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SECTION 283111 - DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Fire-alarm control unit.
2. Manual fire-alarm boxes.
3. System smoke detectors.
4. Heat detectors.
5. Notification appliances.
6. Device guards.
7. Remote annunciator.
8. Addressable interface device.
9. Network communications.

B. Related Requirements:

1. Section 280513 "Conductors and Cables for Electronic Safety and Security" for cables and conductors for fire-alarm systems.

1.3 DEFINITIONS

A. EMT: Electrical Metallic Tubing.

B. FACP: Fire Alarm Control Panel.

C. NICET: National Institute for Certification in Engineering Technologies.

1.4 ACTION SUBMITTALS

A. 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.

B. Shop Drawings: For fire-alarm system.

1. Comply with recommendations and requirements in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.

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2. Include plans, elevations, sections, details, and attachments to other work.
3. Include details of equipment assemblies. Indicate dimensions, weights, clearances, method of field assembly, components, and locations. Indicate indicate termination locations and requirements, and distinguish between 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 performance parameters and installation details for each detector.
10. Verify that each duct detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
11. Include voice/alarm signaling-service equipment layout, grounding schematic, amplifier power calculation, and single-line connection diagram.
12. 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.

C. General Submittal Requirements:

1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.
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.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Field quality-control reports.

1.6 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 and deliver copies to authorities having jurisdiction:

   a. Comply with the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
   b. Provide "Fire Alarm and Emergency Communications System Record of Completion Documents" according to the "Completion Documents" Article in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
   c. 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.

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d. Riser diagram.
e. Device addresses.
f. Provide "Inspection and Testing Form" according to the "Inspect 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.

g. Manufacturer's required maintenance related to system warranty requirements.
h. Abbreviated operating instructions for mounting at fire-alarm control unit and each annunciator unit.

B. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On compact disk, complete with data files.
3. Device address list.
4. Printout of software application.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. 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 Heat 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 tamperproofed components.
6. Audible and Visual Notification Appliances: One of each type installed.
7. Fuses: Two of each type installed in the system. Provide in a box or cabinet with compartments marked with fuse types and sizes.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.

B. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level II technician.

C. NFPA Certification: Obtain certification according to NFPA 72 by a UL-listed alarm company.

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1.9 PROJECT CONDITIONS

A. Perform a full test of the existing system prior to starting work. Document a components not functioning as designed.

B. Interruption of Existing Fire-Alarm Service: Do not interrupt fire-alarm service to fac Owner or others unless permitted under the following conditions and then only after arranging to provide temporary guard service according to requirements indicated:

1. Notify 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 Owner's written permission.

C. Use of Devices during Construction: Protect devices during construction unless devices are placed in service to protect the facility during construction.

1.10 SEQUENCING AND SCHEDULING

A. Existing Fire-Alarm Equipment: Maintain existing equipment fully operational until new equipment has been tested and accepted. As new equipment is installed, label it "NOT IN SERVICE" until it is accepted. Remove labels from new equipment when put into service, and label existing fire-alarm equipment "NOT IN SERVICE" until removed from the building.

B. Equipment Removal: After acceptance of new fire-alarm system, remove existing disconnected fire-alarm equipment and wiring.

1.11 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.
2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Fire alarm system installation shall comply with the City of Portland Fire Department Rules and Regulations.

B. Noncoded, UL-certified addressable system, with multiplexed signal transmission and voice/strobe evacuation.

C. Automatic sensitivity control of certain smoke detectors.

D. All components provided shall be listed for use with the selected system.

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E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA testing agency, and marked for intended location and application.

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. Heat detectors.
3. Smoke detectors.
4. Duct smoke detectors.
5. Automatic sprinkler system water flow.
6. Fire-extinguishing system operation.
7. Fire standpipe system.
8. Dry system pressure flow switch.

B. Fire-alarm signal shall initiate the following actions:

1. Continuously operate alarm notification appliances, including voice evacuation notices.
2. Identify alarm and specific initiating device at fire-alarm control unit 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. Activate emergency shutoffs for gas and fuel supplies.
7. Record events in the system memory.

C. Supervisory signal initiation shall be by one or more of the following devices and actions:

1. Valve supervisory switch.
2. High- or low-air-pressure switch of a dry-pipe or preaction sprinkler system.
3. Elevator shunt-trip supervision.
4. Independent fire-suppression systems.
5. User disabling of individual devices.
6. 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 unit.
5. Ground or a single break in internal circuits of fire-alarm control unit.
6. Abnormal ac voltage at fire-alarm control unit.
7. Break in standby battery circuitry.
8. Failure of battery charging.
9. Abnormal position of any switch at fire-alarm control unit or annunciator.
10. Voice signal amplifier failure.

E. System Supervisory Signal Actions:

1. Initiate notification appliances.

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2. Identify specific device initiating the event at fire-alarm control unit and remote
3. Record the event on system printer.
4. After a time delay of 200 seconds, transmit a trouble or supervisory signal to receiving station.
5. Transmit system status to building management system.

2.3 FIRE-ALARM CONTROL UNIT

A. General Requirements for Fire-Alarm Control Unit:

1. The FACP shall include one (1) Signaling Line Circuit (SLC) that will power, supervise, monitor, and control a maximum of 127 analog addressable points which may be made up of any combination of sensors and modules. The SLC shall have the capability to be wired in an NFPA Style 4, 6, or 7 (Class B) configuration.

2. The FACP shall be capable of expanding to 318 analog addressable points, which may be made of any combination of sensors and modules, by use of up to 2 SLCE-127 Signal Line Communication expansion board. The SLCE-127 shall have the capability to be wired in a NFPA Style 4, 6, or 7 (Class B) configuration.

3. The FACP shall have 3 form C relays dedicated to Alarm, Trouble, and Supervisory conditions. These relays shall have a contact rating of 3 Amps at 24VDC.

4. The FACP shall have a power supply capable of providing a minimum of 3.5 amps of 24 VDC power to devices requiring auxiliary power and/or notification appliances.

5. The FACP shall have two (2) programmable Notification Appliance Circuits rated at no less than 3 amps per circuit and capable of being wired in a Class B configuration. These circuits shall be programmable for the following output types:

   a. Notification Appliance Circuit – Continuous, ANSI Temporal, and Synchronized Output.
   b. Auxiliary Power – Constant and Resettable.

6. The FACP NAC circuits shall include the capability to automatically synchronize notification appliances from multiple manufacturers simultaneously on the same FACP without the need for a synchronization module. Systems that do not allow for multiple brands of strobes to be synchronized together on the same panel are not acceptable. The following manufacturers synchronization protocol shall be supported as a minimum:

   a. Potter/Amseco
   b. Gentex
   c. Wheelock
   d. System Sensor

7. The FACP shall include a 4-wire serial P-LINK bus for communication with system annunciators, power supplies, expansion modules, and other accessories. The P-LINK bus shall support a wiring distance of no less than 6500 feet from the panel to the furthest device and be capable of being wired in Class B.
8. The FACP shall have two (2) programmable I/O Circuits rated at 1 amp per circuit and capable of being wired in a Class B configuration. These circuits shall be programmable for the following output types.

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a. Notification Appliance Circuit – Continuous Output
b. Notification Appliance Circuit – ANSI Temporal Output
c. Notification Appliance Circuit – Synchronized Output.
d. Auxiliary Power – Constant
e. Auxiliary Power – Resettable.
f. Contact Input Pull Station
g. Contact Input Waterflow
h. Contact Input Supervisory
i. Contact Input Tamper
j. Contact Input Fire Drill
k. Contact Input Trouble Monitor
l. Contact Input Aux.
m. Trigger IO Reverse Polarity
n. Trigger IO Reverse Polarity No Trouble
o. Contact Input Reset
p. Contact Input Silence

9. The FACP shall include an operator interface keypad and annunciation panel that includes a backlit LCD display and color coded system status LED's.
10. The FACP shall be housed in a UL listed key locked cabinet with sufficient space to house 8AH or 18AH batteries.
11. The FACP shall include programming terminals for the purpose of addressing system SLC devices without the need for a special programmer.
12. The FACP shall be capable of being programmed with an IP address so that it can reside on a standard TCP/IP network. The IP address shall be able to be assigned dynamically through DDNS or programmed statically.
13. The FACP shall include a built-in TCP/IP Ethernet port for programming and communications purposes.

    a. The TCP/IP Ethernet port shall be capable of communicating to an approved UL listed central station via the internet or other compliant TCP/IP network connection, without the need for additional modules or software.

        1) The central station communication shall be transmitted in a format capable of transmitting event information by point or by software zone.
        2) The installation contractor shall verify the building network components compliance with any applicable codes and standards including NFPA and UL.

    b. The TCP/IP Ethernet port shall be capable of connecting a computer to the FACP for programming purposes using a standard Ethernet patch cable. Systems that require special cables, modules or adapters for programming are not acceptable.
    c. The FACP shall be capable of emailing the systems software program, event history, detector status, and any off-normal events that occur, to up to 20 preauthorized email recipients. Authorized email recipients shall have the ability to opt in and out of email transmissions by sending the FACP a standard email message.

14. The FACP shall include the ability to add a Digital Alarm Communicating Transmitter (DACT). The DACT shall be capable of being used in lieu of or in addition to the IP central station communication capability.
15. The FACP operating software shall include the following features:

    a. The ability to program any input to activate any output or group of outputs on the system.

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b. Drift compensation to ensure smoke detector accuracy betw inspections.
c. Maintenance alert function to warn of excessive dust or dirt accumu detector.
d. Built-in detector sensitivity test meeting the requirements of NFPA 72.
e. 1000 event history buffer that stores all off-normal conditions and ac time/date stamp of when they occurred.
f. Alarm verification feature with a programmable counter.
g. Auxiliary point types to allow for the configuration of non-fire related devices on the SLC loop.
h. One person walk-test capability with all devices tested during walk-test mode recorded in the event history buffer.
i. Duplicate device address detection to determine if more than 1 device per SLC loop shares the same address. An authorized user shall also be able to turn on the LED for any device address to assist in troubleshooting duplicate address troubles.

B. Operator Control and Interface

1. Acknowledge (ACK) Button

a. Depressing the FACP ACK button in response to new alarms and/or troubles shall silence the local piezo sounder and change the alarm and trouble LED's from flashing mode to steady ON mode. The alarm or trouble event information on the LCD display shall also display an icon indicating that the event has been acknowledged.

2. Alarm Silence (SILENCE) Button

a. Depressing the FACP SILENCE button shall cause all silenceable alarm notification appliances and relays to return to their normal non-alarm condition. The selection of which notification appliance circuits and relays that are silenceable by this button, shall be fully field programmable within the confines of all applicable codes and standards. The FACP software shall include silence inhibit and auto silence/unsilence timers.

3. Alarm Activate (DRILL) Button

a. Depressing the FACP DRILL button shall activate all notification appliance circuits. The drill function shall latch until the ESC button is depressed.

4. System (RESET) Button

a. Depressing the FACP RESET button shall cause all electronically latched input devices and software zones, as well as all associated output devices and circuits to return to their normal condition.

5. Display

a. The user interface display shall be a backlit 2 line 32 character LCD.

C. Elevator Recall:

1. Elevator recall shall be initiated only by one of the following alarm-initiating devices:

a. Elevator lobby detectors except the lobby detector on the designated floor.

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b. Smoke detector in elevator machine room.
c. Heat detectors in elevator hoistway or elevator machine room.

2. Elevator controller shall be programmed to move the cars to the alternate r detectors located on the designated recall floors are activated.
3. Water-flow alarm connected to sprinkler in an elevator shaft and elevator m shut down elevators associated with the location without time delay.

   a. Water-flow switch associated with the sprinkler in the elevator pit may have a delay to allow elevators to move to the designated floor.

D. Door Controls: Existing door hold-open devices shall be connected to fire-alarm system.

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

F. Voice/Alarm Signaling Service: Central emergency communication system with microphone, preamplifier, amplifiers, and tone generator, provided as a special module that is part of fire-alarm control unit.

1. 100 watts power with four speaker zone outputs.
2. Back up amplifier
3. Allow the application of, and evacuation signal to, indicated number of zones and, at the same time, allow voice paging to the other zones selectively or in any combination.
4. Programmable tone and message sequence selection.
5. Standard digitally recorded messages for "Evacuation" and "All Clear."
6. 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 unit.
7. Status Annunciator: Indicate the status of various voice/alarm speaker zones and the status of firefighters' two-way telephone communication zones.
8. Preamplifiers, amplifiers, and tone generators shall automatically transfer to backup units, on primary equipment failure.

G. Surge protection and labeling of panels.

H. 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 radio 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.

I. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.

1. Batteries on all panels and NAC power supplies shall be rated for 24 hours stand by and 10 minutes of alarm.

   a. Batteries used for backup power to the main FACP or remote power supply panels shall be of the sealed lead acid, maintenance free type.

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b. Batteries shall be sized according to the power requirements of the FA of operating the system in standby mode for a minimum of 24 ho minutes in alarm condition.

c. Battery calculations shall be supplied showing the calculated standby factoring in a minimum 15% efficiency/derating factor.

J. 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.

2.4 MANUAL FIRE-ALARM BOXES

A. General Requirements for Manual Fire-Alarm Boxes: 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. If indicated as surface 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 unit.
2. Station Reset: Key-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.

   a. Provide (1) at each manual fire alarm box located in a normally occupied space.

2.5 SYSTEM SMOKE DETECTORS

A. General Requirements for System Smoke Detectors:

1. Comply with UL 268; operating at 24-V dc, nominal.
2. Detectors shall be two-wire type.
3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
4. 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.
5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
6. Integral Visual-Indicating Light: LED type, indicating detector has operated and power-on status.
7. Remote Control: Unless otherwise indicated, detectors shall be digital-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit.

B. Photoelectric Smoke Detectors:

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

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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 unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, 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. Each sensor shall have multiple levels of detection sensitivity.
4. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
5. Relay Fan Shutdown: Fully programmable relay rated to interrupt fan motor-control circuit.

2.6 HEAT DETECTORS

A. General Requirements for Heat Detectors: Comply with UL 521.

1. Temperature sensors shall test for and communicate the sensitivity range of the device.

B. Heat Detector, Combination Type: Actuated by a fixed temperature of 135 deg F, unless otherwise indicated.

1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

C. Heat Detector, Fixed-Temperature Type: Actuated by temperature that exceeds a fixed temperature of 190 deg F.

1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
3. Locate only in Kiln Room and at top of elevator shaft.

2.7 NOTIFICATION APPLIANCES

A. General Requirements for Notification Appliances: Individually addressed, connected to a signaling-line circuit, equipped for mounting as indicated, and with screw terminals for system connections.

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1. Combination Devices: Factory-integrated audible and visible devices in a assembly, equipped for mounting as indicated, and with screw terminals for sys

B. Visible Notification Appliances: Xenon strobe lights complying with UL 1971, with clea polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engrav inch-high letters on the lens.

1. Rated Light Output:

a. 15/30/75/110 cd, selectable in the field.

2. Mounting: Wall mounted unless otherwise indicated.
3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
4. Flashing shall be in a temporal pattern, synchronized with other units.
5. Strobe Leads: Factory connected to screw terminals.
6. Mounting Faceplate: Factory finished, white, unless noted otherwise.

C. Voice/Tone Notification Appliances:

1. Comply with UL 1480.
2. Speakers for Voice Notification: Locate speakers for voice notification to provide the intelligibility requirements of the "Notification Appliances" and "Emergency Communications Systems" chapters in NFPA 72.
3. Rated 1/8 to 4 W.
4. Mounting: Surface.
5. Matching Transformers: Tap range matched to acoustical environment of speaker location.

2.8 REMOTE ANNUNCIATOR

A. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, 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 unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

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 wired applications with normally open contacts.

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C. Integral Relay: Capable of providing a direct signal to elevator controller to initiate ele 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 wiring.

D. Control Module:

1. Operate notification devices.
2. Operate solenoids for use in sprinkler service.

2.10 RADIO ALARM TRANSMITTER

A. Transmitter is existing to be maintained. Contractor shall coordinate with the City of Portland Fire Department for required communication between the existing radio alarm transmitter and the fire alarm control panel.

2.11 DEVICE GUARDS

A. Description: Welded wire mesh of size and shape for the manual station or other device requiring protection.

1. Factory fabricated and furnished by device manufacturer.
2. Finish: Paint of color to match the protected device.
3. Provide (1) at each device located at all levels of the Gymnasium, Wrestling Room, Locker Rooms, and Loading Dock Area, shown or not shown.

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.

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3.2 EQUIPMENT INSTALLATION

A. Comply with NFPA 72, NFPA 101, and requirements of authorities having jurisdiction f testing of fire-alarm equipment. Install all electrical wiring to comply with require including, but not limited to, Article 760, "Fire Alarm Systems."

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. Manual Fire-Alarm Boxes:

1. Install manual fire-alarm box in the normal path of egress within 60 inches of the exit doorway.
2. Mount manual fire-alarm box on a background of a contrasting color.
3. 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.

D. Smoke- or Heat-Detector Spacing:

1. Comply with the "Smoke-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for smoke-detector spacing.
2. Comply with the "Heat-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for heat-detector spacing.
3. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Annex A or Annex B in NFPA 72.
4. HVAC: Locate detectors not closer than 36 inches from air-supply diffuser or return-air opening.
5. Lighting Fixtures: Locate detectors not closer than 12 inches from any part of a lighting fixture and not directly above pendant mounted or indirect lighting.

E. 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.

F. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct. Tubes more than 36 inches long shall be supported at both ends.

G. Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location. Do not install smoke detectors in sprinklered elevator shafts.

H. Remote Status and Alarm Indicators: Install in a visible location near each sprinkler water-flow switch, and valve-tamper switch that is not readily visible from normal viewing position.

I. Audible/Visual Alarm-Indicating Devices: Install not less than 6 inches below the ceiling. Install speakers on flush-mounted back boxes with the device-operating mechanism concealed behind a grille. Install all devices at the same height unless otherwise indicated.

J. Device Location-Indicating Lights: Locate in public space near the device they monitor.

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3.3 CONNECTIONS

A. For fire-protection systems related to doors in fire-rated walls and partitions and t partitions, comply with requirements in Section 087100 "Door Hardware." Conne 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 a supervised interface device to the following devices and systems. Install the interface device less than 36 inches from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.

1. Magnetically held-open doors.
2. Alarm-initiating connection to elevator recall system and components.
3. Alarm-initiating connection to activate emergency shutoffs for gas and fuel supplies.
4. Supervisory connections at valve supervisory switches.
5. Supervisory connections at low-air-pressure switch of each dry-pipe sprinkler system.
6. Supervisory connections at elevator shunt-trip breaker.
7. All components indicated as existing or existing relocated.

3.4 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

B. Install framed instructions in a location visible from fire-alarm control unit.

3.5 GROUNDING

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

B. Ground shielded cables at the control panel location only. Insulate shield at device location.

3.6 FIELD QUALITY CONTROL

A. Field tests shall be witnessed by authorities having jurisdiction.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

D. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Visual Inspection: Conduct visual inspection prior to testing.

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a. Inspection shall be based on completed record Drawings and system d
is required by the "Completion Documents, Preparation" table in the
section of the "Fundamentals" chapter in NFPA 72.
b. Comply with the "Visual Inspection Frequencies" table in the "Inspecti
"Inspection, Testing and Maintenance" chapter in NFPA
"Initial/Reacceptance" column and list only the installed components.

2. System Testing: Comply with the "Test Methods" table in the "Testing" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
4. Test audible appliances for the private operating mode according to manufacturer's written instructions.
5. Test visible appliances for the public operating mode according to manufacturer's written instructions.
6. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" section of the "Fundamentals" chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.

E. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.

F. Fire-alarm system will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

H. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.

I. 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.

3.7 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 24 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 shall be manufacturer's authorized replacement parts and supplies.

1. Include visual inspections according to the "Visual Inspection Frequencies" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
2. Perform tests in the "Test Methods" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
3. Perform tests per the "Testing Frequencies" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.

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3.8 SOFTWARE SERVICE AGREEMENT

A. Comply with UL 864.

B. Technical Support: Beginning at Substantial Completion, service agreement shall 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 shall 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.

3.9 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