

SECTION 28 31 10 - FIRE ALARM SYSTEMS, SMOKE ALARMS, CARBON MONOXIDE
ALARMS and DETECTION SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY:

A. Section Includes:

1. Fire Alarm and Detection Systems
2. Single Station Smoke Alarms
3. Single Station and System Carbon Monoxide Detectors

B. Related Sections:

1. Section 01790CP – Campus Utility Connections and Outages
2. Section 01701CPPR – Building Systems Identification & Labeling

1.2 SCOPE OF STANDARD:

- A. This standard applies to fire detection/alarm system and carbon monoxide system components and equipment installed during new construction or as part of any renovation and improvement project.
- B. This Standard is intended to assure that University facility fire detection/alarm systems and Carbon Monoxide (CO) detection and alarm systems provide a high level of fire safety and comply with applicable National, State and City Ordinances as well as other applicable University Design Criteria.
- C. Coordinate Fire detection/alarm systems with all of the following building systems or components as applicable by Code:
1. Fire Suppression Systems
 2. Heating, Ventilation and Air Conditioning (HVAC) systems, smoke control systems, and their related fire, smoke, and combination fire/smoke dampers.
 3. Carbon Monoxide Alarms and Detection Systems
 4. Emergency power systems
 5. Elevators
 6. Building Automation systems (BAS).
 7. Security Systems
 8. 800 MHz Public Safety communications systems
 9. Fire pumps
 10. Theatrical Lighting and audio equipment (where applicable)
 11. Door release services
 12. Mass Notification Alert systems

1.3 REFERENCED PUBLICATIONS:

- A. The documents or portions thereof listed in this section, as well as their referenced documents, shall be considered part of the requirements of this Standard (Utilize latest adopted editions as adopted in the State of Rhode Island).

1. NFPA 45 - Standard on Fire Protection for Laboratories Using Chemicals
2. NFPA 70, National Electrical Code
3. NFPA 72, National Fire Alarm. Code
4. NFPA 90A, Standard for the Installation of Air-Conditioning and Ventilating Systems
5. NFPA 101, Life Safety Code
6. NFPA 720, Standard For The Installation Of Carbon Monoxide(Co) Detection And Warning Equipment
7. Rhode Island State Elevator Code
8. Rhode Island State Building Code
9. Rhode Island Uniform Fire Code: The Uniform Fire Code of the National Fire Protection Association, Inc., Standard 1 (NFPA 1), with appendices, except those portions specifically reserved, deleted, altered, added to, or otherwise amended.
10. Rhode Island Life Safety Code: The Life Safety Code of the National Fire Protection Association, Inc., Standard 101 (NFPA 101), with appendices, except those portions specifically reserved, deleted, altered, added to, or otherwise amended
11. Requirements of the Authority Having Jurisdiction (AHJ)

1.4 QUALITY CONTROL:

- A. FIRE ALARM SYSTEM DESIGNER REQUIREMENTS: The design of the fire alarm and detection system shall be performed by a Licensed Rhode Island Professional Engineer.
- B. Electrical or fire alarm contractors installing, upgrading, maintaining or testing fire alarm equipment in any University building shall be licensed by the State of Rhode Island to perform such work.
- C. The fire alarm contractor shall have a minimum of one National Institute for Certification in Engineering Technologies (NICET) certified Level III fire alarm technician as the lead technician for any project involving the installation of new or modification of existing fire alarm systems.

1.5 800MHZ RADIO SYSTEM SURVEY AND INTERCONNECTIONS:

- A. For renovations within existing facilities, and all new facilities, verify that adequate 800MHZ radio coverage is provided throughout the overall building via a survey performed by a licensed radio and communications systems technician. Where coverage is found to be lacking and requires the installation of a booster antenna, the antenna and all associated power supplies shall be monitored and supervised by the fire alarm system per City of Providence ordinance.

1.6 FIRE ALARM SYSTEM BASIC DESIGN CRITERIA:

- A. One, two and three-family Residential Structure Smoke Alarm Systems:
 1. Provide interconnected "local" (single station) photo-electric type smoke alarms per Rhode Island Fire Safety Code; detectors to have both 120VAC unswitched

power supply, connected to an area lighting circuit, and 9VDC battery backup. Interconnection may be provided by wired or wireless connection.

B. All Other Occupancy Classes:

1. Provide building fire alarm system per Rhode Island Fire Safety Code and system Criteria referenced herein. Fire Alarm System types include: Local Systems, Municipally Connected Systems and High Rise Systems. Other specific requirements may apply in particular occupancy types (i.e.: Assembly occupancies).
2. New fire alarm systems shall be addressable-type. Modifications to existing systems to match existing system type and manufacturer. Any equipment that is installed or modified must be listed for the specific intended use by UL or another nationally recognized testing company.
3. Buildings requiring a municipal connection will be connected to the local Fire department and Brown Public Safety via Municipal connections as follows:
 - a. Each municipal alarm connection will be made using a Gamewell master box, with a blank cover per Providence Fire Department requirements, mounted inside the building, in close proximity to the fire alarm control panel. Master boxes use ¼ second timing.
 - b. If the building is outside the limits of the campus fire alarm loops, contact the Brown Fire Safety Officer. Arrangements will be made with the City of Providence Telecommunications Department and the Providence Fire Department Chief of Dispatch Operations.
4. For buildings equipped with a “Local Fire Alarm System” (not requiring a municipal connection) and for buildings with municipal connections which are not connected to the Brown Fire Alarm Loop, an IP-DACT (Ethernet-protocol Digital Alarm Communications Transmitter) and dedicated Ethernet jack shall be provided so that fire alarm signals may be monitored at the Brown Public Safety Communications Center.
5. Provide manual override controls at the FACP (Fire Alarm Control Panel) for each of the following, where applicable, to allow for drills and testing of the fire alarm system:
 - a. HVAC supply and exhaust fans,
 - b. Stairwell pressurization,
 - c. Smoke venting and smoke control systems,
 - d. Audio and Visual alarm defeat for system testing purposes,
 - e. Elevator,
 - f. City master box,
 - g. Sprinkler flow sensors and tamper switches.
 - h. Security/door release services
 - i. Fire Shutter doors
6. Residential Room Smoke Detector Replacement:

- a. Where Projects include partial renovations of a residential building that has both a fire alarm system and existing single station smoke alarms (or single station carbon monoxide alarms), these single station smoke alarms shall remain in place; any required new devices shall match the existing models installed in the building.
 - b. In all new residential buildings or residential buildings where comprehensive renovations are being performed, the individual room single station smoke alarms (or single station carbon monoxide alarms) will be replaced with system connected smoke detectors with sounder bases installed as described below.
7. Where system smoke detectors or system connected carbon monoxide detectors, with sounder bases, are used to meet the requirement for single station smoke alarms/carbon monoxide alarms in the individual rooms of a Residential building, they shall be connected to the building fire alarm control unit. When operated these specific detectors will sound a local alarm in the room only and will indicate a “supervisory” condition at the fire alarm control unit. If the system is connected to an IP DACT then the supervisory signal shall be transmitted to the Brown Public Safety Communications Center. In the event of tampering with a local smoke detector/carbon monoxide detector (i.e., removal of a device), a system trouble alarm shall sound at the building fire alarm control unit.
 8. Where duct-type smoke detectors are installed in HVAC systems, connect the detectors to the fire alarm control unit to signal an audible and visual supervisory at the Fire alarm control panel (FACP), and to shut down the affected HVAC unit only upon alarm; this alarm condition shall not trigger a general building fire alarm unless specifically requested and authorized by the AHJ.
 9. The building fire alarm system shall be configured to shut down all ventilation and air handling system fans supplying 2,000 CFM or greater capacity.
 10. For laboratory and research buildings, exhaust fans for fume hoods and lab spaces may need to be run at reduced capacity to maintain air quality inside the building per NFPA 45, while simultaneously avoiding excessive negative pressure concerns within the building. Fire alarm system designer to review ventilation system operation on fire alarm with the Office of Environmental Health and Safety.
 11. The building fire alarm system shall monitor all fire suppression equipment, including sprinklers, kitchen hood suppression systems, clean agent suppression systems and dry chemical suppression systems. Any alarm, supervisory or trouble signal generated by these systems shall be annunciated at the fire alarm control panel.
 - a. Individual flow switches shall be provided for every separate sprinkler zone in the building. A flow switch will be provided to monitor main flow in the primary water supply to the sprinkler system. A tamper switch will monitor the position of all sprinkler control valves, and generate a supervisory signal

- at the fire alarm control panel if the valve changes to an off-normal condition.
- b. Cooking range hoods provided with hood fire suppression systems to be provided with fire alarm monitor modules. The Suppression system to include an interlock to shut off electric or gas supply to the range in the event of system activation (i.e., the fire alarm system does not shut off the electric or gas supply).
12. Preaction and Clean Agent Releasing Systems: Single or double interlock features shall be installed in any space where pre-action or clean agent releasing systems are installed. Manual release stations shall also be provided.
 13. Smoke Control System: Where a project requires a smoke control system, connect FACP to smoke control panel for initiation of smoke control system and associated dampers. The smoke control panel and all associated interconnection wiring methods shall comply with UL 864 and be listed as smoke control equipment.
 14. Pre-action systems: Where a project requires a pre-action type control systems (such as for local fire suppression systems), connect FACP to pre-action control panel for initiation of pre-action system.

1.7 CARBON MONOXIDE ALARMS and DETECTION SYSTEMS BASIC DESIGN

CRITERIA: (Only applies to buildings that contain fuel burning appliances)

A. One, two and three-family Residential Structures:

1. Install multiple station (interconnected) carbon monoxide alarms outside of each separate dwelling unit sleeping area in the immediate vicinity of the bedrooms and on every occupiable level of a dwelling unit, including basements, but excluding attics and crawl spaces, per Code requirements.

B. All Other Facilities:

1. Carbon Monoxide detectors shall be installed per Code requirements.
2. In buildings with addressable fire alarm systems, integrate Carbon Monoxide detectors into the building's fire alarm system utilizing local sounder bases with a distinctive alert sound (different from the fire alarm). Carbon Monoxide detectors shall be monitored by the building's fire alarm system. CO alarms will generate a supervisory signal on the fire alarm control panel. A system trouble signal shall sound on the local fire alarm panel in the event of tampering with any local detector. Detectors shall receive their power from the building's fire alarm system.
3. Examples of fuel-burning appliances include but are not limited to water heaters, boilers, HVAC equipment, clothes dryers, stove/ranges, generators, etc.), wood stoves, fireplaces, and idling automobiles in attached garages.

1.8 FIRE ALARM SYSTEM ACCESSORIES:

- A. Provide a lockable Documentation storage cabinet at or adjacent to (within five feet of) the FACP, for storing and securing all documents required for fire alarm system maintenance and response, building floor plans, Emergency Response materials, MSDS sheets, etc. Storage shall be separated from all active electrical, electronic, or electromechanical parts and components. If adequate, storage may contain unconnected spare/repair parts.
- B. The FACP or acceptable remote alarm annunciator shall be mounted in a heated location near the front entrance of the building.
- C. Install an Ethernet data jack in a locked cabinet located adjacent to the fire alarm control unit with $\frac{3}{4}$ inch raceway connecting the FACU to the box containing the data jack. The lock shall be keyed in accordance with Brown IT requirements.
- D. Provide a 110 VAC duplex electrical receptacle within 10 feet of the fire alarm control panel.

1.9 FIRE ALARM SYSTEM FUNCTIONAL DESCRIPTION:

- A. The engineer of record shall develop an input/output Matrix of Operation indicating all device and system inputs with their corresponding alarm, supervisory and trouble operational outputs. The Matrix shall conform to the example shown in NFPA 72. Each input and output function shall also be described in a narrative form that will describe in words the information provided in the Matrix of Operation.
- B. The input/output Matrix of Operation and Narrative shall be used to ensure the fire alarm system control unit operation is programmed correctly.
- C. Specific features and functions included in the system design are to be reviewed during project design development and their applicability determined using the Rhode Island Fire Code.
- D. The following are indicative of the required functions and features of the fire alarm system per NFPA 72:
 - 1. Manual and automatic alarm initiation;
 - 2. Monitoring of alarms and abnormal conditions in fire suppression systems;
 - 3. Monitoring of alarms and abnormal conditions in Carbon Monoxide monitoring systems;
 - 4. Monitoring generator status (“failure to start” and “run”) where the fire alarm panel is powered by a generator.
 - 5. Enabling emergency voice/alarm communications and Firefighters communication systems;
 - 6. Supervision of automatic fire pumps and special service pumps in accordance with NFPA 20, Standard for the Installation of Centrifugal Fire Pumps.
 - 7. Smoke control system and pre-action system interface
 - 8. Door release and security interface.
 - 9. Elevator interface
 - 10. HVAC interface

- E. The following are indicative of the required operational functionality of the fire alarm system per NFPA 72 in the event of an alarm condition:
1. The system alarm LED shall flash.
 2. The local signal in the FACP shall sound.
 3. Activation of alarm notification appliances throughout the building.
 4. The Municipal master box and/or IP-DACT activated for alarm condition.
 5. The LCD display on the FACP and remote annunciator shall indicate all information associated with the fire alarm condition, including the type of alarm point and its location within the protected premises.
 6. History data logging shall log the information associated with each new fire alarm control panel condition, along with time and date of occurrence.
 7. All system output programs assigned via control-by-event equations to be activated by the particular point in alarm, shall be executed and the associated system outputs (alarm notification appliances and/or relays) activated. System outputs could include:
 - i. Firefighter's communications enabled.
 - ii. Elevator capture/recall enabled.
 - iii. Elevator power shunt trip enabled.
 - iv. Smoke control/fan shutdown enabled.
 - v. Public address system shutdown enabled.
 - vi. House lights in Public spaces raised to full-on levels.
 - vii. Door release/release locks on normally locked egress doors.
 - viii. Release and monitoring of clean agent and/or preaction sprinkler systems.
- F. The following are indicative of the required operational functionality of the fire alarm system per NFPA 72 in the event of a supervisory condition:
1. The system supervisory LED shall flash.
 2. A pulsing alarm tone in the control unit shall sound.
 3. The display shall indicate all information associated with the supervisory condition, including device, its location within the protected premises, and the time and date of that activation.
 4. If more supervisory signals are in the system, the operator shall be able to scroll the display to view new signals.
 5. All system output programs assigned via control-by-event equations to be activated by the particular point monitored shall be executed, and the associated system outputs (Supervisory Notification Appliances and/or relays) shall be activated.
- G. The following are indicative of the required operational functionality of the fire alarm system per NFPA 72 in the event of a trouble condition:
1. The system trouble LED shall flash.
 2. A tone in the control unit shall sound.
 3. The display shall indicate all information associated with the trouble condition, including type of trouble point, its location within the protected premises, and the time and date of that activation.

4. All system output programs assigned via control-by-event equations to be activated by the particular point in trouble shall be executed, and the associated System Outputs (Trouble Notification Appliances and/or relays) shall be activated.

1.10 SUBMITTALS:

A. Submit the following documents for reference and/or approval:

1. PRODUCT DATA:

- a. Full equipment list including model numbers and quantities.
- b. Compliance data indicating that all proposed field devices are FM approved or listed with the proposed fire alarm panels.
- c. Highlighted Data Sheets on Devices and Products:
 - i. Fire Alarm Control Panel
 - ii. Batteries
 - iii. Automatic Detectors
 - iv. Manual Stations
 - v. Audible Signaling Devices
 - vi. Visual Signaling Devices
 - vii. Control Devices
 - viii. Electrical back box requirements
 - ix. Wiring

2. SHOP DRAWINGS: Submit project –specific shop drawings (for all engineered fire alarm and CO detection systems) including but not limited to:

- a. Fire Alarm Panel Schematics: include detailed fire alarm and remote annunciator (where applicable) front panel elevations showing all major control devices, zone assignments (where applicable) and identification labels, as well as general locations of all interior modules and components
- b. Diagrams indicating the interconnection of the various panels, modules, field devices, and major junction boxes. Include relevant information detailing the number of circuits, type of devices, number of devices, number of conductors, conduit sizes, and system zone information.
- c. Wiring diagrams for all fire alarm system device connections and interfaces to other building systems such as: HVAC motor starters, magnetic door holders, sprinkler system supervisory valves, lighting and public address system interfaces, door security system interfaces, elevator capture, etc.
- d. Connections to existing fire alarm systems shall be reviewed and coordinated by the engineer of record involved in the design of the fire alarm system.
- e. Scaled floor plans, detailing the layout of all fire alarm devices, including initiating and notification devices, other building systems interfacing with the fire alarm system, and the routing of major system wiring. For zone-type systems, clearly identify zoning on plans.

- i. For speaker devices, include wattage setting for each speaker labeled adjacent to the speaker.
 - ii. For visual devices, include Candela rating for each strobe adjacent to the strobe.
 - iii. Fire safety and related symbols shown on drawings and diagrams shall comply with NFPA 170.
3. Installation and operating instructions for all equipment.
4. Equipment testing procedures.
5. SYSTEM DESIGN CALCULATIONS – Provide calculations for all engineered fire alarm systems showing the electrical load on the following system components:
 - a. Each system power supply, including distributed supplies.
 - b. Standby Battery Calculations
 - c. Voltage drop calculations for each type of circuit.
 - d. Speaker and strobe circuit loading and amplifier loading
 - e. Each auxiliary control circuit that draws power from any system power supply.
6. DEVICE SCHEDULES and SEQUENCE OF OPERATIONS. Provide hard copy and software information including:
 - a. Schedule of all initiating devices, including device type, location, room location, zone (if applicable), and corresponding software address, in Excel spreadsheet format.
 - b. Schedule of all alarm output control function devices (fan shutdown, elevator recall, door release) and corresponding software address in Excel spreadsheet format.
 - c. System description of operation, comprised of operations matrix and written sequence of Operation. Generic information, such as “HVAC shutdown” or “elevator capture” is not acceptable; indicate specific HVAC units and systems being controlled.

PART 2 – PRODUCTS

2.1. MANUFACTURERS:

- A. Fire alarm control units shall be Gamewell/FCI series E3; fire alarm system field devices as manufactured by, or listed as compatible with, by Gamewell/FCI; exceptions are only allowed for University properties where it is required to match existing installations from other system manufacturers to maintain UL system listings.
- B. Fire alarm control units used for releasing services shall be Gamewell/FCI series E3, unless the E3 control unit is not listed or approved for that service. Where the E3 control unit is not listed or approved for releasing services a University-approved equal manufactured by Gamewell/FCI/Honeywell shall be used.

- C. Standalone-type (single station and interconnected single station type) smoke detectors shall be as manufactured by Kidde, Model # i4618 or University-approved equal.
- D. Standalone-type (single station and interconnected single station type) Carbon Monoxide detectors shall be as manufactured by Kidde, Model # KN-COP-IC or University-approved equal.
- E. Standalone-type (single station and interconnected single station type) combination type smoke detector / carbon monoxide detectors shall be as manufactured by Kidde, Model # KN-COSM-IB or University-approved equal.
- F. Where the system connected carbon monoxide detectors are not listed or approved to be connected to the Gamewell/FCI E3 signaling line circuit, the carbon monoxide detectors shall be interfaced to the fire alarm system with an addressable monitor module.

2.2. GENERAL:

- A. Equipment and components shall be new, and the manufacturer's current model.

2.3. FIRE ALARM CONTROL PANEL (FACP):

- A. General: The fire alarm control panel shall include all the hardware, software and firmware required to perform all system functions.
- B. The system shall incorporate software-driven logic to automatically adjust the alarm threshold windows on smoke detectors to compensate for accumulating contamination, detector cleaning, and to keep detector response sensitivity constant.
- C. Provide surge arrestors for fire alarm panels and associated equipment per UL 864.
- D. Display and Controls:
 - 1. Provide system display with all controls and indicators used by the system operator and to program all system operational parameters.
 - 2. Provide status LEDs for: AC power, system alarm, system supervisory, display supervisory, trouble and signal silence.
 - 3. Provide key pad with control capability to command all system functions, number and text entry information, and field programming.
 - 4. Provide operator control switches for: signal silence, reset, system test, and acknowledge; include component manual override switches for system testing as specified elsewhere in this section.
 - 5. Provide with "Walk-test" capability to test field devices.
- E. Power Supply:
 - 1. Include maintenance-free batteries and charger. Battery capacity shall be adequate to operate the complete alarm system in normal or supervisory (non-alarm) mode for a period of 60 hours, with sufficient capacity to operate the system, including alarm-indicating devices in either alarm or supervisory mode for a period of 15 minutes.

2. Provide all FACP's with twenty percent (20%) excess power supply, input circuit, and output circuit capacity at final acceptance to allow for future expansion.
- F. Field Programming:
1. Programming shall be accomplished through the standard FACP keyboard and via laptop computer connection.
 2. Provide two levels of password protection; One level for status-level changes such as zone disable or manual on/off commands; the second (higher-level) for actual change of program information.
- G. Voice Paging: Include a microphone and associated controls to allow voice paging to selected areas (where required).
- H. Fire Department Communication System: Include a complete and separate two-way fire department communication system (where required).
- 2.4. DISTRIBUTED POWER SUPPLIES:
- A. Distributed power supply inputs shall be controlled by addressable interface devices located on the same floor levels as the power supply and controlled by the SLC serving the area to facilitate maintenance.
 - B. Size the distributed power supplies to provide 5 minutes of operation in alarm after 60 hours of system operation in standby power. Where voice evacuation systems are utilized, 15 minutes of alarm shall be provided after operation in standby power.
- 2.5. ADDRESSABLE DEVICES - GENERAL:
- A. Program each device with a unique digital programming address. Addresses shall be set at the device with rotary decade switches, or shall be set electronically.
 - B. Addressable devices to include integral LED indicators for system status, and programmable from the main fire alarm panel.
- 2.6. DETECTOR BASES:
- A. Detector bases shall be low profile twist lock type with screw clamp terminals and self-wiping contacts. Bases shall be installed on a standard 4-inch square or octagonal electrical outlet box.
 - B. Removal of the detector from the base shall cause a trouble indication at the FACU. Removal of the detector shall not disrupt the alarm circuit wiring or prevent the receipt of alarms from other devices operating in the circuit.
 - C. Insertion of an incorrect detector type into the base shall cause a "Wrong Device" trouble condition at the FACU until the proper type of detector is installed, or the system is re-programmed. The system program shall recognize the insertion of a wrong device and shall automatically default to the setpoint values corresponding to the inserted device, and shall monitor alarm and trouble conditions according to the default parameters.

2.7. ADDRESSABLE MONITOR MODULE:

- A. Provide monitor modules to connect any normally open (N.O.) dry contact device as an input into one of the fire alarm signaling line circuit loops.

2.8. ADDRESSABLE CONTROL RELAY MODULE:

- A. Provide addressable control modules to control the operation of building functions such as door holders, elevator capture, door lock release, etc.
- B. Module relays shall operate according to the control program resident in the FACP. Relays shall be supervised for trouble conditions (open, short, device missing/failed) at the FACP.

2.9. AUXILIARY RELAYS:

- A. Provide auxiliary relays for use in conjunction with control modules for fan shutdown or any other application requiring switching of local control circuits. Provide relays with red LED's to indicate when relay is energized.

2.10. MANUAL PULL STATIONS:

- A. Manual pull stations shall be of the "double-action" type. "Break glass" stations are not acceptable. Provide pull stations that utilize the same key as FACP for resetting.
- B. Addressable manual pull stations for addressable fire alarm systems shall include integral contact monitor module to provide addressable operation.
- C. Manual pull stations shall be surface or flush mount, installed with manufacturer's approved backbox.
- D. If system is a "local" fire alarm system, all manual pull stations to be clearly labeled "Local Alarm Not Connected to Fire Dept."
- E. Where directed by BFSO, vandal-resistant stations to include tamper-proof clear lexan shield and frame and line-operated alert horn when activated.

2.11. HEAT DETECTORS:

- A. Spot-type Heat Detectors: low profile, solid-state type; fixed temperature, rate-of-rise, or combination fixed temperature and rate-of-rise, spot type as required per Code.
- B. Linear Heat Detection: Equivalent to Protect-O-Wire, Inc., Line-type heat detection shall be connected to an addressable monitor module and supervised by the fire alarm system. Comply with manufacturer's requirements for spacing and temperature selection.

2.12. SMOKE DETECTORS:

- A. Spot type smoke detectors required per Code: photoelectric or multi-criteria type. Smoke detectors to be self-compensating for temperature and humidity.

- B. All smoke detectors shall be field-measurable and adjustable for sensitivity. The FACP shall function as the smoke detector sensitivity test device, approved and listed for that service.
 - C. Two (2) wire and four (4) wire conventional smoke detectors for existing conventional systems shall be listed as compatible with the fire alarm control panel.
- 2.13. DUCT-MOUNTED SMOKE DETECTORS:
- A. Provide duct smoke detectors with air duct detector housings and remote indication, test, and reset stations.
- 2.14. PROJECTED-BEAM SMOKE DETECTORS:
- A. Projected-beam detectors, with remote reflectors if needed; provide with automatic gain control circuits to compensate for deterioration of signal strength due to environmental factors such as dirt and dust accumulation, component aging and temperature fluctuations, and circuits to prevent "false" alarms due to sudden and complete obscuration.
 - B. Provide remote indication, test, and reset stations for all projected beam smoke detectors.
- 2.15. ELECTROMAGNETIC DOOR HOLDERS:
- A. Provide with adjustable stainless steel pivot-mounted armature and shock-absorbing bearing.
 - B. Door holder power supply circuits shall be independent of fire alarm system power supply circuits; 120 VAC is preferred voltage.
- 2.16. ALARM NOTIFICATION APPLIANCES:
- A. Provide appliances meeting the requirements of the Americans with Disabilities Act (ADA).
 - B. Alarm notification appliances to be provided in combinations of: audible only, audible/visual/ and visual only.
 - C. Provide wall or ceiling mounting, flush or surface mounted, as required. Surface mount appliances to be installed on manufacturers approved factory-finished backboxes.
- 2.17. AUDIBLE ALARM NOTIFICATION APPLIANCES:
- A. Audible alarm Notification Appliances shall be speakers, horns or programmable electronic sounders, with adjustable taps.
 - B. Where required by code, the audible portion of the Public Alarm for all systems shall be Voice Alarm. Provide speakers for annunciation of voice messages. Signals generated must be the Distinctive Evacuation Signal (three-pulse temporal pattern) alternated with a digitized custom textual message.

- C. The system for voice communication shall meet the requirements of NFPA 72 for intelligibility.

2.18. VISUAL ALARM NOTIFICATION APPLIANCES:

- A. Visual alarm Notification Appliances shall be strobe lights, with field-adjustable light intensity. All strobes to be synchronized type, and labeled "FIRE" per ADA guidelines and be listed to UL 1971.
- B. All visual notification devices within a room or adjacent space within the field of view must be synchronized as required per NFPA 72.

PART 3 – EXECUTION

3.1 CONNECTIONS TO EXISTING SYSTEMS:

- A. Connections to existing fire alarm systems shall be supervised and/or coordinated by the FM Division 3 (Electrical) staff and the engineer of record involved in the design of the fire alarm system.
- B. Existing systems must remain operational during modifications or additions to the existing system throughout the duration of the project.

3.2 TEMPORARY SHUTDOWNS:

- A. System shutdowns are to be coordinated per requirements of Brown Standards Section 01790CP – Campus Utility Connections and Interruptions.

3.3 INSTALLATION - GENERAL:

- A. All equipment and components shall be installed in compliance with manufacturers' recommendations. Consult manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc., before beginning system installation.
- B. The contractor shall clean all dirt and debris from the inside and the outside of the fire alarm equipment after completion of the installation.
- C. Provide a red colored locking device on all circuit breakers supplying power to fire alarm equipment to prevent inadvertent shut off of the circuit breaker.
- D. Dedicated smoke detectors that control smoke hatches, smoke/fire doors, and other similar type emergency equipment shall be located per NFPA 72 requirements.
- E. Mount Duct smoke detector Test/Reset stations at 80" AFF in readily accessible areas, adjacent to or within sight of the duct detector. Group stations together where possible. Each station shall be labeled with each device served.
- F. Do not install Smoke detectors in bathrooms with showers, janitor closets, or immediately adjacent intake/exhaust vents, or other areas where false or nuisance alarms may occur.

- G. Locate Smoke detectors a minimum of 3 feet from all supply and return air diffusers and ceiling paddle fans.
- H. Locate control devices utilized for operating auxiliary functions mounted within 3 feet of the system being controlled as required per NFPA 72.
- I. Transmitting and receiving units of projected-beam detectors shall be located and protected from physical damage.
- J. Duct Smoke Detectors: Label duct work and direction of air flow and identify the proper locations for duct detectors. Duct –mounted smoke detectors to be located upstream or sufficiently downstream to prevent nuisance alarms from any humidification grids mounted within the air handlers and associated ductwork. Refer to the manufacturer’s installation instructions for guidelines for the location of duct detectors.

3.4 WIRING AND CIRCUIT IDENTIFICATION:

- A. System wiring shall conform to Division 26 requirements of the Brown Standards, applicable NEC and RI Fire Safety Code requirements, in addition to the requirements noted herein.
- B. Initiating, notification, signaling, and other fire alarm system wiring, circuits, and conductors shall be color coded and identified by number and/or function at termination points (i.e., control panels, remote annunciators, etc.) and splice points (i.e., junction boxes, terminal cabinets, etc.) per RI Fire Safety Code requirements.
- C. Wiring installation:
 - 1. All conductors shall be minimum #16 gauge solid copper, type THHN/THWN/TFN. All wiring shall be run continuously from device to device.
 - 2. Provide minimum separation between the outgoing and return circuits in accordance with the provisions of NFPA-72.
 - 3. All wiring to be run in minimum ¾” metal raceway with steel, not cast-type, couplings and box connectors.
 - 4. “Red-MC” cable, rated as FPLP and 2-hour fire rated for penetrations by UL is allowed for use above accessible hung ceilings, and in walls accessible via adjacent hung ceilings only. Where type “Red-MC” Cable is utilized, UL listed type MC. Cable connectors with insulated bushings and screw type cable attachments shall be used.
 - 5. Conductor size shall be increased as required so as to limit voltage drop in accordance with the lump sum method.
 - 6. Municipal Master Box circuits to be run in separate raceways.
 - 7. AC and DC portions of the fire alarm system shall be installed in separate raceways.
 - 8. Where circuits extend outside of the building, provide wiring with primary surge protection at each end in accordance with NFPA 70 Article 760 and Article 800.
 - 9. Interconnection cable for wiring of municipal master box circuits shall be IMSA-rated, 4/C # 14 AWG solid copper wire. Wiring to be installed in dedicated fire

alarm conduit within buildings, or in a dedicated telecommunications duct when run underground.

10. Ground master box to building service grounds in accordance with the RI Electrical Code.
11. Contact the Facilities Management Electrical shop (Division 3) to coordinate the connection to the municipal loop.

3.5 FIRE ALARM SYSTEM IDENTIFICATION/LABELING:

- A. All fire alarm labeling and component designations shall match Brown labeling requirements. See Section 01701CPPR – Building Systems Identification & Labeling, in addition to this section.
- B. Provide engraved nameplates for Fire Alarm Control Panels, remote annunciators and power supplies. The plate shall contain: the equipment identification, the building or area served, as well as power circuit source and breaker number. Provide type-written directories for all equipment controls and indicators.
- C. Provide computer-generated adhesive labels to indicate the device address and install on the bases of all initiating device and notification appliances, as well as any remote test and monitoring stations. The labels must be legible from a standing position below.
- D. Software labels for addressable detection devices shall reference the room number closest to that device, or note a compass direction. Example: a smoke detector in the hall near room 207 would be labeled “Hallway near Room 207”; a pull station near the north end of a second floor hallway should be labeled “2nd Floor Hallway – North”.
- E. Junction and splice boxes containing fire alarm system wiring, circuits, and conductors: provide with red covers and marked “FIRE ALARM” in $\frac{3}{4}$ " (three-quarter inch) white letters. Provide red paint at each conduit end and at 20-foot intervals in all accessible areas.

3.6 TESTING AND REPORTS:

- A. Fire alarm system testing shall comply with NFPA 72.
- B. Pre-tests and Final tests:
 1. The process for pre-testing a fire alarm system is detailed in the Rhode Island state fire code. A Brown University representative shall be present to witness every fire alarm pre-test.
 2. Before a pre-test is scheduled with the Brown University representative, the installer and the Brown Project Manager shall assure that the fire alarm installation is complete, all auxiliary functions operate and the fire alarm panel is clear of supervisory signals, troubles, ground faults, open and short circuits. Each manual fire alarm box, heat detector, smoke detector, extinguishing system switching circuits, flow switch circuit and each notification appliance circuit shall

be opened in at least two locations to test for the correctness of the supervisory circuitry.

3. All communications shall be tested completely per NFPA 72.
4. The fire alarm system shall be in accordance with this chapter and in one hundred percent (100%) operation prior to acceptance and/or issuance of a certificate of occupancy.
5. Smoke detectors shall not be installed until after the construction clean-up of all trades is complete and final. Detectors that have been installed prior to final clean-up by all trades shall be cleaned or replaced.
6. Either the installing contractor or the fire alarm equipment supplier shall provide qualified personnel to perform the pre-test and the final acceptance test. Other licensed contractors shall be present to test auxiliary functions (elevator capture, fan shut-down, sprinkler flow, etc.).
7. The Contractor will schedule the final fire alarm inspection with the Providence Fire Department, only after the pre-test has been successfully completed.

3.7 DOCUMENTATION AND TURNOVER MATERIALS:

- A. Contractor to provide a documentation package before final system testing; the documentation package shall include all information needed to allow the University to perform additions, modifications, maintenance and repair of the system.
- B. For modifications to existing buildings and facilities, Contractor shall be responsible to modify existing fire alarm system record documentation to incorporate the revised system design and programming requirements. Where such existing documentation does not exist, it shall be developed new under the course of the renovation project.
- C. Documentation package shall include the following:
 1. Complete, updated "As-Built" Submittal and As-Built Drawing information denoting all of the completed and installed system information.
 2. Copies of all completed systems acceptance test reports including operation confirmation of all interfaced systems (elevators, etc.)
 3. Programming files with all system software required for a re-start after traumatic failure. Software must be of appropriate and compatible update version for the firmware installed including hardware key, if required.
 4. Final fire alarm system program and database (where applicable) information, including description of system logic strings, control by event programming, and point identification labels, provided both on CD and in printed form. Include programming manual suitable to allow for the ready understanding, operation and program editing of the fire alarm panel program
 5. State of Rhode Island or NFPA 72 certification form.

3.8 TRAINING:

- A. Provide minimum of four (4) hours of Hands-on instruction in the operation, maintenance of the system, including programming changes and functions to the BFSO and FM Operations Staff.

END OF SECTION 283110