16721 FIRE ALARM AND DETECTION SYSTEMS

PART 1: GENERAL

1.01 QUALITY ASSURANCE

A. The integrated fire alarm system including all equipment, components, and accessories shall be UL listed for the purpose for which the equipment, components, and accessories are used. Factory Mutual (FM) systems are preferred.

1.02 SUBMITTALS

A. For major fire alarm system renovations (such as fire alarm panel revision or replacement) and new system designs, consultant shall engage Cornell University’s Planning, Design and Construction and Environmental Health & Safety to determine overall scope of the work before commencing design.

B. To ensure compliance with the intent of this standard, it is recommended that all new fire alarm and detection system final designs and associated contract submittals be reviewed by Cornell University’s Planning, Design and Construction (CUPDC) and Environmental Health & Safety (EH&S).

C. One (1) copy of each new project fire alarm system submittal shall be sent to both CUPDC Electrical Engineering Section and EH&S for review and comment. Submittals shall contain the following information:

1. Product information for all installed components;
2. System riser diagram with equipment and device labeling;
3. Wire color coding table and/or schedule;
4. System battery stand-by calculations;
5. Special system requirements (voice evacuation, interlocks with other systems such as air handler shutdown, smoke purge, fire pump, generator, etc.)
6. System labeling materials and methods as described in this section.

D. Refer to CU Design and Construction Standard 16010 for additional submittal requirements.

1.03 SYSTEM DESCRIPTION

A. Central Station Connection

1. A Digitize Systems, Inc. Central Station monitors Cornell University’s fire alarm main control panels (FACPs).
2. Existing zone style FACP’s tie into the Central Station via a dedicated copper communication line in the building and a reverse polarity module in the FACP.

3. New installations of addressable style FACP’s shall be tied into the Central Station via a dedicated copper communication line in the building and a Digitize Systems, Inc. “Mux Pad.”

4. It is the responsibility of the project to pay the costs associated with providing and installing the “Mux Pad” station, including interconnecting cabling and conduit from the FACP.

B. Fire Alarm System

1. System shall be of the 24 VDC point-addressable, closed-circuit design type.

2. There shall be only one fire alarm control panel per building complex. Multiple fire alarm panels are unacceptable. “Cross-tripping” of panels is unacceptable.

3. Where suppression release systems are required, the use of the main fire alarm control panel is preferred if listed for releasing. When a release panel is necessary, the release panel trouble and alarm conditions shall be monitored by the FACP.

4. Notification appliance circuits shall be of the Style Z (Class A) type.

5. Signaling line circuits shall be of the Style 4 (Class B) type except in Class R2 occupancies (i.e., dormitories, sorority and fraternity houses, etc.) that shall be of the Style 6 (Class A) type.

6. Low-temperature alarms (to indicate trouble on sprinkler zone if building’s ambient temperature drops below 40°F) shall be installed in buildings that are not provided with Cornell University steam.

C. System Operation and Performance

1. System operation and performance shall include, but not be limited to, the following features conforming with the latest edition of NFPA 72 adopted by the Building Code of New York State (BCNYS):
   a. Manual alarm initiation;
   b. Automatic alarm initiation;
   c. Activation of alarm notification appliances;
   d. Activation of fire safety functions;
e. Activation of fire suppression systems;

g. Monitoring generator status (“failure to start” and “run”) where the fire alarm panel is powered by a generator in accordance with NFPA 72.

h. Processing monitoring supervisory signals;

j. Activation of off-premise signals via the “Mux Pad”;

k. Supervision of automatic fire pumps and special service pumps in accordance with NFPA 20, *Standard for the Installation of Centrifugal Fire Pump*, latest edition adopted by BCNYS.

2. Activation of any manual or automatic initiating device shall cause, but not be limited to, the following action or effects:

a. Activation of alarm notification appliances;

b. Activation of fire safety functions (i.e., elevator recall, operation of smoke/fire doors, smoke dampers, fan control, etc.);

c. Activation of emergency voice/alarm communications;

d. Transmission of alarm signal by a Digitize, Inc. “Mux Pad” to the Central Station;

e. Indication of alarm condition including the device, zone, or location from which the alarm condition was activated by alpha-numeric display at main fire alarm control panel, remote annunciators, and the Central Station.

f. Activation of a duct smoke detector shall shut down its associated air handler and provide a supervisory trouble where permitted by the authority having jurisdiction.

g. Control of the air system as the function of a fire alarm device shall be exclusively by the FACP. Building automation system control is NOT permitted.

1.04 REPROGRAMMING

A. Provide two reprograms of the system by the Manufacturer’s Representative after the panel has been accepted by Cornell University’s Environmental Health & Safety at no additional cost, charge, or fee to Cornell University.
1.05 CONTRACTOR REQUIREMENTS

A. The Contractor providing the fire alarm and detection system shall be licensed per Article 6D of the New York State General Business Law.

1.06 FIRE ALARM SYSTEM DESIGNER REQUIREMENTS

A. The design of the fire alarm and detection system shall be performed by a qualified individual certified as either a National Institute for Certification in Engineering Technologies (NICET) Fire Alarm Systems Level III, or as a Licensed Professional Engineer.

1.07 SYSTEM IDENTIFICATION/LABELING

A. Provide lettered plates for the following equipment, components, and accessories. The plate shall contain the equipment identification (custom panel number, area served), as well as power circuit source and breaker number. Label shall be plastic lamicoid engraved plated or approved equal. (Note: ALL Lettered plates shall be reviewed and approved by Cornell University’s Environmental Health and Safety prior to installation.)

1. Fire Alarm Control Panels
2. Remote annunciators
3. Digitize “Mux Pads”
4. Remote power supplies

B. Provide type-written directories on the following equipment, components, and accessories:

1. Fire Alarm Control Panels (non-addressable systems)
2. Remote annunciators (non-addressable systems)

C. Provide computer-generated adhesive labels and install on the bases of all initiating device and notification appliances, as well as any remote test and monitoring station. The label shall indicate the address and must be legible from a standing position below.

1. Labeling guideline for signaling line circuit (SLC):
   \[ \text{FACP/Board} - \text{Loop/cct #} - \text{Device #} \]

2. Labeling guideline for notification appliance circuit (NAC):
   \[ \text{FACP/Board} - \text{Loop/cct#} - \text{Device # (where addressable)} \]
D. Initiating, notification, signaling, and other fire alarm system wiring, circuits, and conductors shall be color coded and identified by number at termination points (i.e., control panels, remote annunciators, etc.) and splice points (i.e., junction boxes, splice boxes, etc.). Wiring shall be consistent throughout the system with no color changes on individual loops from the FACP.

E. Junction and splice boxes containing fire alarm system wiring, circuits, and conductors shall have red covers and marked “FIRE ALARM” in ¾” (three-quarter inch) white letters.

F. End-of-line resistors in two-wire systems shall be located at the fire alarm control panel, if feasible; otherwise, end-of-line resistors shall be installed in designated junction boxes with red covers and marked in accordance with the specifications of this section (see § 1.07, Para. D. and E. above).

PART 2: PRODUCTS

2.01 CONDUIT, WIRE, AND BOXES

A. Conductors for the initiating device circuits shall be #18 AWG (minimum) stranded THHN copper.

B. Conductors for the notification appliance circuits shall be #14 AWG (minimum) stranded THHN copper.

C. Conductors for the signaling circuits (i.e., multiplex systems) shall be as recommended (minimum) by the manufacturer.

D. Refer to the latest BCNYS adopted version of NFPA 70 (NEC) for further requirements related to fire alarm cabling, specifically Article 760 – Fire Alarm Systems. Code may require the use of specific cable in certain applications such as for circuit integrity.

E. Initiating, notification, signaling, and other fire alarm system circuits and wiring shall be installed in a separate and independent conduit system from other system circuits. It is imperative that life safety cabling be protected from physical damage and from interference/cross communication with other system cabling (i.e. building automation system, telecommunications, and AC circuits).

F. Refer to § 2.04C for “Mux Pad” cabling requirements.
2.02 FIRE ALARM CONTROL PANEL

A. Control Panel Enclosure

1. Enclosures shall be of the heavy-gauge, galvanized steel, dead-front construction with keyed, lockable panel cover type.

2. Enclosures, panel covers, and trim rings shall be of surface, semi-flush, or flush-mounted design type, and assembled with tamper-proof screws. Panel shall be surface-mounted when installed in nonpublic spaces such as mechanical rooms, electrical rooms, and closets. Panel shall be flush mounted when installed in public spaces such as lobbies and corridors. Colors of enclosures shall match where they are installed in the same area.

B. Control Panel Operation

1. Control panel operation configuration shall be compatible for use as addressable (i.e., point identified), zoned (i.e., hard-wired), or combined addressable and zoned system.

C. Control Panel Features

1. System operating hardware including, but not limited to, the system control unit, power supply unit, keyboard display unit, analog loop unit, annunciator boards, relay boards, dual signal units, zone coder units, remote annunciator units, and other system components shall be of the solid state, plug-in module design type.

2. System operating hardware shall be functionally expandable by installing additional solid state, plug-in modules (Note: the installation of additional plug-in modules shall not require the replacement of existing equipment, components, or accessories).

3. System operating software, system configuration, and plug-in modules shall be programmable via front panel user switches or computer program.

4. Soft-key programming provided to disable the following:
   a. Audible circuits
   b. Central station tie connection
   c. Auxiliary functions such as door holders, gas valves, air handlers, preaction sprinkler systems
5. Front panel user switches including, but not limited to, alarm and trouble acknowledge, alarm and trouble silence (while system condition is in “on” or “off” position), alarm and trouble reset, battery fault, drill, bypass, municipal connection, walk-test, circuit disable, relay control, on-board trouble-shooting diagnostics, lamp test, and other switches as required by NFPA 72.

6. Annunciation lights (i.e., LED’s) shall be supervised and of the push-to-test, lock-in, manually reset, tamper-proof type for system alarm, system trouble, and main system operating power (Note: one yellow LED to indicate individual zone trouble and one red LED to indicate individual zone alarm shall be provided per zone).

7. Programmable alarm verification shall be provided for automatic smoke detection devices.

8. Ground-fault indication shall be provided for both positive and negative lines in indicating, notification, and signaling circuits.

9. Control panels shall be provided with alarm circuits and indicators to indicate sub-, main-, or multiple-processor failure.

10. Control panels shall be provided with an emergency operating feature that operates the fire alarm system including, but not limited to, equipment, components, and accessories in a general alarm configuration in the event of sub-, main-, or multiple-processor failure.

11. Control panels shall be provided with a full duplex RS-232 serial interface port to supervise output to a Digitize “Mux Pad.”

12. Fused reset module shall be provided for auxiliary and emergency function power supply (Note: auxiliary and emergency power supply to be separate from control panel power supply).

13. Filtered power source shall be provided for zones to operate smoke, heat, and duct detectors.

2.03 POWER SUPPLIES

A. General

1. Control panel and battery backup power supplies shall be provided and include the following features:

   a. 110/220 or 120/220 VAC input (power source breaker shall be red in color to identify it as part of the fire alarm system);
b. Sufficient power capacity to operate existing system and 25% (minimum) expansion of system equipment, components, and accessories;

c. Transient suppression of input, output, and municipal connection circuits.

2. Built-in solid state, dual-rate battery chargers shall be provided to maintain back-up batteries at peak power for supervisory and operating conditions during main power outages.

3. Automatic transfer of system power supply to battery back-up power supply in the event of a primary power supply failure.

B. Battery Back-Up Power Supply

1. Batteries shall be of the sealed, lead-acid type.

2. Batteries shall be capable of providing operating and supervisory power to meet the requirements of NFPA 72, as required by the latest adopted version of the Building Code of New York State (BCNYS).

3. Batteries shall be capable of providing operating power to operate alarm signals after the above minimum required time period has elapsed to meet the requirements of NFPA 72, as required by the latest adopted version of the Building Code of New York State (BCNYS).

4. Batteries shall be mounted in the main control panel enclosure or in a separate enclosure of similar type to the main control panel.

5. The Engineer of Record shall provide battery calculations to Cornell University’s Electrical Engineer and to Environmental Health & Safety during the submittal process and at the completion of the project.

2.04 CENTRAL STATION CONNECTION - DIGITIZE “MUX PAD”

A. The Project shall confirm the need for the installation of the Digitize “Mux Pad” with Cornell University’s Environmental Health & Safety early in the design phase.

B. The Digitize “Mux Pad” shall be provided as follows:

1. In capital projects, the project contractor shall furnish and install the Digitize “Mux Pad.”

2. In maintenance projects using the PDC Shops, the PDC Electric Shop shall furnish and install the Digitize “Mux Pad.”
3. Cornell University’s Environmental Health & Safety Department shall perform the associated final connections to the fire alarm control panel and communication lines.

4. A space clear of any other equipment, 24" square adjacent to the main fire alarm control panel is required for the “Mux Pad.” The “Mux Pad” will be mounted at 60" AFF to the center of the device.

C. Remote Digitize “Mux Pad” conduit system shall be included in the Contract Documents as part of the Division 16 Contract as follows:

1. One 3/4" conduit with nylon dragline from each fire alarm control panel to designated Cornell University’s System 85 communication cabinet.

2. One 3/4” conduit and Digitize Mux Pad interconnecting cable (contractor to purchase from manufacturer) between FACP and the Mux Pad. Cable should be factory pinned for proper fire alarm panel to be connected.

3. Costs, charges, and fees associated with the connection and installation of the leased telephone lines shall be included in the Contractor’s invitation-for-bid proposal.

2.05 REMOTE ANNUNCIATOR PANEL

A. Remote annunciator panel operation and features shall be similar to the main control panel operation and features (see Section 2.02, Para. B. and Para. C. above).

B. Remote annunciator panels shall be sized to adequately accommodate the required number of modules, user switches, annunciator lights, and other equipment, components, and accessories.

C. Remote annunciator panel enclosures shall be similar to the main control panel enclosures, panel covers, and trim rings (see Section 2.02, Para. A. above). (Note: Keyed locks for remote annunciator panels shall be keyed the same as the main control panel.) However, this panel shall be flush-mounted unless approved for surface-mounting by the Architect of Record.

D. Lettered identification plates for remote annunciator panels shall be similar to lettered identification plates for the main control panel (see Section 1.05 above).

2.06 INITIATING DEVICES

A. Manual Pull Stations

1. Manual pull stations shall be of the non-coded, double-action type.
2. Keyed, latching covers of the automatic reset type shall be provided. (Note: Keyed locks for manual pull stations shall be keyed the same as the main control panel.)

3. Manual pull station housings and doors shall be red in color unless approved by Cornell University’s Planning, Design and Construction Department (Note: Manual station and wall shall be contrasting colors as required by NFPA 72).

4. Manual pull stations shall be installed in accordance to applicable Codes and Standards (see CU Design and Construction Standard 16010, Section 1.01 “Codes and Standards”).

B. Smoke Detectors

1. Smoke detectors shall be of the low profile, solid state, photoelectric or ionization type and shall be compatible for use in addressable, zoned, and combination addressable and zoned systems.

2. Smoke detectors shall be compatible for use in Style D (Class A) and Style B (Class B) circuits. (Note: Special power supplies or compensating devices shall not be required for smoke detectors to properly operate in circuits containing other Style D and Style B initiating devices. Also, Style B (Class B) smoke detectors shall not be used in initiating circuits unless provided with a separate 24 VDC control power supply.)

3. Smoke detectors shall be of the plug-in, lockable head-base type unit and shall each include a power-on indication light, steady alarm-mode indication light, 360° view angle, 360° smoke entry, removable thirty (30) mesh per square inch insect screen, and back pressure and rear-entry flow seal to restrict entry of dust, dirt, and air turbulence.

4. Photoelectric smoke detectors shall be free of radioactive material and completely shielded and electronically protected from RF (i.e., radio frequency) and EM (i.e., electromagnetic) interference.

5. Smoke detectors serving sleeping rooms other than in suites or apartments shall be 24 volt DC, combination smoke and thermal with a local sounder. Power to the detector shall come from the main fire alarm control panel (FACP) or supplemental power supply and shall be supervised to indicate a “trouble condition” if power is lost anywhere on the loop. Activation of the thermal element in the detector shall activate the main FACP to alarm. Removal of the detector shall cause a trouble signal at the main FACP. Activation of the smoke detector shall sound the local sounder in the unit.

6. Smoke detectors serving suites or apartments interconnected per NFPA 72 using one of the following two methods. System shall be reviewed with Cornell University EH&S and PDC Electrical Section prior to design:
a. Devices shall be 115VAC smoke detector with isolated thermal contacts. Smoke detectors shall be interconnected as required by NFPA 72. Activation of the thermal element in the detector shall activate the main FACP to alarm. Auxiliary power requirements for smoke detectors shall include preferred connection to building emergency generator; otherwise provide 9VDC battery backup.

b. Devices shall be 24VDC smoke detector (powered by FACP or supplemental power supply) with isolated thermal contacts. Activation of the thermal element in the detector shall activate the main FACP to alarm. System smoke detection and alarm configuration to be coordinated with Cornell University EH&S.

7. Dedicated smoke detectors that control smoke hatches, smoke/fire doors, and other similar type emergency equipment shall be located within the immediate vicinity of the controlled equipment.

8. Duct smoke detectors shall be provided with air duct detector housings and remote indication, test, and reset stations (Note: Duct detector housing shall be compatible for use with ionization type smoke detectors in Style D (Class A) and Style B (Class B) circuits). Test/Reset stations shall be mounted at 80" AFF in readily accessible areas, adjacent to or within sight of the duct detector. Stations shall be grouped together where possible and shall be labeled with each device served (see §1.05).

9. Smoke detectors shall comply with UL 268 criteria, be UL listed for use with the associated equipment, components, and accessories, and have a proven record of on-line operation of no less than three (3) years.

10. Smoke detectors and duct detector remote indication/test/reset stations shall be installed in accordance with applicable Codes and Standards (see Section 16010, 1.01 - Codes and Standards).

11. Smoke detectors shall not be installed in bathrooms with showers, janitor closets, kitchens, or immediately adjacent intake/exhaust vents, or other areas where false or nuisance alarms may occur.

12. Smoke detectors shall be a minimum of 3 feet from all supply and return air diffusers and ceiling paddle fans.

C. Heat Detectors

1. Heat detectors shall be of the low profile, solid state, fixed temperature or dual-action combination fixed temperature/rate-of-rise type and shall be compatible for use in addressable, zoned, and combination addressable and zoned systems.
2. Heat detectors shall be compatible for use in Style D (Class A) and Style B (Class B) circuits.

3. Dual action heat detectors shall be provided with spring-contact type, fixed temperature and self-restoring type rate-of-rise features.

4. Addressable type heat detectors shall be provided with a visual indication feature to indicate when the detector has been damaged by heat.

5. Heat detectors shall comply with UL 268 criteria, be UL listed for use with the associated equipment, components, and accessories, and have a proven record of on-line operation of no less than three (3) years.

6. Heat detectors shall be installed in accordance with applicable Codes and Standards (see Section 16010, 1.01 - Codes and Standards).

2.07 NOTIFICATION APPLIANCES

A. Notification appliances shall be of the solid state, audible, visible, or audible/visible type and shall be compatible for use in addressable, zoned, and combination addressable and zoned systems.

B. Notification appliances shall be compatible for use in Style Z (Class A) and Style Y (Class B) circuits.

C. Audible notification appliances shall be of the horn type, programmed for temporal tone output. Provide with field-adjustable sound control and output no less than 85 dBA at ten (10) feet. (Note: Field sound level testing to be performed only by Cornell University’s Environmental Health & Safety Department. Sound level adjustments to be performed by installing contractor.) In addition, conform to NFPA requirements for sleeping room notification sound levels of 75 dBA at each sleeping room pillow or 15dBA above ambient sound levels, whichever is greater.

D. Visible notification appliances shall be of the high-intensity, strobe type and output as required by Code. Visible devices shall be synchronized to flash at the same time.

E. Notification appliance housings shall be red or white in color unless approved by Cornell University’s Planning, Design and Construction (Note: the device and wall shall be contrasting colors as required by NFPA 72).

F. Notification appliances shall be installed in accordance with applicable Codes and Standards (see CU Design and Construction Standard 16010, 1.01 - Codes and Standards).
1. Note: In residence halls provide two (2) notification appliance circuits (minimum) per building floor with circuiting connected to alternating devices to provide redundancy of coverage.

G. Coordinate mounting heights of notification devices in all areas with NFPA 72. Note that strobe locations vary by manufacturer; pay close attention to this detail during design phase to accommodate all types and avoid rough-in problems and non-compliant devices.

H. If a voice/speaker system is required, Cornell University’s Electrical Engineer and Environmental Health & Safety shall be notified during the schematic design phase of the project. The speakers shall not be used for general public address announcements.

I. The use of 70VDC for building voice evacuation systems will be considered by Cornell University’s Planning, Design and Construction and Environmental Health & Safety.

2.08 ELECTROMAGNETIC DOOR HOLDERS

A. Electromagnetic door holder shall be of the wall-mounted type and provided with a horizontal-adjustment feature that permits a horizontal adjustment of 25° (minimum). Integral holder/closer is not recommended.

B. Electromagnetic door holders shall be normally energized and immediately operated (i.e., de-energized) upon any local, or system alarm condition.

C. Electromagnetic door holder operating voltages shall be 24 VDC (Note: Electromagnetic door holder power supply circuits shall be independent of fire alarm system power supply circuits) unless reviewed and approved by Cornell University’s Planning, Design and Construction Electrical Engineer or Environmental Health & Safety.

2.09 SPRINKLER SYSTEM DEVICES

A. Vane-type water flow switches with adjustable surge protection delay (to prevent false or nuisance alarms) shall be installed on wet-type sprinkler system piping.

B. In-line type low-pressure switches shall be installed on dry-type sprinkler system piping. (Note: Low-pressure switches shall be provided with an independent fire alarm zone in new installations.)

C. Supervisory-type switches shall be installed on each sprinkler valve (to indicate trouble condition if the valve is closed). (Note: Supervisory switches shall be provided with an independent fire alarm zone in new installations.)
D. Low-temperature alarms (to indicate trouble on sprinkler zone if building’s ambient temperature drops below 40°F) shall be installed in buildings that are not provided with Cornell University steam.

2.10 ACCEPTABLE MANUFACTURERS

A. The fire alarm system shall be a complete operating system of one manufacturer.

B. The equipment, components, and accessories shall be as specified by Cornell University’s Planning, Design and Construction Electrical Engineering Section. Requests for authorization to substitute, vary, or change the specified equipment, components, or accessories of the approved manufacturer may be submitted, in compliance with Cornell University’s Design and Construction Standards (see Section 01001 - General Requirements), to Planning, Design and Construction’s Electrical Engineering Section prior to the Contractor’s submission of the invitation-for-bid proposal.

C. Acceptable fire alarm system manufacturers are: Fire Control Instruments (FCI), Notifier, and Edwards System Technologies (EST); other makes are unacceptable.

END OF SECTION