## SECTION 28 46 21

# FIRE ALARM SYSTEMS

#### **PART 1 - DESIGN DIRECTIVES**

#### 1.1 CAMPUS LIFE SAFETY SYSTEMS DESCRIPTION

- A. Proprietary Supervising Station Operated by Dartmouth College:
  - 1. Utilizes a campus-wide life safety monitoring system.
  - 2. Supervises the college's fire alarm systems.
  - 3. Life Safety Monitoring System: Keltron LS 7000 event management system.
    - a. Monitors the following:
      - 1) Campus building fire alarm systems
      - 2) Emergency generators
      - 3) Carbon monoxide alarm systems.
  - 4. Conditions are annunciated at the following:
    - a. Power Plant
    - b. Safety and Security building
    - c. Facilities Operations & Management building
    - d. Hanover Fire Department Dispatch Center.
  - 5. Notifies campus and town officials of various events at protected premises in the form of alarm, trouble and supervisory signals.
- B. Keltron Life Safety Monitoring System:
  - 1. Receives alarms via campus network:
    - a. Utilizes a Keltron network transmitting device (NET 922) at the building, connected to the serial output of the addressable building fire alarm panel,
    - b. Utilizes a Keltron contact transmitting device (NET 924) connected to the contacts of the conventional building fire alarm panel, CO detection panel, and/or generator (maintenance switch) monitoring module contacts.
    - c. Receives alarms from off-campus facilities via a Keltron network transmitting device (NET 922 or NET 924 if non-addressable) that similarly connects to a separate VPN appliance powered by a dedicated UPS, which in turn connects back to the campus network through a broadband service provider instead of directly.
  - 2. Dartmouth's Network Services:
    - a. Provides VPN appliance and UPS.
    - b. Maintains a separate network switch, powered by a dedicated UPS. Provides required communications during extended power outages.
    - c. Provides IP Addresses for use on the Fire Alarm Network.
- C. Dartmouth College Buildings: All planned for full evacuation upon fire alarm.

- D. Dartmouth College's Mass Notification System: Is not intended to be automatically transmitted/annunciated within buildings through the fire alarm systems.
- E. Hanover Fire Department: Requires a bi-directional amplifier be installed in buildings where necessary for adequate radio operation within the building.
  - 1. A bi-directional amplifier (BDA) shall be planned for installation.
  - 2. Testing upon building construction completion may allow omission of the BDA.

# **1.2 DESIGN CRITERIA**

- A. Design of fire alarm system renovations and new fire alarm and detection systems:
  - 1. By qualified and certified Licensed Professional Fire Protection Engineers.
    - a. System Design Planning Meeting: Consultant will provide credentials for Designer of Record to Dartmouth College representatives.
  - 2. Exception: With approval of FOM-Engineering and Project Manager.
    - a. Licensed Professional Electrical Engineer or Individual NICET Certified for Fire Alarm Systems Level III minimum.
      - 1) May design fire alarm system renovations and new fire alarm and detection systems.
        - a) For small buildings: Less than 10,000 sq ft without atriums or other complex or integrated fire protection systems or fire/smoke separated building sections.
- B. Acceptance Testing/Commissioning: By the Fire Protection Engineer of Record.
  - 1. See Part 3 Execution.
  - 2. Exception: Commissioning Agent will witness and certify the Contractor's performance of systems operation.
    - a. For small buildings: Less than 10,000 sq ft without atriums or other complex or integrated fire protection systems or fire/smoke separated building sections.

## **1.3 COORDINATION WITH LOCAL FIRE DEPARTMENTS**

- A. Facilities in the Town of Hanover: Contact the Town of Hanover Fire Department for:
  - 1. Location of fire alarm annunciator panel.
  - 2. Location of exterior beacon.
- B. Facilities in Other towns: Contact Local Fire Department for:
  - 1. Location of fire alarm annunciator panel.
  - 2. Other requirements.
  - 3. Automatic transmission of fire alarm (via dialer, town master-box, etc.).
  - 4. Knox box keying.

## **1.4 DESIGN DIRECTIVES**

- A. Fire Alarm Systems: Addressable and will include an emergency voice evacuation system for fire alarm notification and for manual messaging within facility.
  - 1. Exceptions: As approved by DC FOM-Engineering and DC Fire Safety Supervisor, with Hanover Fire Department agreement, and in consultation with FOM-Operations.
- B. Duct Smoke Detection:
  - 1. Area Smoke Detectors: Preferred means of smoke detection where operation of duct smoke dampers is required.
    - a. Designs: Include a presentation/description of option for area smoke detection versus duct smoke detectors for Dartmouth College's review during design phase of project.
- C. Fire Alarm System Design:
  - 1. Notification appliance circuits: Class A
  - 2. Initiating and Signaling circuits: Class A
  - 3. Notification method: Voice/speaker
  - 4. Isolation Modules: On each floor and no more than 25 addressable devices on each signaling-line circuit between isolation modules
  - 5. Disable/Bypass Switches: to disable the following:
    - a. Smoke detectors on a floor-by-floor basis. Do not isolate pull stations
    - b. Speaker and strobe circuits on a floor-by-floor basis
    - c. Door hold-open devices
    - d. Elevator recall operation
    - e. HVAC shutdow.
    - f. CO detectors if applicable
    - g. Furnace Trip if applicable
  - 6. Fire Alarm System: Must monitor the Generator; 3 monitoring modules:
    - a. Generator Run
    - b. Generator Alarm
    - c. Generator Not in Auto
  - 7. FA System: Monitor Generator Maintenance Switch; 1 monitoring module:
    - a. Generator Maintenance Switch Off Normal
- D. Fire Alarm Wiring: Installed in a system of EMT
  - 1. 3/4 inch minimum for circuits
  - 2. 1-1/4-inch minimum for risers
  - 3. Raceways, Boxes and Pull Fittings of Fire Alarm Raceway System: Painted red
  - 4. Accessibility Requirements for raceways and junction boxes detailed in other sections of the standard will be strictly enforced on fire alarm installations.
    - a. Exceptions: FPL MC Cable (red)

- 1) Upon FOM-Engineering and FOM Life Safety Shop Supervisor approval.
  - a) Fire alarm wiring in locations such as small wood-framed building and/or existing renovations where conduit installation is not feasible.
- E. Circuits for Initiating-Device, Notification-Appliance, and Signaling-Line:
  - 1. Class Designation:
    - a. SLC Pathway Class Designations: Class A
    - b. Speaker Circuit Class Designation: Class A
    - c. Strobe Circuit Class Designation: Class A
    - d. Pathway Survivability: Level 0
    - e. Isolation Module: Installed on each floor and no more than 25 addressable devices on each signaling-line circuit between isolation modules.
- F. Color Coding:
  - 1. Notification Appliance Circuit; Strobes:
    - a. FPL MC Cable: Red
    - b. Twisted Pair: THHN red/black in 3/4-inch EMT
    - c. Conductors: Solid copper
  - 2. Signaling Line Circuit:
    - a. FPL MC Cable: Red
    - b. Twisted Pair: THHN brown/purple in 3/4-inch EMT
    - c. Conductors: Solid copper
  - 3. Speaker Circuit:
    - a. FPL MC Cable: Red
    - b. Twisted Pair: FPL blue/white shielded "red jacket" in 3/4-inch EMT Conductors: Solid copper. Shielded as may be required by manufacturer
  - 4. 24 VDC Circuits: THHN blue/white
- G. Smoke & Heat Detectors:
  - 1. Locations:
    - a. Smoke Detector: Electrical, tel/data and storage rooms, and concealed but accessible areas such as heated crawl spaces and attics.
    - b. Heat Detector: Cold attics, mechanical spaces, and dirty environments such as dirt floor crawl spaces.
  - 2. Smoke Detectors: Unless otherwise indicated
    - a. Remote Control Type: Digital-addressable
      - 1) Fire Alarm Control Unit:

- a) Individually monitors for calibration, sensitivity, and alarm condition.
- b) Individually adjusts for sensitivity
- c) Capable of identifying detector's location within the system and its sensitivity setting.
- 2) Operator at Fire-Alarm Control Unit: With the designated access level, will be able to manually access the following for each detector:
  - a) Primary status
  - b) Device type
  - c) Present average value
  - d) Present sensitivity selected
- 3) Sensor Range (normal, dirty, etc.): Accessible from fire-alarm control unit.
- H. Duct Smoke Detector Test/Reset Switches:
  - 1. Key type
  - 2. Test/Reset Station Mountings:
    - a. 80 inches AFF in readily accessible areas, adjacent to or within sight of the duct detector
    - b. Group together where possible and label with each device served.
    - c. Where Located Above Accessible Ceilings: Provide markings or other visible means to identify switch locations above the ceiling.
  - 3. Location: To be easily maintained on a regular basis.
  - 4. Access: Allow removal of the tube.
    - a. If Ladders Access is Required: Provide a permanently installed ladder wherever possible.
- I. Pull Stations:
  - 1. Red color
  - 2. Manual Pull Stations: Non-coded, double-action, pull-lever type
  - 3. Keyed Reset
  - 4. Latching Covers: Automatic reset type
- J. Knox Box:
  - 1. Recessed wall mounted at building exterior. Near entrance where fire alarm system annunciator is located
  - 2. Keying: By local fire department
    - a. Dartmouth College FO&M Fire Safety Shop Supervisor: Will perform keying if fire department does not require a knox box.
- K. Smoke Evacuation Systems: 3-way selector switch; bypass/auto/over-ride. Wire to provide a panel trouble when switch is not in the auto position.
- L. Addressable Fire Alarm Panels: Must support laptop PC connection to interrogate system for troubleshooting and programming.

- M. Buildings with Conventional System (Non-Addressable): Pull stations must not be on the same loop as smoke and heat detectors.
- N. Surge Suppression Devices: On power input to fire alarm control panels
- O. Range Hood Fire Suppression Systems: Install for all ranges. Connect to the fire alarm system by means of a monitor module.
- P. Transmission of Fire Alarm Signals:
  - 1. Addressable FACPs:
    - a. Keltron NET922 with appropriate chip for manufacture/model fire alarm control panel
  - 2. Non-Addressable FACPs:
    - a. Four Contacts: Keltron NET924
    - b. Eight Contacts: Keltron NET928
  - 3. Other Contact Devices to be monitored by the Campus Life Safety Monitoring System:
    - a. Four Contacts: Keltron NET924
    - b. Eight Contacts: Keltron NET928
  - 4. Contacts: Pre-programmed on the Dartmouth Keltron monitoring system as follows:
    - a. Fire alarm
    - b. Fire trouble
    - c. Supervisory
    - d. Carbon monoxide alarm
    - e. Generator run
    - f. Generator alarm
    - g. Generator not in auto
    - h. Generator maintenance switch, 'Off Normal
  - 5. Detail Sketch for Keltron Transmitting Device Installation on Campus Network:



6. Keying: Keying for panels, pull stations and other keyed devices shall be standardized to: Cat 30.

## **1.5 IDENTIFICATION/LABELLING:**

- A. Address label is required on every device
- B. Duct detectors above accessible ceilings shall have label/marking (on ACT ceiling grids or access panels) or other visible means to identify locations of duct detector test switches.
- C. 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 laminoid engraved plated or approved equal.
  - 1. Fire Alarm Control Panels
  - 2. Supplementary Notification Appliance Circuit [SNAC] Panels
  - 3. Remote power supplies
- **1.6** WARRANTY for Fire alarm system equipment shall be for 2 years after installation.

## PART 2 - PRODUCTS

- **2.1** ACCEPTABLE EQUIPMENT MANUFACTURERS:
  - A. Fire Alarm Systems
    - 1. Mircom Addressable and Conventional
    - 2. Notifier Addressable and Conventional
    - 3. Secutron Conventional systems only
    - 4. Other to match existing system by approval of Dartmouth College FO&M Fire Safety Shop Supervisor only. [Gamewell-FCI]

## 2.2 SMOKE ASPIRATING DETECTION SYSTEMS

- 1. VESDA
- 2. Other
- B. Transmitting Devices
  - 1. Keltron

#### **PART 3 - EXECUTION**

#### 3.1 INSTALLATION

- A. Fire Alarm Wiring: Installed in a system of EMT, 3/4 inch minimum for circuits, and 1-1/4 inch minimum for risers.
- B. Paint Red: Raceways, boxes and pull fittings of fire alarm raceway system. Accessibility requirements for raceways and junction boxes detailed in other sections of the standard will be strictly enforced on fire alarm installations.
  - 1. Exceptions: Fire alarm wiring in some locations such as small, wood-framed buildings and/or existing renovations where conduit installation is not feasible.
    - a. FPL MC Cable (red) may be accepted, upon approval by FOM-Engineering and FOM Life Safety Shop Supervisor,
- C. Color Coding of Wiring/Cable as Follows:
  - 1. Notification Appliance Circuit (Strobes): FPL MC Cable (red) and twisted pair THHN
  - 2. Red/Black in 3/4-inch EMT: All conductors solid copper
  - 3. Signaling Line Circuit: FPL MC Cable (red) and twisted pair THHN brown/purple in 3/4-inch EMT: All conductors solid copper
  - 4. Speaker Circuit: FPL MC Cable (red) and twisted pair FPL blue/white shielded "red jacket" in 3/4-inch EMT. All conductors solid copper (shielded as may be required by manufacturer)
  - 5. 24 VDC circuits: THHN blue/white
- D. Fire Alarm Components: Install per NFPA 72 and the manufacturer's written instructions
- E. Circuit Breakers Supplying Power to Fire Alarm Panels: Equip with a red colored locking device preventing the accidental operation of the breaker to the off position.

## **3.2 COORDINATION**

- A. Coordination with Dartmouth Campus Keltron Monitoring System:
  - 1. Project/Contractor: Furnish services of Keltron technician for programming and testing at Keltron transceiver and campus Keltron head-end.
  - 2. Coordinate with Keltron technician for documentation, connections, descriptor nomenclature, and testing from the FACP and Keltron transmitting device to the Keltron receiving station.

- 3. Coordinate with the Keltron manufacturer to ensure new Keltron Transceiver chip set matches the FACP manufacturer.
- 4. Coordinate with Dartmouth Network Services for active data connection.
- 5. Coordinate with Dartmouth College FO&M Fire Safety Shop Supervisor for connection to and programming of the Keltron head end equipment.
- B. Coordinate with Dartmouth College FO&M Fire Safety Shop Supervisor for fire alarm system shutdowns.

## **3.3 PRE-PROGRAMMING DOCUMENTATION**

A. Device Address List: A list identifying each device, associated address, and proposed label verbiage. List is to be reviewed by Engineer of Record, Dartmouth FOM Engineering and FOM Life Safety Shop Supervisor.

# 3.4 FIELD QUALITY CONTROL, COMMISSIONING AND ACCEPTANCE TESTING

- A. Installing Contractor: Perform all required field quality control activities, including documenting and submitting functional and integrity test reports. See Records/Documentation.
- B. Commissioning Plan: Created or Reviewed by FP Engineer of Record.
  - 1. Commissioning is to include:
    - a. Equipment installation verification
    - b. Equipment functional testing
    - c. Sequence of operation testing
    - d. Fire and Building Department demonstration testing
  - 2. Detailed Functional/Performance Testing Plan is to Include:
    - a. A per device checklist with description of actuation method
    - b. Control unit annunciations
    - c. Signal transmission sequence
    - d. Notification sequence, and all other sequences of actuations for each device
- C. Pre-Acceptance Testing/Commissioning: Witnessed by FP Engineer of Record, followed by final acceptance testing with the AHJ.

#### **3.5 RECORDS/DOCUMENTATION**

- A. Statement of Completion: Indicate the system installation, field quality control and commissioning is complete.
  - 1. A signed written statement, by the contractor, substantially in the form as follows:
    - a. "The undersigned, having been engaged as the Fire Alarm Contractor for the Baker/Berry Library Project, confirms that the fire alarm and emergency voice evacuation system equipment has been installed in accordance with manufacturer's installation instructions and specifications provided by the manufacturer, that all quality control activities have been completed, and the system is normal and ready for functional testing."

#### DARTMOUTH DESIGN & CONSTRUCTION GUIDELINES

- B. Preliminary Record of Completion: Prepared in accordance with NFPA 72.
- C. Preliminary Test Report: Statement that devices and appliances have been tested per NFPA 72.
- D. As-Built Drawings: Document deviations from shop drawings. Include wire routing, color coding, and tag notifications with exact location of equipment.
  - 1. Document exact device addresses and locations for all initiating devices.
- E. System Completion Record: Supplied by Contractor as specified in NFPA-72.
  - 1. Submit completed form to the Hanover Fire Department and Dartmouth College.

## **3.6 TRAININGS (FOR DARTMOUTH FOM FIRE SAFETY SHOP)**

- A. Two Training Sessions: Schedule for the same day.
  - 1. Fire Alarm System Training
  - 2. Fire Protection System Training

## 3.7 FALSE ALARMS FINES

A. Contractor may be assessed fines by Hanover Fire Department for false alarms initiated by the construction process.