

- E. Bond metallic equipment to the grounding bus bar, using not smaller than a No. 6 AWG equipment grounding conductor.

### 3.3 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA-606-B. Comply with requirements for identification specified in Section 270553 "Identification for Communications Systems."
- B. Paint and label colors for equipment identification shall comply with TIA-606-B for Class 2 level of administration.
- C. Equipment grounding conductors.
- D. Cable and Wire Identification:
  - 1. Label each cable within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
  - 2. Each wire connected to building-mounted devices is not required to be numbered at the device if wire color is consistent with associated wire connected and numbered within panel or cabinet.
  - 3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet.
  - 4. Label each terminal strip, and screw terminal in each cabinet, rack, or panel.
    - a. Individually number wiring conductors connected to terminal strips, and identify each cable or wiring group, extended from a panel or cabinet to a building-mounted device, with the name and number of a particular device.
    - b. Label each unit and field within distribution racks and frames.
  - 5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and -connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.
- E. Labels shall be preprinted or computer-printed type, with a printing area and font color that contrast with cable jacket color but still comply with TIA-606-B requirements for the following:
  - 1. Cables use flexible vinyl or polyester that flexes as cables are bent.

### 3.4 FIELD QUALITY CONTROL

- A. Field tests and inspections must be witnessed by authorities having jurisdiction.
- B. Tests and Inspections:
  - 1. Visually inspect jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA-568-C.1.
  - 2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
  - 3. Test twisted pair cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.

- C. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similarly to Table 10.1 in BICSI's "Telecommunications Distribution Methods Manual," or shall be transferred from the instrument to the computer, saved as text files, printed, and submitted.
- D. Nonconforming Work:
  - 1. End-to-end cabling will be considered defective if it does not pass tests and inspections.
  - 2. Remove and replace cabling where test results indicate that they do not comply with specified requirements.
- E. Collect, assemble, and submit test and inspection reports.
- F. Manufacturer Services:
  - 1. Engage factory-authorized service representative to supervise field tests and inspections.

### 3.5 MAINTENANCE

- A. Software Service Agreement:
  - 1. Technical Support: Beginning at Substantial Completion, verify that software service agreement includes software support for two years.
  - 2. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Verify that upgrading software includes operating system and new or revised licenses for using software.
    - a. Upgrade Notice: No fewer than 30 days to allow Owner to schedule and access the system and to upgrade computer equipment if necessary.
  - 3. Upgrade Reports: Prepare report after each update, documenting upgrades installed.

**END OF SECTION 271513**

**SECTION 280000 - GENERAL PROVISIONS FOR ELECTRONIC SAFETY AND SECURITY**

Reference Section 260000 – General Provisions for Electrical

**END OF SECTION 280000**

**SECTION 280500 - COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY**

Reference Section 260500 – Common Work Results for Electrical

**END OF SECTION 280500**



**SECTION 284621.11 - ADDRESSABLE FIRE-ALARM SYSTEMS****PART 1 - GENERAL****1.1 SUMMARY****A. Section Includes:**

1. Addressable fire-alarm system.
2. Fire-alarm control unit (FACU).
3. Manual fire-alarm boxes.
4. System smoke detectors.
5. Duct smoke detectors.
6. Carbon monoxide detectors.
7. Heat detectors.
8. Fire-alarm notification appliances.
9. Firefighters' two-way telephone communication service.
10. Fire-alarm remote annunciators.
11. Fire-alarm addressable interface devices.
12. Digital alarm communicator transmitters (DACTs).

**B. Related Requirements:**

1. Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for cables and conductors for fire-alarm systems.

**1.2 DEFINITIONS**

A. DACT: Digital alarm communicator transmitter.

B. FACU: Fire-alarm control unit.

C. Voltage Class: For specified circuits and equipment, voltage classes are defined as follows:

1. Control Voltage: Listed and labeled for use in remote-control, signaling, and power-limited circuits supplied by a Class 2 or Class 3 power supply having rated output not greater than 150 V and 5 A, allowing use of alternate wiring methods complying with NFPA 70, Article 725.
2. Low Voltage: Listed and labeled for use in circuits supplied by a Class 1 or other power supply having rated output not greater than 1000 V, requiring use of wiring methods complying with NFPA 70, Article 300, Part I.

**1.3 ACTION SUBMITTALS**

A. Approved Permit Submittal: Submittals must be approved by authorities having jurisdiction prior to submitting them to Architect.

B. Product Data: For each type of product, including furnished options and accessories.

1. Include construction details, material descriptions, dimensions, profiles, and finishes.
2. Include rated capacities, operating characteristics, and electrical characteristics.

C. Shop Drawings: For fire-alarm system.

1. Comply with recommendations and requirements in "Documentation" section of "Fundamentals" chapter in NFPA 72.
2. Include plans, elevations, sections, and details, including details of 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. Annunciator panel details as required by authorities having jurisdiction.
5. Detail assembly and support requirements.
6. Include voltage drop calculations for notification-appliance circuits.
7. Include battery-size calculations.
8. Include input/output matrix.
9. Include written statement from manufacturer that equipment and components have been tested as a system and comply with requirements in this Section and in NFPA 72.
10. Include performance parameters and installation details for each detector.
11. Verify that each duct detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
12. Provide control wiring diagrams for fire-alarm interface to HVAC; coordinate location of duct smoke detectors and access to them.
  - a. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators.
  - b. Show field wiring and equipment required for HVAC unit shutdown on alarm.
  - c. Locate detectors in accordance with manufacturer's written instructions.
13. Include voice/alarm signaling-service equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.
14. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits and point-to-point wiring diagrams.

D. 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 qualified professional engineer responsible for their preparation.

1. Drawings showing location of each notification appliance and smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of device.
2. Design Calculations: Calculate requirements for selecting 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.

1.4 INFORMATIONAL SUBMITTALS

A. Certificates:

1. Seismic Performance Certificates: For FACU, accessories, and components, from manufacturer. Include the following information:
  - a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
  - b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

- c. Detailed description of equipment anchorage devices on which certification is based and their installation requirements.
- B. Field quality-control reports.
- C. Qualification Statements: For Installer.
- D. Sample Warranty: Submittal must include line item pricing for replacement parts and labor.

## 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals.
  - 1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
    - a. Comply with "Records" section of "Inspection, Testing and Maintenance" chapter in NFPA 72.
    - b. Provide "Fire-Alarm and Emergency Communications System Record of Completion Documents" in accordance with "Completion Documents" Article in "Documentation" section of "Fundamentals" chapter in NFPA 72.
    - c. Complete wiring diagrams showing connections between devices and equipment. Each conductor must be numbered at every junction point with indication of origination and termination points.
    - d. Riser diagram.
    - e. Device addresses.
    - f. Air-sampling system sample port locations and modeling program report showing layout meets performance criteria.
    - g. Record copy of site-specific software.
    - h. Provide "Inspection and Testing Form" in accordance with "Inspection, Testing and Maintenance" chapter in NFPA 72, and include the following:
      - 1) Equipment tested.
      - 2) Frequency of testing of installed components.
      - 3) Frequency of inspection of installed components.
      - 4) Requirements and recommendations related to results of maintenance.
      - 5) Manufacturer's user training manuals.
    - i. Manufacturer's required maintenance related to system warranty requirements.
    - j. Abbreviated operating instructions for mounting at FACU and each annunciator unit.
- B. Software and Firmware Operational Documentation:
  - 1. Software operating and upgrade manuals.
  - 2. Program Software Backup: On USB media and approved online or cloud solution.
  - 3. Device address list.
  - 4. Printout of software application and graphic screens.

## 1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Extra Stock Material: Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps for Remote Indicating Lamp Units: Quantity equal to 10 percent of amount installed, but no fewer than one unit.
2. Lamps for Strobe Units: Quantity equal to 10 percent of amount installed, but no fewer than one unit.
3. Smoke Detectors and Fire Detectors: Quantity equal to 10 percent of amount of each type installed, but no fewer than one unit of each type.
4. Detector Bases: Quantity equal to two percent of amount of each type installed, but no fewer than one unit of each type.
5. Keys and Tools: One extra set for access to locked or tamperproof components.
6. Audible and Visual Notification Appliances: One of each type installed.
7. Fuses: Two of each type installed in system. Provide in box or cabinet with compartments marked with fuse types and sizes.

## 1.7 QUALITY ASSURANCE

### A. Installer Qualifications:

1. Personnel must be trained and certified by manufacturer for installation of units required for this Project.
2. Installation must be by personnel certified by NICET as fire-alarm Level III technician.
3. Obtain certification by NRTL in accordance with NFPA 72.
4. Licensed or certified by authorities having jurisdiction.

## 1.8 FIELD CONDITIONS

### A. Seismic Conditions: Unless otherwise indicated on Contract Documents, specified Work in this Section must withstand the seismic hazard design loads determined in accordance with ASCE/SEI 7 for installed elevation above or below grade.

1. The term "withstand" means "unit must remain in place without separation of parts from unit when subjected to specified seismic design loads and unit must be fully operational after seismic event."

## 1.9 WARRANTY

### A. Special Warranty: Manufacturer agrees to repair or replace fire-alarm system equipment and components that fail because of defects in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 ADDRESSABLE FIRE-ALARM SYSTEM

#### A. Description:

1. Noncoded, UL-certified addressable system, with multiplexed signal transmission and voice-and-strobe notification for evacuation.

#### B. Performance Criteria:

1. Regulatory Requirements:
  - a. Fire-Alarm Components, Devices, and Accessories: Listed and labeled by a NRTL in accordance with NFPA 70 for use with selected fire-alarm system and marked for intended location and application.
2. General Characteristics:
  - a. Automatic sensitivity control of certain smoke detectors.
  - b. Fire-alarm signal initiation must be by one or more of the following devices and systems:
    - 1) Manual stations.
    - 2) Heat detectors.
    - 3) Smoke detectors.
    - 4) Duct smoke detectors.
    - 5) Carbon monoxide detectors.
    - 6) Automatic sprinkler system water flow.
  - c. Fire-alarm signal must initiate the following actions:
    - 1) Continuously operate alarm notification appliances.
    - 2) Identify alarm and specific initiating device at FACU, connected network control panels, off-premises network control panels, and remote annunciators.
    - 3) Transmit alarm signal to remote alarm receiving station.
    - 4) Unlock electric door locks in designated egress paths.
    - 5) Release fire and smoke doors held open by magnetic door holders.
    - 6) Activate voice/alarm communication system.
    - 7) Switch HVAC equipment controls to fire-alarm mode.
    - 8) Record events in system memory.
    - 9) Indicate device in alarm on graphic annunciator.
  - d. Supervisory signal initiation must be by one or more of the following devices and actions:
    - 1) Valve supervisory switch.
    - 2) Independent fire-detection and -suppression systems.
    - 3) Zones or individual devices have been disabled.
    - 4) FACU has lost communication with network.
  - e. System trouble signal initiation must 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 addressable sensor, input module, relay, control module, remote annunciator, printer interface, or Ethernet module.
    - 4) Loss of primary power at FACU.
    - 5) Ground or single break in internal circuits of FACU.
    - 6) Abnormal ac voltage at FACU.
    - 7) Break in standby battery circuitry.
    - 8) Failure of battery charging.
    - 9) Abnormal position of switch at FACU or annunciator.
    - 10) Voice signal amplifier failure.
    - 11) Hose cabinet door open.

## f. System Supervisory Signal Actions:

- 1) Initiate notification appliances.
- 2) Identify specific device initiating event at FACU, connected network control panels, off-premises network control panels, and remote annunciators.
- 3) After time delay of 200 seconds, transmit trouble or supervisory signal to remote alarm receiving station.
- 4) Display system status on graphic annunciator.

## g. Network Communications:

- 1) Provide network communications for fire-alarm system in accordance with fire-alarm manufacturer's written instructions.
- 2) Provide network communications pathway per manufacturer's written instructions and requirements in NFPA 72 and NFPA 70.

## h. Device Guards:

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

## i. Document Storage Box:

- 1) Description: Enclosure to accommodate standard 8-1/2-by-11 inch manuals and loose document records. Legend sheet will be permanently attached to door for system required documentation, key contacts, and system information. Provide two key ring holders with location to mount standard business cards for key contact personnel.
- 2) Material and Finish: 18-gauge cold-rolled steel; four mounting holes.
- 3) Color: Red powder-coat epoxy finish.
- 4) Labeling: Permanently screened with 1 inch high lettering "SYSTEM RECORD DOCUMENTS" with white indelible ink.
- 5) Security: Locked with 3/4 inch barrel lock. Provide solid 12 inch stainless steel piano hinge.

## 2.2 FIRE-ALARM CONTROL UNIT (FACU)

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Farenhyt; Honeywell International, Inc.
2. Edwards; Carrier Global Corporation.
3. Gamewell-FCI; Honeywell International, Inc.
4. Siemens Industry, Inc., Building Technologies Division.

## B. Description: Field-programmable, microprocessor-based, modular, power-limited design with electronic modules.

## C. Performance Criteria:

1. Regulatory Requirements: Comply with NFPA 72 and UL 864.
2. General Characteristics:

- a. System software and programs must be held in nonvolatile flash, electrically erasable, programmable, read-only memory, retaining information through failure of primary and secondary power supplies.
- b. Include real-time clock for time annotation of events on event recorder and printer.
- c. Provide communication between FACU and remote circuit interface panels, annunciators, and displays.
- d. FACU must be listed for connection to central-station signaling system service.
- e. Provide nonvolatile memory for system database, logic, and operating system and event history. System must require no manual input to initialize in the event of complete power down condition. FACU must provide minimum 500-event history log.
- f. Addressable Initiation Device Circuits: FACU must indicate which communication zones have been silenced and must provide selective silencing of alarm notification appliance by building communication zone.
  - 1) Addressable Control Circuits for Operation of Notification Appliances and Mechanical Equipment: FACU must be listed for releasing service.
- g. Fire-Alarm Annunciator: Arranged for interface between human operator at FACU and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and programming and control menu.
  - 1) Annunciator and Display: LCD, 80 characters, minimum.
  - 2) Keypad: Arranged to permit entry and execution of programming, display, and control commands.
- h. Alphanumeric Display and System Controls: Arranged for interface between human operator at FACU and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and programming and control menu.
  - 1) Annunciator and Display: LCD, three 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 system for control of smoke-detector sensitivity and other parameters.
- i. Initiating-Device, Notification-Appliance, and Signaling-Line Circuits:
  - 1) Pathway Class Designations: NFPA 72, Class C.
  - 2) Pathway Survivability: Level 1.
  - 3) Install no more than 256 addressable devices on each signaling-line circuit.
  - 4) Install fault circuit isolators to comply with circuit performance requirements of NFPA 72 or with manufacturer's written instructions, whichever is more conservative.
- j. Serial Interfaces:
  - 1) One dedicated RS 485 port for central-station operation using point ID DACT.
  - 2) One RS 485 port for remote annunciators, Ethernet module, or multi-interface module (printer port).
  - 3) One USB and RS 232 port for PC configuration.
  - 4) One RS 232 port for air-aspirating smoke detector connection.
  - 5) One RS 232 port for voice evacuation interface.
- k. Smoke-Alarm Verification:

- 1) Initiate audible and visible indication of "alarm-verification" signal at FACU.
- 2) Activate approved "alarm-verification" sequence at FACU and detector.
- 3) Sound general alarm if alarm is verified.
- 4) Cancel FACU indication and system reset if alarm is not verified.

l. Notification-Appliance Circuit:

- 1) Audible appliances must sound in three-pulse temporal pattern, as defined in NFPA 72.
- 2) Where notification appliances provide signals to sleeping areas, alarm signal must be 520 Hz square wave with intensity 15 dB above average ambient sound level or 5 dB above maximum sound level, or at least 75 dB(A-weighted), whichever is greater, measured at pillow.
- 3) Visual alarm appliances must flash in synchronization where multiple appliances are in same field of view, as defined in NFPA 72.

m. Door Controls: Door hold-open devices that are controlled by smoke detectors at doors in smoke-barrier walls must be connected to fire-alarm system.

n. Remote Smoke-Detector Sensitivity Adjustment: Controls must select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory, and print out final adjusted values on system printer.

o. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to remote alarm station.

p. Voice/Alarm Signaling Service: Central emergency communication system with redundant microphones, preamplifiers, amplifiers, and tone generators provided in separate cabinet located in fire command center as special module that is part of FACU.

q. Indicate number of alarm channels for automatic, simultaneous transmission of different announcements to different zones or for manual transmission of announcements by use of central-control microphone. Amplifiers must comply with UL 1711.

- 1) Allow application of, and evacuation signal to, indicated number of zones and simultaneously allow voice paging to other zones selectively or in combination.
- 2) Programmable tone and message sequence selection.
- 3) Standard digitally recorded messages for "Evacuation" and "All Clear."
- 4) 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 FACU.

r. Status Annunciator: Indicate status of various voice/alarm speaker zones and status of firefighters' two-way telephone communication zones.

s. Preamplifiers, amplifiers, and tone generators must automatically transfer to backup units, on primary equipment failure.

t. Primary Power: 24 V(dc) obtained from 120 V(ac) service and power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, and supervisory and DACT must be powered by 24 V(dc) source.

u. Alarm current draw of entire fire-alarm system must not exceed 80 percent of power-supply module rating.

v. Secondary Power: 24 V(dc) supply system with batteries, automatic battery charger, and automatic transfer switch.

w. Batteries: Sealed lead calcium.

D. Accessories:



1. Instructions: Computer printout or typewritten instruction card mounted behind plastic or glass cover in stainless steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe functional operation of system under normal, alarm, and trouble conditions.
2. Preaction System Functionality:
  - a. Initiate Presignal Alarm: This function must cause audible and visual alarm and indication to be provided at FACU. Activation of initiation device connected as part of preaction system must be annunciated at FACU only, without activation of general evacuation alarm.

## 2.3 MANUAL FIRE-ALARM BOXES

- A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes must be finished in red with molded, raised-letter operating instructions in contrasting color; must show visible indication of operation; and must be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.
  1. Double-action mechanism requiring two actions to initiate alarm, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to FACU.
  2. Station Reset: Key- or wrench-operated switch.
  3. Indoor Protective Shield: Factory-fabricated, clear plastic enclosure hinged at top to permit lifting for access to initiate alarm. Lifting cover actuates integral battery-powered audible horn intended to discourage false-alarm operation.
  4. Weatherproof Protective Shield: Factory-fabricated, clear plastic enclosure hinged at top to permit lifting for access to initiate alarm.
  5. Able to perform at up to 90 percent relative humidity at 90 deg F.
  6. Material: Manual stations made of Lexan polycarbonate.
  7. Able to be used in indoor areas.

## 2.4 SYSTEM SMOKE DETECTORS

- A. Photoelectric Smoke Detectors:
  1. Performance Criteria:
    - a. Regulatory Requirements:
      - 1) NFPA 72.
      - 2) UL 268.
    - b. General Characteristics:
      - 1) Detectors must be two-wire type.
      - 2) Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to FACU.
      - 3) Base Mounting: Detector and associated electronic components must be mounted in twist-lock module that connects to fixed base. Provide terminals in 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) Detector address must be accessible from FACU and must be able to identify detector's location within system and its sensitivity setting.

- 7) Operator at FACU, having designated access level, must 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.).
- 8) Detector must have functional humidity range within 10 to 90 percent relative humidity.
- 9) Color: White.
- 10) Remote Control: Unless otherwise indicated, detectors must be digital-addressable type, individually monitored at FACU for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by FACU.
- 11) Rate-of-rise temperature characteristic of combination smoke- and heat-detection units must be selectable at FACU for 15 or 20 deg F per minute.
- 12) Fixed-temperature sensing characteristic of combination smoke- and heat-detection units must be independent of rate-of-rise sensing and must be settable at FACU to operate at 135 or 155 deg F.
- 13) Multiple levels of detection sensitivity for each sensor.
- 14) Sensitivity levels based on time of day.

B. Ionization Smoke Detectors:

1. Performance Criteria:

a. Regulatory Requirements:

- 1) NFPA 72.
- 2) UL 268.

b. General Characteristics:

- 1) Detectors must be two-wire type.
- 2) Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to FACU.
- 3) Base Mounting: Detector and associated electronic components must be mounted in twist-lock module that connects to fixed base. Provide terminals in 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) Detector address must be accessible from FACU and must be able to identify detector's location within system and its sensitivity setting.
- 7) Operator at FACU, having designated access level, must 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.).

- 8) Detector must have functional humidity range within 10 to 90 percent relative humidity.
- 9) Color: White.
- 10) Remote Control: Unless otherwise indicated, detectors must be digital-addressable type, individually monitored at FACU for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by FACU.
- 11) Rate-of-rise temperature characteristic of combination smoke- and heat-detection units must be selectable at FACU for 15 or 20 deg F per minute.
- 12) Fixed-temperature sensing characteristic of combination smoke- and heat-detection units must be independent of rate-of-rise sensing and must be settable at FACU to operate at 135 or 155 deg F.
- 13) Multiple levels of detection sensitivity for each sensor.
- 14) Sensitivity levels based on time of day.

## 2.5 DUCT SMOKE DETECTORS

A. Description: Photoelectric-type, duct-mounted smoke detector.

B. Performance Criteria:

1. Regulatory Requirements:

- a. NFPA 72.
- b. UL 268A.

2. General Characteristics:

- a. Detectors must be two-wire type.
- b. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to FACU.
- c. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
- d. Integral Visual-Indicating Light: LED type, indicating detector has operated and power-on status.
- e. Detector address must be accessible from FACU and must be able to identify detector's location within system and its sensitivity setting.
- f. Operator at FACU, having designated access level, must be able to manually access the following for each detector:
  - 1) Primary status.
  - 2) Device type.
  - 3) Present average value.
  - 4) Present sensitivity selected.
  - 5) Sensor range (normal, dirty, etc.).
- g. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with supplied detector for smoke detection in HVAC system ducts.
- h. Each sensor must have multiple levels of detection sensitivity.
- i. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
- j. Relay Fan Shutdown: Fully programmable relay rated to interrupt fan motor-control circuit.

## 2.6 CARBON MONOXIDE DETECTORS

- A. Description: Carbon monoxide detector listed for connection to fire-alarm system.
- B. Performance Criteria:
  - 1. Regulatory Requirements:
    - a. NFPA 72
    - b. NFPA 720.
    - c. UL 2075.
  - 2. General Characteristics:
    - a. Mounting: Adapter plate for outlet box mounting.
    - b. Testable by introducing test carbon monoxide into sensing cell.
    - c. Detector must provide alarm contacts and trouble contacts.
    - d. Detector must send trouble alarm when nearing end-of-life, power supply problems, or internal faults.
    - e. Locate, mount, and wire in accordance with manufacturer's written instructions.
    - f. Provide means for addressable connection to fire-alarm system.
    - g. Test button simulates alarm condition.

## 2.7 HEAT DETECTORS

- A. Combination-Type Heat Detectors:
  - 1. Performance Criteria:
    - a. Regulatory Requirements:
      - 1) NFPA 72.
      - 2) UL 521.
    - b. General Characteristics:
      - 1) Temperature sensors must test for and communicate sensitivity range of device.
    - c. Actuated by fixed temperature of 135 deg F or rate of rise that exceeds 15 deg F per minute unless otherwise indicated.
    - d. Mounting: Twist-lock base interchangeable with smoke-detector bases.
    - e. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to FACU.
    - f. Detector must have functional humidity range of 10 to 90 percent relative humidity.
    - g. Color: White.
- B. Fixed-Temperature-Type Heat Detectors:
  - 1. Performance Criteria:
    - a. Regulatory Requirements:
      - 1) NFPA 72.
      - 2) UL 521.

b. General Characteristics:

- 1) Actuated by temperature that exceeds fixed temperature of 190 deg F.
- 2) Mounting: Twist-lock base interchangeable with smoke-detector bases.
- 3) Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to FACU.
- 4) Detector must have functional humidity range of 10 to 90 percent.
- 5) Color: White.

## 2.8 FIRE-ALARM NOTIFICATION APPLIANCES

### A. Fire-Alarm Voice/Tone Notification Appliances:

1. Description: Notification appliances capable of outputting voice evacuation messages.
2. Performance Criteria:

a. Regulatory Requirements:

- 1) NFPA 72.
- 2) UL 1480.

b. General Characteristics:

- 1) Speakers for Voice Notification: Locate speakers for voice notification to provide intelligibility requirements of "Notification Appliances" and "Emergency Communications Systems" chapters in NFPA 72.
- 2) High-Range Units: Rated 2 to 15 W.
- 3) Low-Range Units: Rated 1 to 2 W.
- 4) Mounting: Flush.
- 5) Matching Transformers: Tap range matched to acoustical environment of speaker location.
- 6) Combination Devices: Factory-integrated audible and visible devices in single-mounting assembly, equipped for mounting as indicated, and with screw terminals for system connections.

### B. Fire-Alarm Visible Notification Appliances:

1. Performance Criteria:

a. Regulatory Requirements:

- 1) NFPA 72.
- 2) UL 1971.

b. General Characteristics:

- 1) Rated Light Output:
  - a) 6, 13, 15, 30, 75, 110, 177 cd.
  - b) 15/30/75/110 cd, selectable in field.
- 2) Clear or nominal white polycarbonate lens mounted on aluminum faceplate.
- 3) Mounting: Wall mounted unless otherwise indicated.

- 4) For units with guards to prevent physical damage, light output ratings must be determined with guards in place.
- 5) Flashing must be in temporal pattern, synchronized with other units.
- 6) Strobe Leads: Factory connected to screw terminals.
- 7) Mounting Faceplate: Factory finished, red.

## 2.9 FIREFIGHTERS' TWO-WAY TELEPHONE COMMUNICATION SERVICE

- A. Description: Dedicated, two-way, supervised, telephone voice communication links between FACU, fire command center, and remote firefighters' telephone stations. Supervised telephone lines must be connected to talk circuits by controls in control module.
- B. Performance Criteria:
  1. Regulatory Requirements:
    - a. NFPA 72.
  2. General Characteristics:
    - a. Common-talk type for firefighter use only.
    - b. Selective-talk type for use by firefighters and fire wardens.
    - c. Controls to disconnect phones from talk circuits if too many phones are in use simultaneously. Indicator lamp must flash if phone is disconnected from talk circuits.
    - d. Addressable firefighters' phone modules to monitor and control loop of firefighter phones. Module must be capable of differentiating between normal, off-hook, and trouble conditions.
    - e. Audible Pulse and Tone Generator, and High-Intensity Lamp: When remote telephone is taken off hook, it causes audible signal to sound and high-intensity lamp to flash at FACU fire command center.
    - f. Selector panel controls to provide for simultaneous operation of up to six telephones in selected zones. Indicate ground faults and open or shorted telephone lines on panel front by individual LEDs.
    - g. Display: Digital to indicate location of caller.
    - h. Remote Telephone Cabinet: Flush- or surface-mounted cabinet as indicated; factory-standard red finish; with handset.
      - 1) Install one-piece handset to cabinet with vandal-resistant armored cord. Silk-screened or engraved label on cabinet door, designating "Fire Warden Phone" or "Fire Emergency Phone."
      - 2) With "break-glass" door access lock.
    - i. Remote Telephone Jack Stations: Single-gang, stainless steel-plate mounted plug, engraved "Fire Warden Phone" or "Fire Emergency Phone."
    - j. Handsets: One push-to-talk sets with noise-canceling microphone stored in cabinet adjacent to FACU in fire command center.

## 2.10 FIRE-ALARM REMOTE ANNUNCIATORS

- A. Performance Criteria:
  1. Regulatory Requirements:

- a. NFPA 72.
- 2. General Characteristics:
  - a. Annunciator functions must match those of FACU for alarm, supervisory, and trouble indications. Manual switching functions must match those of FACU, including acknowledging, silencing, resetting, and testing.
    - 1) Mounting: Flush cabinet, NEMA 250, Type 1.
  - b. Display Type and Functional Performance: Alphanumeric display and LED indicating lights must match those of FACU. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

## 2.11 FIRE-ALARM ADDRESSABLE INTERFACE DEVICES

### A. Performance Criteria:

- 1. Regulatory Requirements:
  - a. NFPA 72.
- 2. General Characteristics:
  - a. Include address-setting means on module.
  - b. Store internal identifying code for control panel use to identify module type.
  - c. Listed for controlling HVAC fan motor controllers.
  - d. Monitor Module: Microelectronic module providing system address for alarm-initiating devices for wired applications with normally open contacts.
  - e. Control Module:
    - 1) Operate notification devices.
    - 2) Operate solenoids for use in sprinkler service.

## 2.12 DIGITAL ALARM COMMUNICATOR TRANSMITTERS (DACTs)

### A. Performance Criteria:

- 1. Regulatory Requirements:
  - a. NFPA 72.
- 2. General Characteristics:
  - a. DACT must be acceptable to remote central station and must be listed for fire-alarm use.
  - b. Functional Performance: Unit must receive alarm, supervisory, or trouble signal from FACU and automatically capture one telephone line(s) and dial preset number for remote central station. When contact is made with central station(s), signals must be transmitted. If service on either line is interrupted for longer than 45 seconds, transmitter must initiate local trouble signal and transmit signal indicating loss of telephone line to remote alarm receiving station over remaining line. Transmitter must automatically report telephone

service restoration to central station. If service is lost on both telephone lines, transmitter must initiate local trouble signal.

- c. Local functions and display at DACT must 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 central station or FACU.
- d. Digital data transmission must include the following:
  - 1) Address of alarm-initiating device.
  - 2) Address of supervisory signal.
  - 3) Address of trouble-initiating device.
  - 4) Loss of ac supply.
  - 5) Loss of power.
  - 6) Low battery.
  - 7) Abnormal test signal.
  - 8) Communication bus failure.
- e. Secondary Power: Integral rechargeable battery and automatic charger.
- f. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine areas and conditions for compliance with requirements for ventilation, temperature, humidity, and other conditions affecting performance of the Work.
  - 1. Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment and wiring are installed, before installation begins.
- B. Examine roughing-in for electrical connections to verify actual locations of connections before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- A. Preinstallation Testing: Perform verification of functionality of installed components of existing system prior to starting work. Document equipment or components not functioning as designed.
- B. Interruption of Existing Fire-Alarm Service: Do not interrupt fire-alarm service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary guard service in accordance with requirements indicated:
  - 1. Notify Construction Manager and Owner no fewer than seven days in advance of proposed interruption of fire-alarm service.



2. Do not proceed with interruption of fire-alarm service without Construction Manager's and Owner's written permission.
- C. Protection of In-Place Conditions: Protect devices during construction unless devices are placed in service to protect facility during construction.

### 3.3 INSTALLATION OF EQUIPMENT

- A. Comply with NECA 305, NFPA 72, NFPA 101, and requirements of authorities having jurisdiction for installation and testing of fire-alarm equipment. Install electrical wiring to comply with requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems."
1. Devices placed in service before other trades have completed cleanup must be replaced.
  2. Devices installed, but not yet placed, in service must be protected from construction dust, debris, dirt, moisture, and damage in accordance with manufacturer's written storage instructions.
- B. Install wall-mounted equipment, with tops of cabinets not more than 78 inch above finished floor.
1. Comply with requirements for seismic-restraint devices specified in Section 270548.16 "Seismic Controls for Communications Systems."
- C. Manual Fire-Alarm Boxes:
1. Install manual fire-alarm box in normal path of egress within 60 inch of exit doorway.
  2. Mount manual fire-alarm box on background of contrasting color.
  3. Operable part of manual fire-alarm box must be between 42 and 48 inch above floor level. Devices must be mounted at same height unless otherwise indicated.
- D. Smoke- and Heat-Detector Spacing:
1. Comply with "Smoke-Sensing Fire Detectors" section in "Initiating Devices" chapter in NFPA 72, for smoke-detector spacing.
  2. Comply with "Heat-Sensing Fire Detectors" section in "Initiating Devices" chapter in NFPA 72, for heat-detector spacing.
  3. Smooth ceiling spacing must not exceed 30 ft.
  4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas must be determined in accordance with Annex A or Annex B in NFPA 72.
  5. HVAC: Locate detectors not closer than 36 inch from air-supply diffuser or return-air opening.
  6. Lighting Fixtures: Locate detectors not closer than 12 inch from lighting fixture and not directly above pendant mounted or indirect lighting.
- E. Install cover on each smoke detector that is not placed in service during construction. Cover must remain in place except during system testing. Remove cover prior to system turnover.
- F. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend full width of duct. Tubes more than 36 inch long must be supported at both ends.
1. Do not install smoke detector in duct smoke-detector housing during construction. Install detector only during system testing and prior to system turnover.
- G. Remote Status and Alarm Indicators: Install in visible location near each smoke detector, sprinkler water-flow switch, and valve-tamper switch that is not readily visible from normal viewing position.

- H. Audible Alarm-Indicating Devices: Install not less than 6 inch below ceiling. Install bells and horns on flush-mounted back boxes with device-operating mechanism concealed behind grille. Install devices at same height unless otherwise indicated.
- I. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inch below ceiling. Install devices at same height unless otherwise indicated.
- J. Device Location-Indicating Lights: Locate in public space near device they monitor.

#### 3.4 ELECTRICAL CONNECTIONS

- A. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- B. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."
- C. Install electrical devices furnished by manufacturer, but not factory mounted, in accordance with NFPA 70 and NECA 1.
- D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.
  - 1. Nameplate must be laminated acrylic or melamine plastic signs, as specified in Section 260553 "Identification for Electrical Systems."
  - 2. Nameplate must be laminated acrylic or melamine plastic signs with black background and engraved white letters at least 1/2 inch high.

#### 3.5 CONTROL CONNECTIONS

- A. Install control and electrical power wiring to field-mounted control devices.
- B. Install nameplate for each control connection, indicating field control panel designation and I/O control designation feeding connection.

#### 3.6 PATHWAYS

- A. Pathways above recessed ceilings and in inaccessible locations may be routed exposed.
- B. Pathways must be installed in EMT.
- C. Exposed EMT must be painted red enamel or installed in factory red conduit.

#### 3.7 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 Section 087100 "Door Hardware." Connect hardware and devices to fire-alarm system.
  - 1. Verify that hardware and devices are listed for use with installed fire-alarm system before making connections.

- B. Make addressable connections with supervised interface device to the following devices and systems. Install interface device less than 36 inch from device controlled. Make addressable confirmation connection when such feedback is available at device or system being controlled.
  - 1. Magnetically held-open doors.
  - 2. Electronically locked doors and access gates.
  - 3. Supervisory connections at valve supervisory switches.

### 3.8 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 270553 "Identification for Communications Systems."
- B. Install framed instructions in location visible from FACU.

### 3.9 GROUNDING

- A. Ground FACU and associated circuits in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."
- B. Ground shielded cables at control panel location only. Insulate shield at device location.

### 3.10 FIELD QUALITY CONTROL

- A. Field tests must be witnessed by authorities having jurisdiction.
- B. Administrant for Tests and Inspections:
  - 1. Owner will engage qualified testing agency to administer and perform tests and inspections.
  - 2. Engage qualified testing agency to administer and perform tests and inspections.
  - 3. Engage factory-authorized service representative to administer and perform tests and inspections on components, assemblies, and equipment installations, including connections.
  - 4. Administer and perform tests and inspections with assistance of factory-authorized service representative.
- C. Tests and Inspections:
  - 1. Visual Inspection: Conduct visual inspection prior to testing.
    - a. Inspection must be based on completed record Drawings and system documentation that is required by "Completion Documents, Preparation" table in "Documentation" section of "Fundamentals" chapter in NFPA 72.
    - b. Comply with "Visual Inspection Frequencies" table in "Inspection" section of "Inspection, Testing and Maintenance" chapter in NFPA 72; retain "Initial/Reacceptance" column and list only installed components.
  - 2. System Testing: Comply with "Test Methods" table in "Testing" section of "Inspection, Testing and Maintenance" chapter in NFPA 72.
  - 3. Test audible appliances for public operating mode in accordance with manufacturer's written instructions. Perform test using portable sound-level meter complying with Type 2 requirements in ASA S1.4 Part 1/IEC 61672-1.

4. Test audible appliances for private operating mode in accordance with manufacturer's written instructions.
5. Test visible appliances for public operating mode in accordance with manufacturer's written instructions.
6. Factory-authorized service representative must prepare "Fire Alarm System Record of Completion" in "Documentation" section of "Fundamentals" chapter in NFPA 72 and "Inspection and Testing Form" in "Records" section of "Inspection, Testing and Maintenance" chapter in NFPA 72.

- D. Fire-alarm system will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.
- F. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.
- G. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

### 3.11 DEMONSTRATION

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

### 3.12 MAINTENANCE

- A. Maintenance Service: Beginning at Substantial Completion, maintenance service must include 12 months' full maintenance by skilled employees of manufacturer's designated service organization. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper operation. Parts and supplies must be manufacturer's authorized replacement parts and supplies.
  1. Include visual inspections in accordance with "Visual Inspection Frequencies" table in "Testing" paragraph of "Inspection, Testing and Maintenance" chapter in NFPA 72.
  2. Perform tests in "Test Methods" table in "Testing" paragraph of "Inspection, Testing and Maintenance" chapter in NFPA 72.
  3. Perform tests per "Testing Frequencies" table in "Testing" paragraph of "Inspection, Testing and Maintenance" chapter in NFPA 72.

### 3.13 SOFTWARE SERVICE AGREEMENT

- A. Comply with UL 864.
- B. Technical Support: Beginning at Substantial Completion, service agreement must include software support for two years.
- C. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software must include operating system and new or revised licenses for using software.

1. Upgrade Notice: At least 30 days to allow Owner to schedule access to system and to upgrade computer equipment if necessary.

**END OF SECTION 284621.11**