervise all addressable loop devices for placement, correct location, and proper operation.
- I. The system shall support distributed processor detectors with the following attributes:
 - 1. Automatic device mapping
 - 2. Electronic addressing
 - 3. Environmental compensation
 - 4. Pre-alarm for dirty detectors
 - 5. Automatic day/night sensitivity adjustment

- J. System circuits shall be configured as follows:
 - 1. Analog addressable circuits: Class B
 - 2. Initiating device circuits: Class B
 - 3. Notification Appliance Circuits: Class B
- K. Capable of performing a U.L. listed detector sensitivity test.
- L. The power supplies shall be high efficiency, switched mode type, and shall monitor the incoming line. Upon power outage or brownout conditions, the power supplies shall automatically switch to the batteries.
 - 1. The power supply shall provide internal power and 24 VDC for notification appliance circuits.
 - 2. All output circuits shall be power limited.
 - 3. The battery shall be sized to support the system for 4 hours, and then operate all notification appliances for 5 minutes.
- M. Acceptable Manufacturers:
 - 1. Edwards

2.2 REMOTE ANNUNCIATOR PANEL

- A. Flush mounted annunciator panel with backlit alpha-numeric display, minimum 4 lines of 20 characters each.
- B. Minimum 50 user definable messages for each annunciator.
- C. Communications between annunciators utilizing RS-485 port at minimum 19.2 kbps.
- D. RS-232 printer output at minimum 9.6 kbps.
- E. Provide with necessary flush or surface mounted backboxes.

2.3 MANUAL PULL STATIONS

- A. Semi-flush, single action, break glass type.
- B. Constructed of red lexan with raised white lettering reading "Pull For Fire".
- C. Upon activation, handle shall lock in the alarm condition. A key shall be required to reset the manual pull station. Cylinders shall be keyed to match the fire alarm control panel.
- D. Unless directly connected to a central station alarm service, municipal alarm system, or local fire alarm dispatch station, provide a clearly legible sign above each manual pull station stating "Local Alarm Only - Call Fire Department By Telephone".
- E. Provide intelligent monitor module.

2.4 PHOTOELECTRIC SMOKE SENSOR

- A. Detector shall operate on a light scattering principal. The detector shall have a photo-optic chamber with an infrared light emitting diode and a high speed light sensing photo diode. Capable of sensing visible products of combustion.
- B. Alarm conditions shall be indicated by a steady red glow from the LED mounted on the sensor.
- C. Sensor shall be microprocessor based, with electronic point addressing to indicate to the system which device is in alarm.
- D. The sensor shall be continuously monitored to measure any changes in sensitivity due to dirt, smoke or humidity. Any build up of foreign material shall cause trouble signal at the control panel indicating that maintenance is required.
- E. Sensor shall be capable of automatic device mapping and day/night sensitivity adjustment.
- F. Sensors shall be twist lock mounted to a separate base provided with screw terminals for field wiring. The detector shall be tamper resistant and shall be removable only with a special tool.
- G. Provide wire guards as shown on plans.
- H. Provide auxiliary relays and 24 VDC power for elevator capture or smoke evacuation control where indicated.

2.5 CONTROL RELAY MODULE

- A. Addressable device with a form "C" dry relay contact used to control external appliances such as door closers, fans, dampers etc.
- B. Relay contact rating:
 - 1. 24 VDC = 2amps (pilot duty)
 - 2. 120 Vac = .5 amps
- C. Polling and alarm/active status provided by on board red and green LEDs.

2.6 INPUT MODULE

- A. Addressable device used to connect 2 class B analog initiating device circuits.
- B. Input circuit wiring requirements
 - 1. Maximum allowable wire resistance - 50 ohms per circuit
 - 2. Maximum allowable wire capacitance - .1uF per circuit
- C. Polling and alarm/active status provided by on board red and green LEDs.

2.7 FIXED TEMPERATURE THERMAL DETECTOR

- A. Self-restoring thermal detector.

- B. Rated at 135°F fixed temperature.

2.8 CARBON MONOXIDE GAS DETECTOR

- A. Provide ceiling mounted combustible gas detectors as shown on plans.
- B. Activation of a CO detector shall cause a supervisory signal on the fire alarm control panel. System shall report to monitoring station as a supervisory signal per NFPA 720 requirements.
- C. Provide with local audible base with a Temporal 4 pattern.
- D. Detector shall be UL Listed.
- E. Provide monitor module for each CO detector. Addressable CO detectors would be acceptable.

2.9 DUCT TYPE SMOKE DETECTORS

- A. Smoke detector shall be solid state, unipolar type with dual chamber construction and operate on the ionization principle.
- B. Capable of detecting both visible and non-visible products of combustion.
- C. Self-compensating circuitry to provide stability against aging and dust.
- D. Field adjustable sensitivity, pre-set in the factory.
- E. Enclosure suitable for mounting on an air duct, with a sampling tube that extends into the duct air stream.
- F. Suitable for installation within an air-duct system with air velocities from 300-4,000 feet per minute.
- G. Provide a remote LED alarm and key operated test switch for each duct smoke detector. Install remote test switches in visible and accessible locations adjacent each duct smoke detector.

2.10 VISUAL SIGNAL DEVICE

- A. Provide backbox for recessed installations except for installations on existing walls.
- B. 24 VDC.
- C. Visual strobe shall have the following characteristics:
 - 1. ADA compliant.
 - 2. White light output of 75 candela.
 - 3. Flash rate from 1 Hz to 3 Hz.
 - 4. Pulse duration of 0.2 seconds.
 - 5. Reflector and lexan lens with the word "Fire" imprinted.

2.11 AUDIO-VISUAL SIGNAL DEVICE

- A. Provide backbox for recessed installations except for installations on existing walls.
- B. 24 VDC.
- C. Horn shall be rated for 93 dB at 10'.
- D. Visual strobe shall have the following characteristics:
 - 1. ADA compliant.
 - 2. White light output of 75 candela.
 - 3. Flash rate from 1 Hz to 3 Hz.
 - 4. Pulse duration of 0.2 seconds.
 - 5. Reflector and lexan lens with the word "Fire" imprinted.

2.12 MAGNETIC DOOR HOLDERS

- A. Magnetic door holders shall be furnished and installed as part of the hardware specifications.
- B. Electrical Contractor shall connect all magnetic door holders.

2.13 DIGITAL COMMUNICATOR

- A. Dual telephone line interface, electronically supervised.
- B. Reports in six major communication formats including SK4/2, SK FSK1, BFSK14/BFSK23, SiA8, SIA20, SK3/1, and SESCOA 3/1.
- C. Auxiliary relay, programmable to indicate trouble or alarm.
- D. Automatic 24 hour test.
- E. Provide all required programming required to communicate with the central station chosen by the Owner.

2.14 BATTERIES AND CHARGER

- A. Provide battery and charger to provide 24 VDC standby power for the fire alarm system.
- B. Provide lead-calcium maintenance free batteries. Size batteries to permit 60 hours under supervisory condition, and then sound all alarms for 5 minutes.
- C. Cell reversal protection.
- D. 10 year minimum life expectancy.
- E. Battery charger shall be self-regulating, solid state type, capable of full charging a depleted battery within five hours.
- F. Install battery charger within the fire alarm control panel.
- G. Install batteries with fire alarm control panel or in a vented enclosure located

adjacent to the fire alarm control panel.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

1. During installation and testing, and prior to the system being put into service, all manual stations shall be appropriately marked "NOT IN SERVICE" by the Contractor.
2. The 120 volt, 60 cycle AC required to power the system and the remote terminal unit (STU) shall be connected at the location specified by the Project Manager.
3. Wiring to all initiation and signal circuits shall be two wire class B. A fault on a circuit loop shall cause a trouble alarm to initiate for its associated zone at the fire alarm control panel.
4. All wiring shall conform to N.E.C. Articles 725 and 760, and to NFPA-72, "National Fire Alarm Code".
5. Detection and initiating equipment shall be listed by UL or approved by FM.
6. All surface mounted devices shall be mounted on a special box furnished by fire alarm equipment manufacturer. Total assembly shall be secure, smooth contour and have no protrusions.
7. Where detectors are installed on wood or masonry surfaces, attach brackets directly to the surface with tamperproof fasteners. Where detectors are installed on suspended ceilings, provide additional supports in the ceiling, such as channel support system, angle iron or additional runner bars. Fasten the additional supports rigidly to the ceiling runner bar system. Attach bracket to the supports with tamperproof fasteners. Install metal spacers between the bracket and supports so that the ceiling tiles will not be a part of the support system.
8. Mount FACP and all sub panels at working height.

B. Audible/Visible Device Installation:

1. Field verify audible alarm type in existing building and provide to match.
2. Devices shall be installed at eighty inches (80") minimum above the floor, or six inches (6") below the ceiling, whichever is lower, in accordance with ADA guidelines.

3. Audible devices intended for operation in public spaces shall have a sound level of not less than seventy-five (75) dBA at ten feet (10'), nor more than 110 dBA at the minimum hearing distance from the device.
4. Audible devices intended for operation in private spaces shall have a sound level of not less than forty-five (45) dBA at ten feet (10'), nor more than 110 dBA at the minimum hearing distance from the device.
5. All audible emergency alarm signals shall be at least 15 dbA over the existing sound level within a space or shall exceed the maximum sound level by 5 dbA for at least 60 seconds, whichever is louder. Within areas occupied by persons with hearing impairments, audible emergency alarms must have the intensity and frequency to provide notification of an alarm condition.

C. Wiring:

1. Wiring shall be in accordance with National Electric Code
2. All exposed wiring shall be installed in conduit or surface raceway. Existing conduit if acceptable may be used. Fire rated cabling may be run above accessible ceilings. Cable in mechanical rooms, crawl spaces and exterior shall be run in conduit.
3. All wiring not in conduits shall be plenum rated and fire rated and installed in a separate bridge ring raceway system, located on 4' centers.
4. Underground conduit shall be Schedule 40, PVC at twenty-four (24) inches, minimum, below grade. Risers from underground conduits to exterior devices shall be rigid steel. Underground conduits shall be 3/4 inch trade size, minimum. A separate ground wire shall be pulled and properly terminated when PVC conduit is used.
5. Conduit to PIV's and backflow preventers shall be run in sprinkler supply piping trench. Work shall be coordinated with fire sprinkler subcontractor.
6. Wire and cable shall be #14 AWG size, solid copper, THHN/TWN for horns, manual stations, smoke or heat detectors, waterflow switches, valve supervisory switches and other initiating and indicating devices. Communication loop wiring shall be shielded in accordance with the Manufacturer's recommendations
7. Wiring shall be continuous from device to device. Splicing shall be accomplished by use of terminal blocks in locked cabinets keyed alike with the fire alarm control unit, or junction boxes. No connections or splices shall be made underground.
8. Control cabinets shall not be used as pull boxes or raceways. Wiring gutters and locked terminal cabinets shall be used.
9. The Fire Alarm System wiring shall be installed in a workmanlike manner, subject to the approval of the project manager

10. All harnessing of wires shall be accomplished by use of approved nylon tie wraps.
11. All wiring shall be numbered and color coded in accordance with this Specification.
12. Tests of all wiring shall be conducted for proper connection, continuity, and resistance to ground. The minimum allowable resistance between any two conductors or between conductors and ground is one (1) megohm as checked by a "megger" after all conduit, conductors, detector bases, etc. have been installed, but before the detector devices are plugged into the base or end-of-line devices installed.

D. Routing:

1. All fire alarm system conduits shall be provided either parallel or perpendicular to building structural members.
2. All fire alarm system conduits shall be provided at a height so as not to obstruct any portion of a window, doorway, stairway, or a passageway, and shall not interfere with the operation of any existing mechanical or electrical equipment.
3. All fire alarm system conduits and cable shall be routed to minimize the potential for physical damage, either mechanical or by fire.
4. All fire alarm system junction boxes, pull boxes, terminal cabinets, control enclosures and device backboxes shall be readily accessible for testing, service and maintenance.

E. Wall, Floor and Ceiling Penetrations:

1. All conduit penetrations of walls shall be provided with escutcheon plates on either side of the wall.
2. All conduit penetrations of walls, floors, and ceiling shall be sealed around the conduits, restoring the walls, floors and ceilings to their original condition, fire resistance and integrity.

F. Concealment:

1. Conduit shall be concealed except where shown on the drawings.
2. All conduit, raceways, junction boxes, panels, electrical enclosures, relays and device backboxes shall be concealed in ceiling spaces, electrical shafts or closets in all finished areas.
3. Conduit, raceways, junction boxes, panels, electrical enclosures, relays and device backboxes may be exposed in unfinished areas.
4. All fire alarm system components, including devices, junction boxes, electrical enclosures, relays and device backboxes shall be provided so as to be readily accessible for inspection, testing, service and maintenance.

G. Terminations:

1. All fire alarm conductor terminations shall be on numbered terminals or terminal strips. All fire alarm conductor terminations shall be within junction boxes, device backboxes, terminal cabinets, control panels or other suitable metal enclosures. Terminals and terminal strips shall be suitable for the size and number of conductors connected to them.
2. All connections and end-of-line devices shall be accessible for inspection, testing and servicing.
3. Terminations to terminals other than barrier/pressure plate type terminals shall use crimp-on ring-type or Y-type spade connectors
4. Splices shall be permitted only when routing of existing conductors prohibits point-to-point terminations in existing junction boxes, terminal cabinets, etc. All such splices shall be provided with new terminal strips with proper labeling in junction boxes, terminal cabinets, etc.

H. Control Panel Location and Wiring:

1. Install annunciator panel in the main lobby/F.D. Point of Entry if the control panel is located in an area other than the main lobby/F.D. Point of Entry.
2. All control panel wiring shall be fully dressed and bundled with nylon tie wraps. Bundled wiring shall be routed parallel to terminal strips within control panels, with individual conductors turned out at 90 degree angles to their associated terminal connections. AC power conductors shall be bundled and routed separately from low voltage conductors. A minimum 2-inch separation shall be maintained between AC power conductors and low voltage conductors wherever possible. All control cabinets shall be sized to accommodate the requirements of this section.
3. Each conductor terminating within a control panel shall be uniquely numbered with durable plastic tags or uniquely identifiable by a combination of numbers and color codes. These conductor numbers shall be shown on the record (As-Built) drawings in a manner allowing ready identification of any field wiring conductor in any control panel.

I. Mounting and Labeling of Devices:

1. All fire alarm devices shall be rigidly mounted, using appropriate backboxes, to building structural members, permanent walls, ceilings or fixtures designed for the purpose.
2. All devices shall be labeled with device address or device count as appropriate. Label shall be sticky back type attached to base of device. Label identification shall be consistent with As-Built drawings.

J. Color Coding and Wire Numbering:

1. All conductors entering and leaving terminal cabinets and junction boxes shall be numbered in a logical and consecutive manner.

2. All conductors shall be color coded. Color coding shall be by wire insulation, not taping or banding. The numbering and color coding shall be continuous for each circuit wire.
3. Wires shall be numbered at each connection, termination, and junction point. Wire numbering tags shall be Brady Perma-Code, Westline, or equal.
4. Color coding shall be as follows:

CIRCUITS	COLOR CODES
Alarm Initiating Circuits	Blue and Brown
Alarm Initiating Circuits	Blue and Brown
Horns, 24VDC	Yellow(+) and Black
Storobes, 24VDC	White (+) and Purple
System AC Power	Black and White
Sprinkler Horn	Black and White
Valve Supervision	Orange and Yellow
DC Power	Red(+) and Black

3.2 TESTING

A. General:

1. After complete installation of the equipment and submittal of as-built drawings, the Contractor shall perform complete tests of the system. After these tests have been completed, the Contractor shall request final acceptance inspection and tests in the presence of the Project Manager and local authority. Coordination of final acceptance test date and times with those to be present is the responsibility of the Contractor. The Contractor shall demonstrate that all conditions of the plans and specifications have been met. The tests shall include proper operation of all devices and testing of supervised circuits. The installation will be checked against the as-built drawings. The Contractor shall furnish all testing materials and instruments. A punch list will be developed and the Contractor shall correct punch list items. There will be a reinspection of punch list items. If additional reinspections are found necessary to assure compliance with the Contract, they shall be made at the Contractor's expense.
 - a. The Contractor shall provide, at no additional cost to the Contract price, the following services by the Manufacturer's representative:
 - (1) Prior to the final inspection, "pre-test" the entire fire alarm system to assure that all new equipment is properly installed and functions in accordance with plans and specifications.
 - (2) The Manufacturer's representative shall certify that the entire new and existing installation was tested and performed satisfactorily.
2. Final acceptance tests shall be coordinated by the contractor and performed in the presence of the owners representative as follows:

- a. Operation of the fire alarm control panel and indicating components in accordance with factory recommended procedures.
- b. Operational tests of all devices (i.e., detector, waterflow indicator, manual pull box, and valve supervisory device) in accordance with the factory recommended procedures.
- c. Audible/visible testing of all indicating appliances. Tests shall include sound level (dBa) and light intensity (lumens).
- d. Checks of each initiating circuit or device address for correct indications at the control unit, and any remote annunciator.
- e. Operation of the S.T.U. including receipt of the appropriate zoned signal at the Palo Alto Communications Center.
- e. A checkout report shall be prepared by the contractor and submitted to the Project Manager. The checkout report shall include a listing of detector sensitivity for each detector. The report shall summarize the results of all tests and shall serve as the contractor's certification that the system is properly installed and fully functioning.

3.3 INSTALLED SPARE PARTS

- A. Provide the following installed spares per building. Installed spare includes the device, backbox, wiring, programming and up to 50 feet of surface raceway.
 - a. (5) smoke detectors, (2) heat detectors, (7) strobes, (5) A/V devices, (5) pullstations, (4) additional Zone addressable modules and associated tie-ins and (4) duct smoke detectors and Fan shutdown tie-ins.
 - b. Turn over all unused spare to owner for spare parts.

3.4 WARRANTY AND INSTRUCTION

- A. The complete fire protection system shall be fully tested and guaranteed for a period of one year after Owner's Representative written acceptance.
- B. Provide a minimum of 4 hours of instruction to the operating personnel designated by the Owner's Representative with regard to use and operation of the system. Content of the training shall include:
 - 1. Overview of system operations.
 - 2. Overview of system equipment and device locations.
 - 3. Detailed operation guidelines.
 - 4. Periodic maintenance procedures.
 - 5. Periodic testing procedures.
- C. Provide 3 sets of keys to all panels, manual stations, etc., to the Owner's Representative.

- D. Prior to request for final payment submit a quantity of bound Operator Manuals that shall include as a minimum:
1. Shop drawings
 2. Bill of Material.
 3. Manufacturer's equipment description for each piece of equipment, each device and each initiation and control module type used.
 4. Record Drawings for fire alarm wiring diagrams showing typical connection diagrams for each type of device and a complete riser diagram showing all devices, zones, and wiring requirements. Record Drawings for fire alarm wiring diagram shall show all terminal connections at all panels.
 5. Instruction report stating when instruction was given and who was in attendance, signed by the Owner's Representative.
 6. Submit a written test report from an authorized representative of the equipment manufacturer that each device and overall system operation has been 100% tested and approved.
 7. Certificate of Completion as described in NFPA-72.

END OF SECTION