

SECTION 283111**DIGITAL, ADDRESSABLE, FIRE-ALARM SYSTEM****PART 1 - GENERAL****1.1 SUMMARY**

- A. Section Includes:
1. Fire alarm control panel.
 2. Manual pull stations.
 3. System smoke detectors.
 4. Nonsystem smoke detectors.
 5. Heat detectors.
 6. Notification appliances.
 7. Magnetic door holders.
 8. Remote annunciator.
 9. Addressable interface device.
 10. Digital alarm communicator transmitter.
 11. Network communications.

1.2 DEFINITIONS

- A. LED: Light-emitting diode.
- B. NICET: National Institute for Certification in Engineering Technologies.

1.3 SYSTEM DESCRIPTION

- A. Noncoded, UL-certified addressable system, with automatic sensitivity control of smoke detectors and multiplexed signal transmission, dedicated to fire-alarm service only.
- B. Source Limitations for Fire-Alarm System and Components: Provide system manufacturer's certification that all components provided have been tested as and will operate as a system.
- C. Each duct smoke detector installed concealed in a shaft or above ceiling shall be provided with remote alarm indicator/key-operated test switch.
- D. UL-certified addressable system, with multiplexed signal transmission and voice/strobe evacuation.
- E. Automatic sensitivity control of certain smoke detectors.
- F. All components provided shall be listed for use with the selected system.
- G. Electrical components, Devices, and Accessories: listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.4 SUBMITTALS

- A. General Submittal Requirements:
1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect. Submittal of product data and shop drawings to Architect shall be provided together and shall show evidence of review by authorities having jurisdiction.
 2. Shop Drawings shall be prepared by persons with the following qualifications:
 - a. Trained and certified by manufacturer in fire-alarm system design.
 - b. NICET-certified fire-alarm technician, Level III minimum.
 - c. Licensed or certified by authorities having jurisdiction.
- B. Bill of Materials: Complete list of all parts needed to fully install selected system components.
- C. Product Data: For each type of product indicated.
1. Include construction details, material descriptions, dimensions, profiles, and finishes.
 2. Include rated capacities, operating characteristic, and electrical characteristics.
- D. Shop Drawings: For fire-alarm system. Include plans and details.
1. Comply with recommendations in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72.
 2. Include plans, elevations, sections, details, and attachments to other work.
 3. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and locations. Indicate conductor sizes, indicate termination locations and requirements, and distinguish between factory and field wiring.
 4. Detail assembly and support requirements.
 5. Include voltage drop calculations for notification appliance circuits.
 6. Include battery-size calculations.
 7. Include input/output matrix.
 8. Include statement from manufacturer that all equipment and components have been tested as a system and meet all requirements in this specification and in NFPA 72.
 9. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits.
- E. Delegated-Design Submittal: For notification appliances and smoke and heat detectors, in addition to submittals listed above, indicate compliance with performance requirements and design criteria; Including analysis data signed and sealed by the qualified professional Engineer responsible for their preparation.
1. Drawings showing the location of each notification appliance and smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of the device.
 2. Design Calculations: Calculate requirements for selecting the spacing and sensitivity of detection, complying with NFPA 72. Calculate spacing and intensities for strobe signals and sound-pressure levels for audible appliances.
 3. Indicate audible appliances required to produce square wave signal per NFPA 72.
- F. The contractor shall obtain the stamp and seal of the registered engineer on the fire alarm shop drawings. The Engineer of Record for these documents will not seal the shop drawings. Provide fire alarm devices and relocate existing on a design build basis as required. Connect equipment to existing fire alarm zones in accordance with manufacturer's recommendations. Provide additional power supplies as necessary for new devices. After the installation is complete, the

fire alarm system shall be tested in the presence of fire department representatives and the owner's representative for system integrity and operation. Coordinate exact fire alarm requirements with fire department prior to bids. Make necessary changes to design/build documents as designed per fire department comments. Provide shop drawings for approval after receipt of AHJ approval, revise and re-submit as required for fire department approval and obtaining applicable permits.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
1. Comply with the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
 2. Provide "Record of Completion Documents" according to NFPA 72 article "Permanent Records" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter.
 3. Complete wiring diagrams showing connections between all devices and equipment. Each conductor shall be numbered at every junction point with indication of origination and termination points.
 4. Riser diagram.
 5. Device addresses.
 6. Air-sampling system sample port locations and modeling program report showing layout meets performance criteria.
 7. Record copy of site-specific software.
 8. Provide "Maintenance, Inspection and Testing Records" according to NFPA 72 article of the same name and include the following:
 - a. Frequency of testing of installed components.
 - b. Frequency of inspection of installed components.
 - c. Requirements and recommendations related to results of maintenance.
 - d. Manufacturer's user training manuals.
 9. Manufacturer's required maintenance related to system warranty requirements.
 10. Abbreviated operating instructions for mounting at fire alarm control panel.
- B. Field quality-control reports.
- C. Sample Warranty: For special warranty.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project, and shall be directly supervised by a NICET Level III technician.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. NFPA Certification: Obtain certification according to NFPA 72 by a UL-listed alarm company.

1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace fire-alarm system equipment and components that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Extent: All equipment and components not covered in the Maintenance Service Agreement.
- B. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS**2.1 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - ~~1. Match existing building system.~~
 - ~~a. Products shall match existing fire alarm system and maintain UL listing requirements of the entire system.~~
 - 2. Edwards EST, a UTC Company.
 - 3. Fire Control Instruments, Inc.; a Honeywell company.
 - 4. NOTIFIER; a Honeywell company.
 - 5. Siemens Building Technologies, Inc.; Fire Safety Division.
 - 6. SimplexGrinnell LP; a Tyco International company.

2.2 SYSTEMS OPERATIONAL DESCRIPTION

- A. Fire-alarm signal initiation shall be by one or more of the following devices and systems:
 - 1. Manual stations.
 - 2. Smoke detectors (verified automatic alarm operation).
 - 3. Duct smoke detectors.
- B. Fire-alarm signal shall initiate the following actions:
 - 1. Continuously operate alarm notification appliances.
 - 2. Identify alarm at fire alarm control panel and remote annunciators.
 - 3. Transmit an alarm signal to the remote alarm receiving station.
 - 4. Release fire and smoke doors held open by magnetic door holders.
 - 5. Activate voice/alarm communication system.
 - 6. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
 - 7. Close smoke dampers in air ducts of air-conditioning duct systems and shutdown associated fans.
 - 8. If supplies are not essential to life safety, retain first subparagraph below for shutoffs installed in supplies that may be hazardous.
 - 9. Record events in the system memory.
 - 10. Record events by the system printer.
- C. Supervisory signal initiation shall be by one or more of the following devices and actions:
 - 1. Valve supervisory switch.
 - 2. User disabling of zones or individual devices.
 - 3. Loss of communication with any panel on the network.

- D. System trouble signal initiation shall be by one or more of the following devices and actions:
1. Open circuits, shorts, and grounds in designated circuits.
 2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
 3. Loss of communication with any addressable sensor, input module, relay, control module, remote annunciator, printer interface, or Ethernet module.
 4. Loss of primary power at fire alarm control panel and remote panels.
 5. Ground or a single break in fire alarm control panel and remote panel internal circuits.
 6. Abnormal ac voltage at fire alarm control panel and remote panels.
 7. Break in standby battery circuitry.
 8. Failure of battery charging.
 9. Abnormal position of any switch at fire alarm control panel or annunciator.
 10. Opening of building rapid entry key boxes (Knox-Box).
- E. System Trouble and Supervisory Signal Actions: Initiate notification appliance and annunciate at fire alarm control panel and remote annunciators. Record the event in system memory log.
- F. Equipment: Provide fire alarm equipment, devices, conductors, connections, etc. to achieve the above functions. Where monitoring and control points are located on equipment furnished by others, the fire alarm system shall extend to those equipment locations.

2.3 FIRE ALARM CONTROL PANEL

- A. General Requirements for Fire alarm control panel:
1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864 and listed and labeled by an NRTL.
 - a. System software and programs shall be held in flash electrically erasable programmable read-only memory (EEPROM), retaining the information through failure of primary and secondary power supplies.
 - b. Include a real-time clock for time annotation of events on the event recorder
 - c. Provide communication between the FACP and remote circuit interface panels, annunciators, and displays.
 - d. The FACP shall be listed for connection to a central-station signaling system service.
 - e. Provide nonvolatile memory system database, logic, and operating system and event history. The system shall require no manual input to initialize in the event of a complete power down condition. The FACP shall provide a minimum 500-event history log.
 2. Addressable initiation devices that communicate device identity and status.
 - a. Smoke sensors shall additionally communicate sensitivity setting and allow for adjustment of sensitivity at fire alarm control panel.
 - b. Temperature sensors shall additionally test for and communicate the sensitivity range of the device.
 3. Addressable control circuits for operation of mechanical equipment.
- B. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire alarm control panel and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.
1. Annunciator and Display: Liquid-crystal type, 3 line(s) of 80 characters, minimum.

2. Keypad: Arranged to permit entry and execution of programming, display, and control commands and to indicate control commands to be entered into the system for control of smoke-detector sensitivity and other parameters.
- C. Initiating Device, Notification Appliance, and Signaling Line Circuits:
1. Pathway Class Designations: NFPA 72, Class A.
 2. Pathway Survivability: Level 0.
 3. Limit the quantity of installed addressable devices to 80 percent of the signaling line circuit capacity.
- D. Smoke-Alarm Verification:
1. Initiate audible and visible indication of an "alarm-verification" signal at fire alarm control panel.
 2. Activate an NRTL-listed and -approved "alarm-verification" sequence at fire alarm control panel and detector.
 3. Record events in system memory log.
 4. Sound general alarm if the alarm is verified.
 5. Cancel fire alarm control panel indication and system reset if the alarm is not verified.
- E. Notification-Appliance Circuit:
1. Audible appliances shall sound in a three-pulse temporal pattern, as defined in NFPA 72.
 2. Carbon monoxide gas alarm warnings shall be of a four-pulse temporal pattern and comply with NFPA 720.
 3. Where notification appliances provide signals to sleeping areas, the alarm signal shall be 520-Hz square wave with an intensity of 15 dB above the average ambient sound level or 5 dB above the maximum sound level, or at least 75 dBA, whichever is greater, measured at the pillow.
 4. Visual alarm appliances shall flash in synchronization where multiple appliances are in the same field of view, as defined in NFPA 72.
- F. Door Controls: Door hold-open devices that are controlled by smoke detectors at doors in smoke barrier walls shall be connected to fire-alarm system.
- G. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.
- H. Voice/Alarm Signaling Service: Central emergency communication system with redundant microphones, preamplifiers, amplifiers, and tone generators provided in a separate cabinet located in the fire alarm control panel or as a special module that is part of fire alarm control panel.
1. Alarm channels for automatic, simultaneous transmission of different announcements to different zones or for manual transmission of announcements by use of the central-control microphone. Amplifiers shall comply with UL 1711 and be listed by an NRTL.
 - a. Allow the application of and evacuation signal to specific zones and, at same time, allow voice paging to the other zones selectively or in any combination.
 - b. Programmable tone and message sequence selection.
 - c. Standard digitally recorded messages for "Evacuation" and "All Clear."
 - d. Generate tones to be sequenced with audio messages of type recommended by NFPA 72 and that are compatible with tone patterns of notification appliance circuits of fire alarm control panel.

2. Status Annunciator: Indicate the status of various voice/alarm speaker zones and the status of firefighters' two-way telephone communication zones.
 3. Preamplifiers, amplifiers, and tone generators shall automatically transfer to backup units, on primary equipment failure.
- I. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory signals and digital alarm communicator transmitters shall be powered by 24-V dc source.
 1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.
 - J. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.
 1. Batteries: Sealed, valve-regulated, recombinant lead acid.
 - K. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.
 - L. Fire Alarm Document Storage: Provide document storage cabinet adjacent to fire alarm control panel. Label as "Fire Alarm Document Storage". Cabinet enclosure shall be constructed similar to fire alarm control panel with similar finish, mounting, and secure key access.

2.4 MANUAL PULL STATIONS

- A. General Requirements for Manual Pull Stations: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. Where device cannot be flush mounted, provide manufacturer's surface back box.
 1. Single-action mechanism, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire alarm control panel.
 2. Station Reset: Key- or wrench-operated switch.
 3. Indoor Protective Shield: Factory-fabricated clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm. Lifting the cover actuates an integral battery-powered audible horn intended to discourage false-alarm operation.

2.5 SYSTEM SMOKE DETECTORS

- A. General Requirements for System Smoke Detectors:
 1. Comply with UL 268; operating at 24-V dc, nominal.
 2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire alarm control panel.
 3. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
 4. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
 5. Integral Visual-Indicating Light: LED type indicating detector has operated and power-on status.

6. Remote Control: Unless otherwise indicated, detectors shall be analog-addressable type, individually monitored at fire alarm control panel for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire alarm control panel.
 - a. Rate-of-rise temperature characteristic shall be selectable at fire alarm control panel for 15 or 20 deg F per minute.
 - b. Fixed-temperature sensing shall be independent of rate-of-rise sensing and shall be settable at fire alarm control panel to operate at 135 or 155 deg F.
 - c. Provide multiple levels of detection sensitivity for each sensor.
- B. Photoelectric Smoke Detectors:
 1. Detector address shall be accessible from fire alarm control panel and shall be able to identify the detector's location within the system and its sensitivity setting.
 2. An operator at fire alarm control panel, having the designated access level, shall be able to manually access the following for each detector:
 - a. Primary status.
 - b. Device type.
 - c. Present average value.
 - d. Present sensitivity selected.
 - e. Sensor range (normal, dirty, etc.).
- C. Duct Smoke Detectors: Photoelectric type complying with UL 268A.
 1. Detector address shall be accessible from fire alarm control panel and shall be able to identify the detector's location within the system and its sensitivity setting.
 2. An operator at fire alarm control panel, having the designated access level, shall be able to manually access the following for each detector:
 - a. Primary status.
 - b. Device type.
 - c. Present average value.
 - d. Present sensitivity selected.
 - e. Sensor range (normal, dirty, etc.).
 3. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector.
 4. Each sensor shall have multiple levels of detection sensitivity.
 5. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
 6. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit. Interconnect to shutdown associated fan.

2.6 NOTIFICATION APPLIANCES

- A. General Requirements for Notification Appliances: Connected to notification appliance signal circuits, zoned as required, equipped for mounting as specified and with screw terminals for system connections.
 1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated and with screw terminals for system connections.
 2. Device Color: Factory finished, red.
- B. Voice/Tone Speakers:
 1. Speakers shall comply with UL 1480 and shall be listed and labeled by an NRTL.
 2. High-Range Units: Rated 2 to 15 W.

3. Low-Range Units: Rated 1 to 2 W.
 4. Mounting: Per plans.
 5. Face Plate Label: The word "FIRE" is engraved in minimum 1-inch-high letters on the device.
 6. Matching Transformers: Tap range matched to acoustical environment of speaker location.
- C. Strobes:
1. LED strobe lights comply with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate.
 2. Rated Light Output:
 - a. 15/30/75/110 cd, selectable in the field. Set to required values identified on shop drawings.
 3. Mounting: Per plans.
 4. Face Plate Label: The word "FIRE" is engraved in minimum 1-inch-high letters on the device.
 5. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
 6. Flashing shall be in a temporal pattern, synchronized with other units.
 7. Strobe Leads: Factory connected to screw terminals.

2.7 MAGNETIC DOOR HOLDERS

- A. Description: Units are equipped for wall or floor mounting as indicated and are complete with matching doorplate.
1. Electromagnet: Requires no more than 3 W to develop 25-lbf holding force.
 2. Wall-Mounted Units: Flush mounted unless otherwise indicated.
 3. Rating: 24-V ac or dc.
- B. Material and Finish: Match door hardware.

2.8 REMOTE ANNUNCIATOR

- A. Description: Annunciator functions shall match those of fire alarm control panel for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire alarm control panel, including acknowledging, silencing, resetting, and testing.
1. Mounting: Surface cabinet, NEMA 250, Type 1.
- B. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire alarm control panel. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.
- C. Location:
1. Main Front Entry

2.9 ADDRESSABLE INTERFACE DEVICE

- A. General:
1. Include address-setting means on the module.
 2. Store an internal identifying code for control panel use to identify the module type.
 3. Listed for controlling HVAC fan motor controllers.

- B. Monitor Module: Microelectronic module providing a system address for alarm-initiating devices for wire applications with normally open contacts.
- C. Integral Relay: capable of providing a direct signal to elevator controller to initiate elevator recall and to circuit-breaker shunt trip for power shutdown.
 - 1. Allow the control panel to switch the relay contacts on command.
 - 2. Have a minimum of two normally open and two normally closed contacts available for field wiring.
- D. Control Module:
 - 1. Operate notification devices.
 - 2. Operate solenoids for use in sprinkler service.

2.10 DIGITAL ALARM COMMUNICATOR TRANSMITTER

- A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632 and be listed and labeled by an NRTL.
- B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire alarm control panel and automatically capture one telephone line(s) and dial a preset number for a remote central station. When contact is made with central station(s), signals shall be transmitted. If service on either line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.
- C. Local functions and display at the digital alarm communicator transmitter shall include the following:
 - 1. Verification that both telephone lines are available.
 - 2. Programming device.
 - 3. LED display.
 - 4. Manual test report function and manual transmission clear indication.
 - 5. Communications failure with the central station or fire alarm control panel.
- D. Digital data transmission shall include the following:
 - 1. Address of the alarm-initiating device.
 - 2. Address of the supervisory signal.
 - 3. Address of the trouble-initiating device.
 - 4. Loss of ac supply or loss of power.
 - 5. Low battery.
 - 6. Abnormal test signal.
 - 7. Communication bus failure.
- E. Secondary Power: Integral rechargeable battery and automatic charger unless served from the fire alarm control panel.
- F. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

2.11 NETWORK COMMUNICATIONS

- A. Provide network communications for fire alarm system according to fire alarm manufacturer's written requirements.
- B. Provide network communications pathway per manufacturer's written requirements and requirements in NFPA and NFPA 70.
- C. Provide integration gateway using BACnet for connection to building automation system.

2.12 FIRE ALARM WIRE AND CABLE

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:
 - 1. Comtran Corp.
 - 2. Draka USA.
 - 3. Genesis Cable Products; Honeywell International, Inc.
 - 4. Rockbestos-Suprenany Cable Corporation.
 - 5. West Penn Wire/CDT; a division of Cable Design Technologies.
- B. General Wire and Cable Requirements: NRTL listed and labeled as complying with NFPA 70, Article 760.
- C. Signaling Line Circuits: Twisted, shielded pair, not less than size as recommended by system manufacturer:
 - 1. Circuit Integrity Cable: Twisted shielded pair, NFPA 70, Article 760, Classification CI, for power-limited-fire alarm signal service Type FPL. NRTL listed and labeled as complying with UL 1424 and UL 2196 for a 2-hour rating.
- D. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation.
 - 1. Low-Voltage Circuits: No 16. AWG, minimum.
 - 2. Line-Voltage Circuits: No. 12 AWG, minimum.

2.13 DEVICE GUARDS

- A. Description: Welded wire mesh of size and shape for the manual station, smoke detector, gong, or other device requiring protection.
 - 1. Factory fabricated and furnished by manufacturer of device.
 - 2. Finish: Paint of color to match the protected device.

PART 3 - EXECUTION**3.1 EQUIPMENT INSTALLATION**

- A. Comply with NFPA 72 for installation of fire-alarm equipment.
 - 1. Devices placed in service before all other trades have completed cleanup shall be replaced.

2. Devices installed but not yet placed in service shall be protected from construction dust, debris, dirt, moisture, and damage according to manufacturer's written storage instructions.
- B. Install wall-mounted equipment, with tops of cabinets not more than 72 inches above the finished floor.
- C. Smoke- or Heat-Detector Spacing:
1. Comply with NFPA 72, "Smoke-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for smoke-detector spacing.
 2. Comply with NFPA 72, "Heat-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for heat-detector spacing.
 3. Smooth ceiling spacing shall not exceed 30 feet.
 4. Spacing of detectors for irregular areas, for irregular ceiling construction and for high ceiling areas shall be determined according to Annex A in NFPA 72.
 5. HVAC: Locate detectors not closer than 3 feet from air-supply diffuser or return-air opening.
- D. Install a cover on each smoke detector that is not placed in service during construction. Cover shall remain in place except during system testing. Remove cover prior to system turnover.
- E. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct.
1. Do not install smoke detector in duct smoke-detector housing during construction. Install detector only during system testing and prior to system turnover.
- F. Duct Smoke Detectors and HVAC Shutdown/Closure:
1. Fans: Provide duct smoke detectors at supply and return ducts of HVAC fans in excess of 2000 cfm. Provide with individual addressable control module at motor controller/starter and connect to shutdown fan.
 2. Return Risers: Provide duct smoke detector on each floor at connections to common air return risers of HVAC fans in excess of 15,000 cfm. Detection shall shutdown fan.
 3. Smoke Dampers: Provide duct smoke detector within 5 feet of each smoke damper or combination fire/smoke damper. Include remote status indicator and test station for detector. Circuit smoke dampers to 20A, 120V life safety branch circuits in local life safety branch panel of the associated construction phase (install circuit breaker lock on branch breaks). Provide individual circuits for each air handling unit zone. Refer to mechanical plans for associated zones. Control each damper individually with addressable control modules from fire alarm system.
- G. Manual Pull Stations: Install manual fire-alarm box in the normal path of egress within 60 inches of the exit doorway. Mount manual fire-alarm box on a background of contrasting color. The operable part of manual fire-alarm box shall be between 42 inches and 48 inches above floor level. All devices shall be mounted at the same height unless otherwise indicated.
- H. Remote Status Indicators and Test Switch: Install near each smoke detector and each sprinkler water-flow switch and valve-tamper switch that is not readily visible from normal viewing position or not readily accessible.
- I. Smoke Detection at Fire Alarm Control Panel: Provide smoke detector within 5 feet of fire alarm control panel.

- J. Smoke Detector Protection: Avoid installing detection heads until final cleanup of all trades is complete. If this is unavoidable, protect detectors and provide cleaning prior to final fire alarm testing.
- K. Audible Alarm-Indicating Devices: Install not less than 6 inches below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille. Install all devices at the same height unless otherwise indicated.
- L. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches below the ceiling. Install all devices at the same height unless otherwise indicated.
- M. Device Location-Indicating Lights: Locate in public space near the device they monitor.
- N. Annunciator: Install with top of panel not more than 72 inches above the finished floor.
- O. Each duct smoke detector installed concealed in a shaft or above ceiling shall be provided with remote alarm indicator/key-operated test switch.

3.2 FIRE ALARM WIRING INSTALLATION

- A. Comply with requirements in Division 26. Comply with NECA 1 and NFPA 72.
- B. Wiring Method: Install cables in metal conduit throughout. Comply with additional pathway survivability requirements of NFPA 72 for the application.
 - 1. Except raceways are not required in accessible indoor ceiling spaces where plenum rated cable is utilized. Metal conduit shall still be utilized when concealed within walls and inaccessible ceilings, or when exposed in unfinished spaces.
 - 2. Cables and raceways used for fire alarm circuits, and equipment control wiring associated with the fire alarm system, may not contain any other wire or cable.
- C. Cable terminations shall consist of no more than two wires per terminal point.
- D. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks or plug connectors.
- E. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.
- F. Color-Coding: color-code fire alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and another for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm indicating devices. Paint fire alarm system junction boxes and covers red.

- G. Wiring to Remote Alarm Transmitting Device: 1-inch conduit between the fire alarm control panel and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

3.3 CONNECTIONS

- A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Division 08 Section "Door Hardware." Connect hardware and devices to fire-alarm system.
 - 1. Verify that hardware and devices are NRTL listed for use with fire-alarm system in this Section before making connections.
- B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 3 feet from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.
 - 1. Smoke dampers in air ducts of air-conditioning duct systems.
 - 2. Magnetically held-open doors.
 - 3. Electrically locked doors and access gates.
 - 4. Supervisory connections at valve supervisory switches.
 - 5. Data communication circuits for connection to building management system.
 - 6. Data communication circuits for connection to mass notification system.
 - 7. Supervisory connections at fire-extinguisher locations.
 - 8. Fan shutdown connection at fans serving ducts with duct smoke detectors or smoke dampers.
- C. Provide two analog voice line connections of digital alarm communication transmitter to building voice service demarcation point for central station monitoring.
- D. Fire Sprinkler Alarm Devices: Coordinate exact quantity and location with Fire Sprinkler Contractor.
- E. Selective Shutdown: Fire alarm shutdown/closure sequences shall be isolated to only initiate shutdown/closure for components directly associated with the specific location/zone/area where fire/smoke has been detected. Where allowed by code, and not in conflict with smoke control sequences, shutdown/closure shall not be initiated in adjacent locations/zones/areas until fire/smoke has been detected there.
- F. Line Voltage Source Connections: Provide dedicated 120 volt line voltage branch circuit and connection to each fire alarm equipment item or device requiring a line voltage source. In buildings with an emergency generator, branch circuit shall be served from a life safety branch source. Serve from new circuit breaker in nearest available panel.

3.4 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Electrical Identification."
- B. Install framed instructions in a location visible from fire alarm control panel.

- C. Provide breaker locks on circuit breakers within source panels serving fire alarm equipment. Include red marking and label as "Fire Alarm Circuit".
- D. Address labeling on all devices that are addressable. Match facility colors.

3.5 GROUNDING

- A. Ground fire alarm control panel and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

3.6 FIELD QUALITY CONTROL

- A. Field tests shall be witnessed by authorities having jurisdiction.
- B. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- C. Tests and Inspections:
 - 1. Visual Inspection: Conduct visual inspection prior to testing.
 - a. Inspection shall be based on completed Record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" Table in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter.
 - b. Comply with "Visual Inspection Frequencies" Table in the "Inspection" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
 - 2. System Testing: Comply with "Test Methods" Table in the "Testing" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
 - 3. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
- D. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.
- E. Fire-alarm system will be considered defective if it does not pass tests and inspections.
- F. Test and Inspection Report:
 - 1. Perform test/inspections and submit report prior to Engineer's final punch inspection.
 - 2. Report shall consist of any developed test result data and shall, at minimum, include a copy of this "Field Quality Control" Section of the specification to illustrate Contractor acknowledgement of tests and inspections.
 - a. Contractor shall indicate successful completion by initialing individual test and inspection requirements listed above on the copy. Initialing indicates that tests and inspections were performed for specified work with a successful outcome. Work not found to be in compliance was corrected and retested/reinspected successfully or has been specifically clarified and noted above by the Contractor.
 - b. Acknowledgement of Tests and Inspections:

- c. “Tests and inspections have been successfully completed as specified, or have been clarified/noted above.

Representative Company Name: _____

Representative Personnel Name: _____

Representative Personnel Signature: _____

Date of Report: _____”

3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

END OF SECTION 283111