

# OFPC Standard Specification

## DIVISION 28

### FIRE ALARM AND SMOKE DETECTION SYSTEM

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*The issuance and revision history of this section is tabulated below. Please destroy any previous copy in your possession*

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## DIVISION 28

### FIRE ALARM AND SMOKE DETECTION SYSTEM

#### PART 1 GENERAL

##### 1.1 WORK INCLUDED

- A. This section specifies the requirements for furnishing and commissioning a fully functional addressable fire alarm and voice evacuation system with full interface with other related systems. Work shall include, but not limited to, the following.
1. Fire alarm control and annunciator panels
  2. Manual fire alarm stations
  3. Automatic fire, smoke, and heat detection devices
  4. Audible and visual alarm notification devices
  5. Required batteries, battery panels, and associated accessories
  6. Fire door control, security door control
  7. Air handler duct smoke detection, and shutdown
  8. Sprinkler system PIVs, OS&Y valves, and tamper switch monitoring
  9. Sprinkler systems water flow and/or pressure switch monitoring
  10. Monitoring of fire pump controls
  11. Fire/smoke damper control
  12. Activation of "Passive smoke removal system"

13. Activation of deluge and pre-action sprinkler systems

14. Elevator recall and power shutdown

15. System acceptance testing and commissioning

## 1.2 REFERENCES

A. NFPA 101 - Safety to Life from Fire in Buildings and Structures

B. NFPA 13 - Installation of Sprinkler Systems

C. NFPA 20 – Installation of Stationary Pumps

D. NFPA 70 - National Electric Code

E. NFPA 72 - National Fire Alarm Code

F. NFPA 90A – Installation of Air-Conditioning and Ventilating Systems

G. NFPA 92A – Smoke- Control Systems

H. UL 864 - Control Units for Fire Protective Signaling Systems

I. ADA Accessibility Guidelines (ADAAG)

J. Texas State Insurance Code

K. Texas Accessibility Standards (TAS)

L. International Building Code

M. All electronic equipment shall comply with all FCC limits governing radio frequency electromagnetic interference and be so labeled.

N. None of the terms or provisions of this specification shall be constructed as waiving any of the rules, regulations or requirements of Codes.

## 1.3 SYSTEM DESCRIPTION

A. The automatic fire detection and alarm system shall consist of a main fire alarm control panel with Integrated audio control panel, remote annunciator, detection devices, audible and visual notification devices, remote devices, and manual stations wired in accordance with the schedule on the Drawings and shall function as specified herein. The system shall use supervised multiplex data communications circuits, close loop initiation circuits, individual zone supervision, and individual audible and visual alarm circuit supervision. The main Fire Alarm Control panel shall be a new Simplex 4100U network node.

B. The system shall have sufficient capacity to incorporate all equipment and perform all functions as per intent of the specifications and Drawings. The system shall have an overall 20 percent spare capacity that includes but not limited to communication network, terminal strips, amplifier, batteries, etc., reserved for future expansion.

- C. The system shall be capable of being programmed on site for downloading, uploading or editing operating sequence or programming to accommodate and facilitate building parameter changes or changes as required by codes.
- D. A data communications network transmitting multiplexed input and output signals, which shall be electronically supervised, shall connect all control panel nodes. The communication network shall consist of a communication cable transmitting all system operations in a digitally encoded format, an audible signaling bus serving all remote amplifiers.
- E. The system shall be designed such that alarm indications override trouble conditions. There shall be no limit, other than maximum system capacity, as to the number of addressable devices and/or zones, which may be in alarm simultaneously. The panel shall be capable of measuring the sensitivity of the addressable ionization and photoelectric detectors connected to it.
- F. The system shall initiate the following system outputs when any area or duct detector, manual station, or water flow switch operates in accordance with the fire alarm functional matrix: (Final Fire Alarm functional matrix shall be coordinated with UTD and OFPC during commissioning meetings prior to final system programming.)
  - 1. Audible devices - speakers.
  - 2. Visual devices – strobes
  - 3. Automatically transmit all activity to the Simplex IMS at Campus Dispatch via existing fire alarm fiber optic network deployed campus wide.
  - 4. Display individual detector and/or zone number on alphanumeric display with optional user-defined message.
  - 5. Light an indicating lamp on the device initiating the alarm.
  - 6. Shut down the associated HVAC system and operate dampers per drawing.
  - 7. Activate the elevator recall.
  - 8. Release all magnetic fire door holders.
- G. The fire alarm and smoke detection system shall be used to monitor tamper switches and water flow switches on sprinkler and fire suppression systems.
- H. Fire alarm and smoke detection system shall release fire doors that are held open and security access controlled doors that are held close if desired.
- I. Fire pumps shall be monitored by the fire alarm and smoke detection system.

- J. Fire alarm and smoke detection system shall include the provision of duct-mounted smoke detectors. Duct mounted smoke detectors shall be mounted by the HVAC contractor and fire alarm interface wired by the Fire Alarm Contractor. Interface with HVAC damper control, and air-handler shutdown shall be provided by the HVAC contractor.
- K. System shall be compatible with the existing Simplex 4120 network and IMS. New FACP shall be a 4100U network node with voice modem (slave)

#### 1.4 QUALITY ASSURANCE

- A. The system shall be installed by competent mechanics, regularly employed by a Fire Alarm contractor with full responsibility for proper operation of the system including debugging and proper calibration of each component in the entire system. The Contractor shall be with 3 years or more experience with installation of this type. The fire alarm technician shall be licensed by State Fire Marshal in order to install, certify and service the fire alarm system. Supplier shall be licensed by State Fire Marshal in order to sell fire alarm product, and shall have an in-place support facility within 50 miles of the site with technical staff, spare parts inventory and all necessary test and diagnostic equipment.
- B. The complete Fire Alarm and Smoke Detection System installation shall be in strict accordance to the national and local electrical codes and the electrical section of these specifications. The equipment shall be manufactured by a manufacturer who has been engaged in this type of production (both hardware and software) for at least ten years. The product shall be UL listed under standards 864 (Control Units for Fire Protective Signaling Systems).

#### 1.5 SUBMITTALS

- A. Provide submittals for the following information in addition to and in accordance with
- B. Complete plan drawings showing all devices, panels, and conduit runs.
- C. Project specific system interconnection (riser) diagrams. (System architecture.)
- D. Dimensional drawings/manufacturer's specification data for each component.
- E. Complete elementary and/or schematic drawings for all Fire Alarm System electrical and electronic circuits.
- F. Typical component connection and interconnection diagrams.
- G. Complete system wiring diagrams for all components and interfaces to equipment supplied by others.
- H. Complete sequence of operations of all functions of the system. A fire alarm typical input/output functional matrix clearly defining fire alarm event and action, which is recommended by NFPA 72 A.10.6.2.3 (9), shall be submitted to the Owner for review and approval.
- I. Detailed color conventions proposed for all graphics and graphic elements and states.

- J. Manufacturer's Representatives. The Contractor shall submit a listing of the manufacturer's representatives responsible for installation coordination and service.

## 1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver fire alarm system components in factory-fabricated containers.
- B. Store in a clean, dry space and protected from the weather.
- C. Handle control and annunciator panels carefully to avoid damage to material components, enclosure and finish.

## PART 2 - PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

- A. Provide a UL listed point addressable multiplex fire alarm control system. Acceptable supplier is Simplex. NO SUBSTITUTIONS. Contact David Harbison with SimplexGrinnell (972-587-5287, [dharbison@simplexgrinnell.com](mailto:dharbison@simplexgrinnell.com)) for information.

### 2.2 FIRE COMMAND CENTER OPERATOR WORKSTATION

### 2.3 FIRE ALARM CONTROL PANELS

- A. Control panel enclosure shall consist of a floor-standing or surface-mounted back-box, hinged door, keyed lock, and Back-box shall be sized to accommodate batteries, battery charger, power supply, control panel, indicating, initiating, communications, relays, and switch modules.
- B. The control panel power connections (whether ac or dc) shall be separately fused within the control panel. The system power supply shall be provided with an integral uninterruptible power source (UPS). This UPS shall provide continuous power to the system in the event of a commercial power failure. Transfer from commercial power shall be instantaneous to ensure proper processor operation and indicated by flashing the system power long-life light-emitting diode (LED).
  - 1. Loss of commercial power shall be annunciated as a system trouble. System trouble shall be indicated for over-voltage or under-voltage conditions, blown fuses, or disconnected batteries.
  - 2. 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.

3. A dual-rate battery charger shall be provided, which is capable of recharging the batteries to 80 percent capacity in 12 hours.

4. Batteries shall be sized to provide 24 hours of standby operation followed by 15 minutes of alarm.

C. The control panel shall be modular with solid-state electronics and microprocessor. The control panel shall provide power, annunciation, supervision, and control for the detection and alarm system. The system shall be capable of reading and displaying at the control panel the sensitivity of remote addressable ionization and photoelectric detection devices. The detection system shall remain 100 percent 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.

1. The control panel shall be capable of supporting addressable detection devices.

2. The panel annunciator shall be an alphanumeric display, which shall provide an user-definable message associated with each detection device or zone.

3. 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 alphanumeric annunciator.

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.

4. Ground fault detection shall be provided for all initiating and audible circuits. Lamp test capability shall be provided to test all visual panel indicators and associated software.

5. The system alarm lamp shall flash and an integral trouble buzzer shall sound upon receipt of any alarm condition. Acknowledgment 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 alarm buzzer to resound and the alarm lamp to flash.

6. The system trouble lamp shall flash and an integral trouble buzzer shall sound upon the occurrence of any trouble condition. Acknowledgment 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.

7. 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. The panel shall be capable of receiving and processing alarms even when in the service mode.

8. The control panel shall report, by specific device number, any device removed from an addressable initiating circuit, and all other devices shall continue to function.
9. The control panel shall have the ability to support an optional printer terminal.
10. 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 and devices cleared.
11. Each panel shall have the following capacity:
  - a. Points 2000 addressable analog point capacity.
  - b. Amplification: 100 watts, 70.7 VRMS, distributed, with one 100-watt backup amplifier every three amplifier.
  - c. Audio Channels: two.
  - d. Power Supply: 20 amps, 24 Vdc.
  - e. Battery Backup: Per Section 2.3.B.4 of this specification. Minimum 50 ampere-hour
  - f. Mounting: NEMA 12 wall- or floor-mounted enclosure.
  - g. System Power: 120 Vac, 60 Hz, and single phase.

The following primary controls shall be visible through a front control panel.

- a. 80-character liquid crystal display.
- b. Individual red fire alarm LED.
- c. Individual red priority 2 alarms LED.
- d. Individual yellow supervisory service LED.
- e. Individual yellow trouble LED.
- f. Green “power on” LED.
- g. Yellow signals silenced LED.
- h. Fire alarm acknowledge key.
- i. Priority 2 alarm acknowledge key.
- j. Supervisory service acknowledge key.

- k. Trouble acknowledge key.
- l. Alarm silence key.
- m. System reset key.
- n. Speaker circuit selection switches with LEDs.
- o. Master audio control microphone.

13. The following functions shall be provided by operating the front control panel.

- a. LED testing.
- b. Alarm, trouble, and abnormal condition listing.
- c. Enabling and disabling of each monitor point separately.
- d. Activation and deactivation of each control point separately.
- e. One-person test enable.
- f. Running self-diagnostic.
- g. Display historic logs.
- h. Point listing.

14. Scrolling through menu options or lists shall be accomplished in a self-directing manner in which prompting messages shall direct the user. These controls shall be located behind an access door.

Under normal conditions the front display panel shall display a “System Normal” message and the current time and date. Should an abnormal condition be detected the appropriate LED (Alarm, Supervisory or Trouble) shall flash.

The unit audible signal shall pulse for alarm conditions and sound steady for supervisory and trouble conditions. The LCD shall display the following information relative to the abnormal condition of a point in the system.

- a. 40 character custom location label
- b. Type of device (i.e., smoke, pull station, water flow)
- c. Point status (i.e., alarm, trouble)

D. Fire alarm audio control panel shall provide complete voice annunciation control of the fire alarm system. Panel shall include ability to select paging zone by area or all call.

Panel shall support both live paging and prerecorded digital messages. Panel shall be integral to main fire alarm control panel  
Performance:

1. Audio Channels: one simultaneous 70.7 VRMS channels, minimum.
2. Audio Levels: As required by NFPA 72
3. Digital Message : Shall be standard UTD custom message.
4. Preamp Supervision and Automatic Changeover: yes.
5. Amplification: supports 10 distributed- or central bank amplifiers.
6. Backup Amplification: supports four backup amplifiers.
7. Degrade Mode: degrade mode reverts to tone generation.
8. Mounting: NEMA 12 wall- or floor-mounted enclosure.
9. System Power: 120 Vac, 60 Hz, single phase.
10. Shall have the capability of receiving remote live and pre-recorded messages over existing UTD Fiber Audio infrastructure. Included as part of this project shall be the provision of a dedicated switch on the

E. Initiating circuit modules shall maintain complete reporting of device status while in trouble due to any addressable device having its active transmitting component fail, open, or shorted. The initiating circuit modules shall detect a line break and provide information to the control panel, allowing the user to determine between which two devices the break has occurred.

F. Detection line circuit monitoring shall be provided by a zone input module. Each circuit shall be capable of Class A or B wiring. With Class B wiring, a capacitive end-of-line device shall be required. Each zone shall accommodate up to 96 ionization or photoelectric detectors, or 96 flame detectors, as well as any quantity of shorting-type contact devices. Upon actuation of any detector or device installed on a zone circuit, that particular zone shall lock into alarm and the zone identification and location shall be annunciated at the control unit. Zone troubles, such as opens, shall be annunciated at the control unit giving zone identification and trouble description. Alarm information and transmission shall have priority over trouble.

G. An output circuit indicating operation of dc audible devices, leased line or city tie shall be provided by an indicating module. Upon command by the control unit the output circuits will respond as configured. Leased line or city circuits shall be limited energy outputs. All signal circuits shall require and be fitted with an appropriate end-of-line resistor (EOLR). Each circuit shall be fused separately. The module shall be supervised by the 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.

- H. For control of air-handling units, elevators, and beacon lights, relay modules shall be provided. The module shall be system interconnected and shall be operable by the control unit or manually. It shall contain eight independent relays, fitted with Form C contacts, rated at 120 Vac, 10 amps, minimum, inductive.

## 2.4 PERIPHERAL DEVICES

- A. All detection devices shall contain an integral alarm LED. All addressable detectors shall be individually identifiable by zone. Mounting bases shall be provided by life safety contractor, included with detector as a complete assembly.
- B. The addressable ionization detector shall be a plug-in, twist/lock unit, which shall be capable of removal from or installation into its base with one hand.
  - 1. 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 product of combustion to enter while preventing foreign matter from entering and causing unwanted alarms.
  - 2. The 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 either internal and external operation conditions or malfunctions.
- C. The addressable photoelectric smoke detector shall contain an LED as its light source and photodiode 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. The 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.
- D. The addressable thermal detector shall be of the rate-compensated, fixed-temperature type. The detector shall be individually annunciated on the control panel. The detectors shall contain an integral alarm lamp.
- E. The addressable programmable interface module is designed to provide an interface for direct-shortening contact devices. The unit is used with water flow switches, pressure switches, tamper switches on OS&Y valves, and other contact closure devices. The unit shall electrically supervise wiring to contacts via EOLR provided by life safety contractor.
- F. The addressable manual pull station shall operate on any addressable detection circuit. The addressable manual pull station shall be individually annunciated on the control panel. The unit shall be double-action initiated, having latching relays.

- G. The air duct smoke detector shall operate on a cross-sectional air-sampling principle to overcome stratification and skin effect. The air duct detector shall consist of a standard addressable 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 photoelectric detector, and be installed in the ventilating duct as indicated in the manufacturer's instructions. The air duct smoke detector shall come with appropriate addressable detector and base, remote test station, and inlet sampling tubes.
- H. The detector mounting base shall be of the twist/lock type with screw terminals. Pigtailed or in-line connectors shall not be permitted. It shall be possible to secure the detector in the base. The detector mounting base shall be universal for addressable photoelectric detectors.
- I. Alarm bells shall be of the polarized 24-Vdc type. The mechanisms shall be fully enclosed and dust-proof. They shall be designed to be mounted on a wall, ceiling, or other suitable rigid surface that is free from vibration.
- J. Alarm 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. They shall be designed to be mounted on a wall, ceiling, or other suitable rigid surface and capable of being surface, semi flush, or flush mounted.
- K. Alarm speakers (non-ceiling mounted) shall be of the polarized 24-Vdc type. The speaker shall have 70.7 VRMS inputs and have field-selectable power taps from 1/4 watt to 2 watts. Speaker shall have frequency response of 400 to 4,000 Hz and be UL listed for fire alarm voice evacuation use. Shall be White in color. Speakers shall be designed to be mounted on a wall or other suitable rigid surface and shall be capable of being surface, semi flush, or flush mounted.
- L. Alarm speakers (ceiling mounted) shall be of the polarized 24-Vdc type. The speaker shall have 70.7 VRMS inputs and have field selectable power taps from 1/4 watt to 2 watts. Speaker shall have frequency response of 400 to 4,000 Hz and be UL listed for fire alarm voice evacuation use. Speaker shall have 4-inch cone and shall have 7.25-inch-diameter circular metal faceplate with white enamel finish. Speakers shall be designed to be mounted on a wall, ceiling, or other suitable rigid surface and be capable of being flush mounted.
- M. Strobe lights shall produce a minimum of 15 candelas at approximately one flash per second with continuously applied voltage. The maximum pulse duration shall be 0.2 seconds with a maximum duty cycle of 40 percent. Rated voltage shall range from 18 to 31.2 volts for nominal 24-Vdc models. The xenon flash tube and associated circuitry shall be enclosed in a translucent white polycarbonate lens with "fire" inscribed on the lens. Plate color shall be white.
- N. Water flow switches: Flow switches shall be UL listed for its intended purpose; furnished under Division 23 and electrically connected under Division 28. Individual addressable modules shall be provided on each switch.

- O. Sprinkler Valve Tamper Switches: Switch shall be provided with either one or two sets of SPDT micro switches as required. Tamper switch shall be UL listed for its intended purpose, furnished under Division 23 and electrically connected by Division 28. Individual addressable modules shall be provided on each switch.

## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. Contractor shall examine the areas and conditions under which the fire alarm system is to be installed and notify the Contractor in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed until unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

Installation of fire alarm devices, field wiring and control panels shall be by this division (28). Installation of all conduit, backboxes, 120 vac circuits and other required raceways or provisions shall be by Division 26.

- A. Install system and materials in accordance with the manufacturer's written instructions, drawing set, and details, the applicable requirements of the NEC and NFPA 72, and specifications in Division 16.
- B. Junction boxes used as back boxes for fire alarm system field devices shall be 4-inch square with 2 1/8-inch minimums in depth. Install adapter plates and extension rings where required. Junction boxes for concealed conduit system shall be flush mounted.
- C. Mount outlet box for electric door holder to withstand 80-pound-pulling force.
- D. Smoke detectors are to be installed after the building has been final cleaned and the jobsite is clear of all construction debris and or work that would allow dirt/dust into the building. Upon initial installation, all fire alarm detection devices shall have the original plastic dust covers installed. Dust covers shall not be removed until installation is completed and the system is ready for test.
- E. Each conductor shall be identified as shown on the shop drawings by attaching permanent alphanumeric wire markers within 2 inches of the wire termination at both ends. Marker legends shall be visible. Junction box and pull box covers shall be painted yellow or have embossed adhesive tape labeling that is minimum 1/4-inch white letters over a yellow background with text "Fire Alarm". Install end-of-line device in box with text "End-of-Line" or "EOL". Number-code or color-code conductors, appropriately and permanently for identification and servicing of system.

- F. Splices shall only be made on terminal strips. All fire alarm wiring shall be installed in raceways as per drawing. All external wiring shall be color-coded and shall not be installed in the same outlet box, junction box, or conduit with conductors of lighting or power systems.
- G. Locate and install the detector assembly for optimum response time and easy accessibility.
- H. All Devices shall be labeled with its unique system address. Use permanent, printed label with black font on white background.

### 3.3 TESTING

- A. The entire fire alarm system shall be field tested in accordance with NFPA standards and other applicable standards in the presence of the Construction Inspector. Inspection and test method shall be in compliance with NFPA 72. Inspection and test record forms that are recommended by NFPA 72 shall be utilized. Results of such testing shall be recorded on forms approved for the purpose, certified and submitted to the Construction Inspector prior to final acceptance.
- B. All test equipment; instruments, tools, and labor that required conducting the system tests shall be provided by the Contractor. The following equipment, but not limited to, shall be a minimum for conducting such tests.
  - 1. Ladders and scaffolds as required for access all field devices.
  - 2. Multi-meter for reading voltage, current and resistance.
  - 3. Intelligent device programmer/tester.
  - 4. Laptop computer with programming software for any required program revisions.
  - 5. Two-way radios, flashlights, smoke generation devices and supplies.
  - 6. Decibel meter.
- C. Perform all electrical and mechanical tests required by the equipment manufacturer's certification form. In addition, measure and adjust each of the ionization detectors to the maximum stable sensitivity setting. This must be performed with the detector at its operational environmental conditions in the area. Bench settings are not acceptable. All test and report costs shall be in the contract price. A checkout report shall be prepared by the installation technicians and submitted in triplicate, of which one copy 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 to these Specifications.
  - 3. Serial numbers, locations by zone and model number for each installed detector. All intelligent devices shall be tested and logged for correct address and sensitivity using test equipment specifically designed for that purpose.

Sensitivity settings for each ionization and photoelectric detector as measured in place with the HVAC system operating.

4. Wiring runs shall be tested for continuity, short circuits and ground before system is energized.
5. Test of individual zones as applicable.
6. HVAC Contractor shall provide cfm readings at each duct detector with HVAC system operating.
7. HVAC shutdown response upon smoke detection.
8. Water flow alarm response upon water flow or tamper switch activation.
9. Elevator recall, alternate floor recall, and power shutdown response.
10. Technician's name, certificate number, and date.

#### D. Final Acceptance Test (FAT)

1. The FAT shall be conducted in the presence of the Owner and under the supervision of the Manufacturer. Prior to FAT, the Owner shall be provided drawings showing the correct address for all addressable alarm initiation devices. The address

shall be shown in their respective locations for the device on drawings. Signals shall be sequentially numbered as the address of the controlling module.

2. System wiring shall be tested to demonstrate correct system response and correct subsequent system operation in the event of:

- a. Open, short, and ground fault for intelligent analog signaling circuit.
- b. Open, short, and ground fault for intelligent digital signaling circuit.
- c. Open, short, and ground fault for network signaling circuit.
- d. Intelligent device removal.
- e. Primary power or battery disconnected.
- f. Type of device miss-match the address ID.
- g. Polarity check.

3. System indications shall be demonstrated as follows.

a. Correct message display for each alarm input at the remote control panel, central control panel and operator's workstation graphic display.

1. Correct annunciator light for each alarm input at each annunciator and color graphic of operator's workstation.

b. Secondary power capacities shall be demonstrated as follows.

1. System primary power shall be disconnected for a period of 24 hours. At the end of that period, an alarm condition shall be created and the system shall perform as specified for a period of 15 minutes.

2. *System primary power shall be restored 48 hours and system charging current shall be normal trickle charge for a fully charges battery pack.*

3. *System battery voltages and charging currents shall be checked at the fire alarm control panel using the test code and displayed on the LCD display.*

4. The entire system needs to be tested in compliance with the building emergency operation sequence specified by contract document. The tests are included, but not limited to, fire door control, security door control interface, air handler duct smoke detection shutdown interface, sprinkler system PIVs, OS&Y valves, and tamper switch monitoring, sprinkler systems water flow and/or pressure switch monitoring, monitoring of fire pump controls, fire/smoke damper control, Passive smoke removal system interface, and elevator recall power shutdown.

5. In the event of system failure to perform as specified and programmed during the FAT, the test shall be terminated at the discretion of the Owner.

a. The Contractor shall retest the system correcting all deficiencies and providing test documentation to the Owner without additional cost to the Owner.

b. In the event that software changes are required during the FAT, a utility program shall be provided by the system manufacturer to compare the edited program with the original. The utility shall field a printed list of the changes and all system functions, inputs and outputs affected by the changes. The items listed by the program shall be the minimum acceptable to be retested before calling for resumption of the FAT. The printed list and the printer log of the retesting shall be submitted before scheduling of the FAT.

c. The Owner may elect to require the complete FAT to be performed again if, in their opinion, modifications to the system hardware or software warrant complete retesting.

### 3.4 MANUFACTURER'S FIELD SERVICES

- A. Include services of factory-certified technicians to supervise installation, adjustments, calibrations, final connections, and system testing. A representative of the manufacturer shall instruct the Owner and demonstrate the system after the Owner has occupied the building.

Formal training for the operation and maintenance of fire alarm equipment and the systems specified herein shall be provided by manufacturer trained and certified personnel. The training shall consist of 2 4-hour training sessions. The timing of the training shall coincide with the schedule for the manufacturer's representatives to be on site for testing and start-up of each building fire alarm system. The formal training shall be provided at a location designated or provided by the Owner for number of personnel selected by the Owner, in addition to any informal on-site orientation and training.

- B. As-built drawings shall be provided upon acceptance of the system with quantities per contract document.

END OF SECTION