

MIT

Design Standards

DIVISION 28 — Fire Alarm

Issued 2022



Department
of Facilities

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1. MIT FIRE ALARM SYSTEM GOALS

The goal of MIT's fire alarm system is to provide the highest level of fire detection, alarming and notification, including select toxic gas monitoring, for the safety of our MIT community, facility occupants and emergency responders. Goals secondary to public safety include reducing the Institute's exposure to property loss and interruption of education and research. A tertiary goal is to design a system capable of delivering intelligible mass notification messages. In order to meet these goals, fire detection coverage is required in 100% of all facilities. In existing buildings, projects will bring all renovated areas into conformance with Institute standards and current building codes based on the level of the alteration.

MIT operates a Proprietary Supervising Central Station fire alarm system. The system monitors only MIT alarms from contiguous and non-contiguous campus properties. The central station also monitors categories of alarms such as water flow, low air pressure, and other categories as necessary based on the program.

2. CODES AND FM GLOBAL

The Design Consultant is responsible for designing facilities which are in compliance with the most current codes and regulations for all projects which have been adopted by Massachusetts.

Current codes include, but are not limited to, the Massachusetts State Building Code - 780 CMR and the Massachusetts Comprehensive Fire Safety Code 527 CMR 1.00: Modifications to NFPA 1 Fire Code - 2015 Edition.

MIT's Underwriter is FM Global which has design and product requirements that must be adhered to. These requirements often exceed the requirements of the NFPA and Building Codes. FM Global now posts all of its data sheets online at www.fmglobaldatasheets.com. The appropriate FM Global data sheets must be reviewed during the schematic and design development phases of a project to ensure requirements for a particular project are incorporated into the design. The Engineering Design Professional must submit the basis of design, working drawings and relevant calculations for review and approval of the FM loss prevention consultant in addition to review by MIT. Further and of important note, all MIT facility designs are reviewed by FM Global for acceptance and/or comment.

3. NFPA 241 PLAN

All demolition and/or new construction operations to comply with NFPA 241 in accordance with 527 CMR Chapter 16.

NFPA 241 Construction Fire Safety Plan to be submitted with the Cambridge ISD Building Permit application as required by the City of Cambridge. All documentation to be provided to the MIT Construction Project Manager for internal review and approval prior to submitting to Cambridge ISD.

Development of the NFPA 241 Construction Fire Safety Plan to be inclusive but not limited to the following:

- Be developed by an individual knowledgeable of the applicable standards.
- Include a review of the existing space to identify existing life safety and fire protection features as necessary
- Acknowledge and be coordinated with the MIT Campus Master NFPA 241 Construction Fire Safety Program
- Inclusive of items included on the provided MIT Checklist including but not limited to:
 - Roles and Responsibilities
 - Fire Protection & Life Safety Impairments
 - Existing Fire Protection & Life Safety Systems
 - Hot work Procedures
 - Site Logistics
 - Construction Floor Plans
 - Impairment Logs
 - CFD FPPM Form

4. DESIGN REVIEW CHECKLIST

The Design Consultant is responsible for submitting this information at each phase of design for review by MIT Facilities Engineering Group. The following sections outline the items which are expected to be submitted at each phase of the design process.

3.1 Schematic Design (SD) Phase

MIT will use this submittal to develop comprehensive cost scoping for project budget development. In addition to information noted below, the documents shall include statements of conditions, known and unknown, that could affect project cost (i.e. “This portion of the ceiling is extremely tight and may require relocation of some existing services” or, “length of corridor may require multiple FA closets depending on length of wire runs and exact placement of equipment”)

It is the intent of MIT Department of Facilities that these documents identify areas of cost implication that the contractor can use to identify scope and costs that can be tracked through future phases of development.

Provide the following information in the Schematic Design submittal:

1. Provide the International Existing Building Code Level of Alteration for renovation work
2. Review of applicable codes, regulations, and standards.
3. Review and report on existing building infrastructure's impact on the design. If status is unknown through site investigation, consult with fire alarm system manufacture representative and MIT facilities engineering group fire alarm engineers.
4. System descriptions (Basis of Design/Narrative.
5. Alternative design concepts.
6. Outline specifications.
7. Equipment cut sheets.
8. Statement of probable costs.
9. Simplified one-line diagram depicting all devices.
10. Cost (order of magnitude) of third party testing.

3.2 Design Development (DD) Phase

1. Design development should include sufficient detail to capture the expected scope of the project for pricing
2. Provide documentation of applicable codes, regulations, and standards.
3. Update system descriptions/narrative/Basis of Design.
4. Alternative design concepts that require pricing.
5. Riser diagram specific to the building. Diagram shall be substantially developed in comparison to the Schematic Phase.
6. Sequence of operation input /output matrix on the drawings. Narrative form is not acceptable as required by NFPA 72.
7. Include wiring chart matching MIT standards, including color codes of new circuits. Include color coding of wiring. This will assist with the future repair, maintenance and testing.
8. Design specifications coordinated with drawings and project scope.
9. Floor plans including:
 - a. Floor identification
 - b. Location on floor
 - c. Room names and numbers
 - d. Locations of primary power sources feeding fire alarm equipment for disconnecting purposes
 - e. North arrow

- f. Graphical scale
 - g. Existing and new devices for in scope and adjacent spaces
 - h. Terminal cabinets
 - i. Control panels
 - j. Features that will affect placement of fire alarm equipment.
10. Identify on plans locations of high ceilings, ceiling types, beams, and solid joists.
 11. Equipment cut sheets.
 12. Settings of wattage of speakers.
 13. Settings of candela ratings of strobes.
 14. Confirm synchronization of strobes or provide design to synchronize.
 15. Alternating circuits shown for speakers and for strobes.
 16. Coordinate with architect on acoustic limitations of space for assurance of speaker intelligibility.
 17. Mounting requirements for devices. Include extra deep boxes where required by MIT standards.
 18. Fire Alarm electrical loads coordinated with electrical drawings.
 19. Coordination with fire suppression systems.
 20. Coordination with HVAC systems
 21. Coordination with Gas systems and MIT EHS requirements for fire alarm integration
 22. Variances approved by responsible authorities.
 23. Labeling requirements shown per MIT standards.
 24. Coordination with 3rd party testing agent included in scope.

3.3 90% Construction Documents and Construction Documents (CD) Phase

1. Include documentation required in design development phase
2. Include additional documentation and details required for a constructible system specific to the project needs, which may include building-wide fire alarm requirements outside of the project boundaries.
3. List of design changes from the Design Development issue.
4. Updated equipment cut sheets.
5. Include labeling details that match MIT latest standards. FEG or the system manufacturer can provide.

3.4 Shop Drawing Phase

1. Ensure that the shop drawing submittals comply with all aspects of the contract documents.
2. Note in writing any deviations for discussion with MIT.
3. Provide written certification that shop drawing submittals are compliant.

3.5 Record Drawing Phase

1. A draft living document of the fire alarm as-built documents and matrices shall be maintained on the job site and updated on a progress and testing basis.
2. Review record drawings and final submittals for compliance.
3. Provide a written report of compliance or deviations.

5. FIRE ALARM SYSTEMS DESIGN CRITERIA

All fire alarm systems must conform to the latest edition of NFPA 1, Fire Code, as adopted by The Massachusetts State Building Code as well as to 527 CMR 1. The design requirements that appear in the following paragraphs are based on experience with operating and maintaining MIT's fire alarm system. These requirements are to be followed without deviation, unless through discussion with the project manager and the MIT Fire Protection Engineer an alternate path is agreed on. MIT is open to alternate approaches.

This Design Guideline is not part of the contract documents that will direct the contractors work and will be the basis for a legal agreement between MIT and the general contractor. It is the responsibility of the fire alarm system designer to incorporate MIT's standards and direction into the contract documents in a manner that will provide clear direction to the contractor during both the bidding and execution phases of the project. Failure to do so will result in RFI's and eventually in change orders, since the contractor will be unaware of the areas where MIT's requirements differ from minimum code requirements.

4.1 General Requirements

For future mass notification, voice notification (emergency voice / alarm communication (EVAC) shall be designed for all new fire alarm systems.

Horns are only permitted for extensions or modifications to existing fire alarm systems.

4.2 Annunciator

An annunciator is to be located in the fire command center or main closet location if a fire command center is not required in the building, per NFPA 1.

A remote annunciator is to be located at each entrance used by the fire department access to the building, per NFPA 1.

All annunciators must be configured with the same layout and functionality, as requested by the fire department and allowed by NFPA 1. This may require each annunciator to be a node depending on the manufacturer.

The annunciators must have indicators (alarm and trouble) and bypass switches for each initiating device type (smoke detector, heat detector, manual station, water flow, tamper, etc.) by floor.

Each annunciator is required to have a microphone to broadcast live voice messages.

All annunciators are to have expanded displays with a minimum of 640 characters for detailed annunciation.

4.3 Initiating Devices

General: Any detector installed in normally locked rooms shall be provided with a remote indicating light outside the room. Control modules are needed when multiple RAIs will be installed. Provide MIT standard mounting detail on the drawings.

Heat-Sensing Fire Detectors: Heat detectors shall be of the fixed temperature type only, rate of rise detectors are not permitted. Any heat detectors mounted in normally locked rooms shall have a remote indicating light outside the room. Control modules are needed when multiple RAIs will be installed.

Devices for new and renovated systems, shall be circuited to the floors located on.

Smoke-Sensing Fire Detectors:

1. Smoke detectors are to be installed in all electrical and mechanical rooms. Often electrical panels are installed in open areas such as corridors, offices, laboratories and other spaces. Sometimes these are adjacent to transformers. These pose the same risk as panel and transformers in electrical closets. The project team and Design Engineer shall consider installing smoke detectors for early warning at these locations.
2. Smoke detectors are to be installed in plumbing rooms that contain pumps and motors.
3. Smoke detectors may be required in certain laboratory and research areas.

Smoke Detection for Air Duct Systems:

1. Duct smoke-sensing fire detectors shall be mounted so that they are accessible for service and have an accessible remote test and indicating station that can be reached from the floor or a ladder of no more than six feet in height.
2. Air sampling type smoke detectors might be required when duct smoke detectors are not accessible. This allows the components that are likely to require service to be located in a location that accessible.
3. Duct detectors shall be programmed to provide a distinct supervisory signal to the MIT operations center.
4. Occasionally, a duct will be laid out in the shop drawings in a manner that will require multiple duct detectors. The drawings or specifications should note that the additional detector is to be provided if necessary.

Projected Beam-Type Smoke Detectors: The use of beam detectors is discouraged due to maintenance costs; aspiration type systems should be considered first, unless there is no other solution.

Air Sampling-Type Smoke Detectors: Aspirating detection systems shall be engineered and detailed drawings shall be provided. Return sampling tube must be provided and unions must be provided where required for maintenance.

Radiant Energy Sensing Fire Detectors:

1. Only where required by Code, flame detectors should be provided in areas where combustion engines for generators, fire pumps or similar are located within a building. These provide the earliest warning of a fire such as at a battery arcing or along the fuel lines.

Gas Detection for Carbon monoxide: Are required in all residential and child-care, day-care or similar occupancies where sleeping may occur. The installed locations should be based on the Technical Options in accordance with 527 CMR 31.05 where detectors are located in areas that contain fossil fuel burning appliances including boilers, generators, etc.

Other locations where gas detection is required shall be designed per building codes and per NFPA requirements. Refer to MIT EH&S standards for gas detection integration with the fire alarm system.

Sprinkler Waterflow Alarm-Initiating Devices:

1. Water flow detectors shall be vane type with retard.
2. A main water flow switch shall be provided.
3. The main water flow switch should be set to activate between 45 and 60 seconds, and the floor or zone water flow switch should be set to activate between 30 and 40 seconds.

Manually Actuated Alarm-Initiating Devices: Pull stations shall be double-action and mounted at 48 inches AFF. Surface mounted manual stations shall be mounted on back boxes matching the manufacturer of the manual station.

Supervisory Signal, Initiating Devices, Generator & Transfer Switches:

1. The status (running or fault) of the generator is required to be displayed on the fire alarm control unit and all annunciators.
2. The automatic transfer switch position (normal power or secondary power source) is required to be displayed on the fire alarm control unit and all annunciators.

4.4 Notification Appliances

Horn / strobes, speaker / strobes and strobes are required to be installed so that the entire strobe lens is between 80 and 96 inches above the finished floor per NFPA 72. The notification appliances shall be located at a uniform height throughout the building. The mounting height should consider the location of notification appliances in connecting buildings when determining the mounting height.

The designer should assume that the fire alarm system will be used for mass notification in the future. NFPA 72 prohibits the appliances to be labeled 'Fire' if the equipment is used for notification purposes other than fires. The label on the appliances is required to be labeled "Alert" or not labeled.

A UL 1971 listed red 24 VDC strobe (beacon) shall be provided and mounted outside of the building at the location of fire department entry in accordance with requirements of the fire department.

The designer shall verify synchronized or unsynchronized state of existing strobes. Modify for synchronization as required.

The designer shall verify "ALERT" or "FIRE" on existing devices.

In areas where multiple circuits are provided and serve the same area, the load on each circuit should be distributed within 20% of the average of all circuits on that floor. The intent is to distribute the load over the circuits and not load circuits to their maximum. The circuits shall be loaded up to a maximum 70%.

The drawings which locate speakers and strobes shall also indicate the speaker tap setting (1/4 Watt, 1/2 Watt etc.) as part of the drawing CAD symbol. These settings shall be based on the engineers experience and knowledge of the program use for the space. Alternatively, required sound pressure levels may be indicated (75 dB, 81 dB etc.) Since it is inevitable that some of the settings will require adjustment, the specifications should require that the contractor provide one readjustment of the settings and should ask for a unit price should more than one adjustment be required.

The designer must indicate those spaces which will have notification appliances and those that will not, at the Design Development phase.

Voice intelligibility is required in sleeping units, corridors, common offices areas, conference rooms, classrooms and similar spaces. Intelligibility may be required in other areas depending on the fire alarm and mass notification strategy. For example, campus lock down procedures may require individuals to remain in private offices and if walls are soundproofed, a speaker may be required in each individual office to provide intelligibility in the offices. Locations where

intelligibility will be required should be reviewed with the MIT Fire Protection Engineer at Schematic Design phase.

If a speaker is not provided in each individual office, the fire alarm raceway system should be designed to allow for future improvements.

Confirm that required audibility will be provided in all spaces within the scope or altered by the scope. New walls or acoustic treatments may reduce audible signals below requirements.

Consider ceiling devices where they may improve visibility and audibility coverage.

Coordinate color of devices with existing and the ceiling color.

The NFPA 72 'Distinctive Evacuation Signal' is required to use square wave with a fundamental frequency of 520 Hz \pm 10 percent in all buildings regardless if the building has sleeping areas.

Where very early smoke detection apparatus are used, unions shall be provided where maintenance requires the removal and reinstallation of the tubing.

An electric bell is to be provided above all of the fire department connections to the sprinkler system. The water flow bell is to be powered from a 24 VDC power supply that is separate from the fire alarm system and capable of being activated if the fire alarm system is not operational.

4.5 Interfacing

General: The fire alarm system will likely be required to interface with a number of building systems. This interfacing is required to be coordinated through the design process. The strategy should be agreed in the design development phase and interface locations should be coordinated in the construction document phase.

Mass Notification:

1. The fire alarm system is required to be configured to receive one analog line level (0.707 VRMS or greater) audio input.
2. The fire alarm system is required to be provided with a 'low priority mass notification input' which will activate the strobes and broadcast the received audio signal through the fire alarm speakers. This signal will be configured to not override any active fire alarm messages and if a fire alarm occurs when a low priority message is active the fire alarm message is to be broadcast.
3. The fire alarm system is required to be provided with a 'high priority mass notification input' which will activate the strobes and broadcast the received audio signal through the fire alarm speakers. This signal will be configured to override any active fire alarm messages and if a fire alarm occurs when a high priority message is active the fire alarm message will not be broadcast.
4. The use of the fire alarm mass notification inputs will be determined in the future. The

use will be determined through the risk analysis and documented in the emergency response plan.

HVAC System Controls:

1. The HVAC systems should not rely on logic from the building management system to shutdown air handling units unless permitted by the MIT Fire Protection Engineer.
2. Shutdowns are preferred to be completed at the motor starter or VFD.
3. Duct smoke detectors with sampling tubes require a minimum velocity to operate, this will likely require the smoke dampers to close if the air handling unit is not operational.
4. Complex smoke control systems are preferred to be controlled by a building management system that is listed to perform smoke control functions. This strategy shall be coordinated with the designer and the MIT Fire Protection Engineer during detailed design.
5. Provide separate input/output matrix for HVAC, SMOKE, FIRE SMOKE damper controls.
6. Fire/Smoke dampers must be coordinated with HVAC. They must be able to be controlled from the 24V fire alarm system without inducing currents on the SLC circuits.
7. Each supply / return fan in the building over 2,000 cfm in capacity shall be monitored for airflow status by the fire alarm system and have a dedicated hand-off-auto (HOA) switch located on one of the cabinets located at the main fire alarm control unit and any other annunciator cabinets featuring LED / bypass switches. The HOA shall be programmed to be “green” when the airflow status device is made, “red” when the airflow device is not made, and “white” when the HOA is in AUTO.
8. Each fan shall be equipped with three (3) addressable relay modules: one “start” module to interface with the fan’s starter or VFD, one “stop” module to interface with the fan’s start or VFD, and one module to provide an output signal to the BMS that the fan has been manually commanded to start through an HOA switch. The designer shall coordinate the location of the dedicated BMS control module with Division 23. Each fan shall also be equipped with one (1) addressable monitor module to supervise airflow status from a dedicated pressure transducer on the fan.
9. A single dedicated addressable relay module shall be provided for the building that communicates to the BMS that the HVAC bypass switch on a main fire alarm control unit cabinet or remote annunciator cabinet has been actuated. This relay will allow for any fan which is shutdown during testing to automatically restart once the fire alarm system has been reset or returned to normal status.
10. Fire / smoke dampers, when provided, shall be monitored for position status (open / closed), regardless of whether they are associated with a smoke control system or not. Non-smoke control fire / smoke dampers shall have their status annunciated at a main fire alarm control unit cabinet and any remote annunciator cabinet with LED / bypass capabilities. All fire / smoke dampers shall be equipped with a pre-manufactured accessory enclosure cabinet by Space Age Electronics containing four (4) addressable

modules and a local bypass switch: one addressable relay provided for damper control (interfaced with 120VAC power through an interposing relay), two addressable monitor modules for damper position status supervision and one addressable monitor module for bypass switch supervision.

11. Fire / smoke dampers equipped with duct detectors requiring a minimum airflow velocity shall be programmed to close when all of the fans associated with the dampers are off. Each air system associated with a set of fire / smoke dampers shall be provided with an addressable monitor module that will supervise a “damper open” signal from the BMS when a system comes out of unoccupied mode. Once the signal is received, the fire / smoke dampers shall be commanded to open.
12. Where air handling systems enter a rated shaft with a fire / smoke damper that when closed would cutoff supply to the riser, the duct detector associated with said damper shall be programmed to shutdown the associated air system and after a 60 second delay close all fire / smoke dampers in the associated ductwork.

Access Control:

1. Control modules must be provided at each security card access controller for control of floor exit and stairwell doors for egress, elevators, and other similar functions. The team must coordinate with campus security.
2. All fire alarm control panels shall be provided with a switch for manual release of doors.
3. The use of delayed egress doors may require smoke detectors located within the vicinity of the doors or complete smoke detection in the areas.

4.6 System Power

If a generator exists in the building to provide emergency or standby power, the fire alarm system should be connected to an emergency or standby power source. The NFPA 72 reduction in duration to 4 hours is not permitted because generators on campus are not provided with 24 hour fuel supply.

The secondary power supply calculations should be based on operating the fire alarm system for 24 hours in standby operation followed by 15 minutes for full building alarm including all increases for future expansion and all addresses are used on each SLC card. The batteries shall be sized to provide an additional 50 percent of the calculated load, i.e. calculations require 50 AH batteries, 75 AH batteries are required to be provided.

The MIT campus Red Loop which provides emergency power to many of the older buildings on campus shall not be considered the same as having a generator specifically serving the building or buildings.

The calculations should assume that the signaling line circuit cards and amplifiers are fully loaded. This eliminates the need to update the power supply calculations when a detector or speaker is added to the circuit.

Upon loss of AC power the doors shall release after 10 seconds, therefore the load is not required to be included in the standby battery calculation.

4.7 Raceway and Conduit

Communication wiring from node to node in the fire alarm system shall be provided with 2-hour rating for survivability.

Fire alarm conduit shall be 3/4 inch minimum, EMT conduit with fittings painted red. Conduit fill shall not exceed 40 percent. The conduit fill should include 20 percent spare space in all conduits and 40 percent in all risers for installation of cabling in the future. This allows for addition of conductors without having to add raceways.

Extension rings are not permitted. The contract documents will need to require extra deep or specialty back boxes to be provided.

Above 10 feet and where concealed and not visible, MC cable is permitted; below 10 feet install fire alarm cable in rigid conduit.

Terminal cabinets shall be 14 GA steel painted red with a continuous piano hinge and marked "Fire Alarm Terminal Cabinet". The cabinets shall include tool-less terminal strips. The terminal cabinets are required to have a keyed lock that is keyed the same as the fire alarm system in the building.

Provide terminal cabinets on each floor where served from a node on a floor above or below. Terminal cabinets shall be located for maintenance without the use of a ladder.

If speakers are not installed in each individual office, an additional junction box should be located in the raceway system to allow for a speaker to be easily added to the office in the future. This has been beneficial when the acoustics for the office have been revised to reduce sound from outside the office.

In architecturally sensitive finished areas where conduit must be exposed specify surface mounted raceway, Wiremold 700 or equal.

In locations where surface mounted conduit is installed, skirts shall be provided around junction boxes for devices and appliances. The size of the skirts is to be coordinated with the fire alarm equipment manufacturer. The skirts are to be continuously welded at all seams, the welds sanded smooth and painted to match the installed surface.

For ceiling mounted devices, provide extra deep backboxes by SpaceAge or otherwise sized to improve maintenance.

4.8 Circuiting and Cabling

General:

1. MIT has a specific color code for all fire alarm cabling. The color must be in accordance with the table that follows this section as an appendix. MIT has developed this legend to make future system maintenance and troubleshooting is easier for the Repair and Maintenance personnel and reduce system downtime, which is an important safety factor as well. While the wire is available from local suppliers it is not always a stock item and there could be lead time and minimum order issues. Be sure that there is language to get this requirement on the table early in the contractor's submittal process. The documents must require that the cable be submitted early in the construction phase.
2. Communication wiring from node to node in the fire alarm system shall be provided with 2-hour rating for survivability.
3. For renovation projects, the extension of existing circuits shall match the existing circuit color codes.
4. The minimum wire size of any conductor is 16 AWG.
5. All wiring is required to be stranded. All cabling is required to be 7 strands.
6. All fire alarm cabling is required to be installed in conduit to provide mechanical protection.
7. All calculations shall be completed using the lump sum method, distributed load calculations are not acceptable.
8. No splices, t-taps or inline terminal block connections are allowed. All wiring shall be point to point from device to device. The use of wire nuts is not permitted, since loose cables connected by wire nuts are difficult to find and trouble shoot.
9. The cable shall terminate under saddle plates or be terminated with an insulated fork compression terminal where saddle plates are not provided.
10. End of line resistors, where used, shall be in the floor terminal cabinets at the riser. End of line resistors are permitted to be installed in the monitored device (i.e. water flow, tamper switch, four wire carbon monoxide detector, etc.) when only one device is being monitored by the fire alarm system.
11. MIT will provide the cabling for the Active Multiplex Transmission System (XA loop). The contractor will be responsible for determining the length, acquiring, installing and returning the unused cabling to MIT. The contractor will work with the MIT electricians on the termination of the cabling.

Signaling Line Circuits:

1. All signaling line circuits are required to be designed as a Class X circuit. Isolation is required between floors. Field isolation modules are not preferred.
2. New installations are not permitted to exceed 70 percent of the total available addresses. This allows for additional equipment to be installed on the fire alarm system.

Notification appliance circuits:

1. The NAC calculations should include an additional 20% increase in circuit load and length for future expansion. This is a minimum requirement as buildings that are expected to undergo significant changes may require a larger increase for future expansion.
2. Class A circuits should use the entire circuit length with the load located at the end. Assuming the load is at the middle of the circuit is not acceptable.
3. A minimum of two notification appliance circuits are required per floor. The circuits should alternate so that a fault on one circuit would maintain notification on a floor. If a room contains two notification appliances, each appliance should be connected to a different circuit.
4. Class B notification appliance circuits are permitted for dedicated speakers in stairs.
5. In dormitories, the speakers in the corridor are to be connected to different circuits than the sleeping and dwelling units. This allows for the speakers to remain operational in the corridors in the event of tampering within the rooms.
6. In dormitories, the audible and visible notification circuits serving notification appliances within the housemaster's apartment are required to be connected to a dedicated circuit. This requirement is intended to minimize disruption caused by testing.

4.9 Residential Fire Alarm

Each dormitory room or suite requires a single station addressable smoke sensor with sounder base. Standalone smoke alarms (directly powered with 120V power) are not permitted to be installed. System smoke detectors are used.

The designer shall indicate suites on the design drawings. All sounders shall operate when any detector within the suite is activated.

Sounder bases shall be programmed to sound the NFPA 72 'Distinctive Evacuation Signal' (Temporal Three) tone.

A dedicated SLC loop is required for dormitory room or suite smoke sensors on each floor.

Tampering of any fire alarm equipment within the sleeping or dwelling unit should not impact the operation of the fire alarm equipment that is not located in the sleeping or dwelling unit. The floor devices (smoke sensors, manual pull stations, water flow devices) shall be independent of the SLC loop that monitors the dorm room / suite sensors.

The SLC loop shall be a dedicated channel from the fire alarm control unit and shall not be "isolated" or "split" from the SLC loop monitoring other floor devices. This requirement may differ from normal fire alarm practice and must be specifically called to the contractor's attention.

Where there are two or more rooms that form a suite with a common hallway or study area, a smoke sensor shall be installed in the hallway/common area in addition to the bedrooms.

Tactile notification appliances (bed shakers) will be required in rooms occupied by hearing impaired students. A detail of the wiring for this system is attached at the end of this section.

A dedicated fire alarm annunciator that monitors the room/suite smoke sensors and is labeled “Dorm Room Smoke Sensors” is required in these locations:

1. In the front lobby adjacent to the building fire alarm annunciator.
2. In the building managers office.
3. Adjacent to the main Fire Alarm Control Panel.

4.10 Supervising Station

All new fire alarm systems are required to be provided with the following interfaces to report signals to the MIT Supervising Station. Note some of these interfaces will be used at system acceptance and others may be used in the future.

1. Dry electrical relay contacts to Active Multiplex Transmission System as required.
2. Digital Alarm Transmitter (DACT).
3. RS-232 interface.

Active Multiplex Transmission System: The fire alarm system will need to provide electrical contacts to communicate with a Data Gathering Panel (DGP). The DGP must be a separate Simplex 4100ES with an XA Loop Interface card. The DGP will translate the signals received to the status of a XA loop address. Note existing systems may be interfaced through AutoCall XA loop interface circuit boards, these circuit boards are no longer being manufactured and there is a significant premium on these components. Existing AutoCall XA loop interface circuit boards may be reused if spare inputs are available. The central station needs to receive the following separate signals:

1. Fire alarm (pull station, heat, smoke).
2. Water flow.
3. Duct smoke activation.
4. Any trouble in the system.
5. Any unacknowledged new trouble. This signal is activated any time that a trouble is not acknowledged within 20 seconds, this signal clears once the trouble is acknowledged.
6. Fire pump motor or engine running for electric and diesel fire pumps.
7. Electric fire pump supervisory signals to include controller connected to alternate source (loss of primary power), phase loss and phase reversal. Due to address limitations on the existing active multiplex transmission system, these may be combined into one supervisory signal.

8. Diesel fire pump supervisory signals to include controller is off or manual and trouble on controller or engine. Due to address limitations on the existing active multiplex transmission system, these may be combined into one supervisory signal.
9. Supervisory signals which are to be individually reported, shall include but are not limited to:
 - a. Valve tamper.
 - b. Low and high air pressure.
 - c. Low water pressure to the building if not fed by the campus fire protection loop.
 - d. Low space temperature in dry sprinkler rooms.
 - e. Loss of power to air compressors.
 - f. CO, methane or other gas detection.
 - g. Fire pump supervisory signals.
 - h. Low battery alarm on gas monitoring systems.
 - i. Panel trouble on gas monitoring systems.
 - j. Highly toxic, toxic, pyrophoric gas detection.
 - k. Flammable gas detection.
 - l. Flammable liquid vapor and liquid leak detection.
 - m. Low oxygen detection.
 - n. High priority mass notification message active that has overridden an active notification message.
 - o. Solenoid disconnect

Digital Alarm Communicator Transmitter (DACT): The fire alarm system shall be programmed to transmit a unique address for each system component. The DACT shall be programmed to output signals in the Contact ID format. As part of the Contractor submission, a complete list of all signals is required to be provided to MIT for programming of the supervising station equipment.

RS-232 Interface: The fire alarm system is required to have an RS-232 interface to communicate signals to a printer or to a centralized system associated with the supervising station.

4.11 Bi-directional Antenna Systems

During an emergency, reliable communication is critical. Clear radio transmissions and the ability to communicate between first responders inside a building and emergency personnel outside the building can help expedite an emergency response, prevent further injuries and potentially save lives. Emergency Responders lose communications when in-building radio signals are weakened by structures such as concrete, metal, and low-E glass windows. At MIT, this primarily takes place in the lower levels and tunnel system. To solve these communication challenges, Bi-Directional Amplifier (BDA) Systems are installed with the Fire Alarm Systems and provides signal boosting to enhance in-building radio frequency (RF) signal coverage.

A BDA System is a critical component to the fire alarm systems and therefore a life safety system. BDA is a code driven requirement. Please refer to NFPA 72 and 1221, IBC Section 916, and IFC Section 510.

Cambridge Fire Department requires that prior to a new building or major renovation being given its Certificate of Occupancy (CO) that a communications study be completed to determine radio signal strength throughout the structure. If the study indicates no or limited coverage, then a radio enhancement system will be required. The radio enhancement system is known as a Bi-directional Antenna System (BDA).

The study is conducted when the structure is 85% - 90% complete (i.e. building envelope, roof, walls, windows, and ceilings in place). As such, the extent of the enhanced radio coverage requirement is unknown until that time. Therefore, it is recommended that the space for the BDA equipment and vertical cable pathway be determined during architectural design and if feasible, those areas built during the project. Both of these spaces must meet strict fire rating requirements and it is significantly less expensive to build them as part of the overall construction project than to attempt to determine how and where to “fit them in” later after the RF survey determines a BDA system is necessary.

The BDA system must be monitored by the building’s fire alarm system and annunciate the status of any signal booster(s). The monitoring panel shall provide visual and labeled indication of the following for each signal booster:

- Normal AC power
- Signal booster trouble
- Loss of normal AC power
- Failure of battery charger
- Low-battery capacity
- Donor antenna trouble

BDA Systems have proven to be effective and valuable to the MIT Campus and should be included for consideration in the following scenarios:

1. New buildings.
2. In all renewals of whole fire alarm systems, either part of a project or as a stand-alone renewal.

As with all life safety systems, the BDA System shall be designed by a registered professional engineer, installed by a qualified vendor who shall oversee the start-up, testing and commissioning, permitted, inspected and approved by CFD, and final acceptance of both the design prior to installation and the installed system shall be provided by CFD, the Engineer of Record, and MIT.

Lastly, in support of projects, the BDA systems, when aligned with the two points above, shall always be considered during the very early planning stages of projects.

4.12 Building Level Emergency Power Off System

Emergency Power Off stations are commonly known for their uses in Data Centers and provides a means for disconnecting electrical power to electronic and Information Technology equipment, as noted in NFPA 25. NFPA 25 is technically a recommended standard and not required by law unless adopted or deemed a requirement by the authority having jurisdiction. The Massachusetts Electrical Code, on the other hand, does require EPOs at some locations as outlined below.

In recent years, Cambridge Fire Department has requested that Emergency Power Off buttons (EPO's) be installed as a means of remotely disconnecting due to their ability to disconnect all building level power (does not include medium voltage equipment) using a single action, remotely, typically located near the entrance to the facility or within the Fire Command Center. The ability to disconnect power in a centralized and remote manner aids to the well-being, safety and expeditious response of emergency personnel.

Although not mandated by Code, but highly desirable to CFD, the provisions of an EPO shall always be considered in projects where the scope of work aligns with the functional change.

Those projects include:

1. All new buildings.
2. Entire building renovations and alterations (which would include Infrastructure renewal of entire electrical service switchboards and first level main overcurrent protective device(s)).
3. Select maker spaces or shop spaces, room based EPO typically located near the entrance to the space.

The Massachusetts Electrical Code requires EPOs in the following locations:

1. To shut down information technology rooms (i.e. - large IT rooms and data centers), including all mechanical equipment serving the room. This requirement mimics NFPA 75.
2. Remote shutdown of generators. This includes emergency and standby generators. Note: there is an exception to the above if there are personnel available 24/7/365 with knowledge of where/how to shut off the aforementioned systems.

Lastly, in support of projects, the EPO system, when aligned with the three points above, shall always be considered during the very early planning stages of projects.

6. DESIGN DOCUMENTATION

6.1 Designer Responsibilities

The designer is responsible for producing the following documentation:

1. Specifications.
2. Drawings including the following:
 - a. Floor plans indicating all walls, device and appliance locations, control units, risers, terminal cabinets.
 - b. Riser diagrams. Riser diagram device quantities shall match those indicated on the Drawings.
 - c. Input / output Matrix of Operation.
 - d. Annunciator layout of switches and buttons.
 - e. Equipment mounting heights.

6.2 Submittal Requirements

Contractor Documentation is to include the following items. The designer needs to require the contractor to provide documentation in accordance with the “Documentation” chapter in the latest edition of NFPA 72. Product data including data sheets and installation instructions that clearly indicate which model is being provided.

1. Shop Drawings (Installation Documentation):
 - a. Floor plans indicating conduit routing and contents.
 - b. Riser diagrams.
 - c. Control unit diagrams for the interior and exterior of the equipment.
 - d. Typical wiring diagrams.
 - e. Input / output Matrix of Operation.
 - f. Calculations including power supplies, voltage drop, dB loss and conduit fill.

6.3 As-Built Documentation

The contractor will be required to update the product data for all equipment installed.

The contractor is to update the shop drawings to reflect the actual installed condition.

The Engineer of Record shall review all changes to the Input / output Matrix of Operation. The Input / output Matrix of Operation is to reflect the programming logic of the fire alarm system.

7. COORDINATION

The fire alarm system interfaces with a number of building systems. It is important that the fire alarm system is coordinated with the other systems during the design phase. The interfacing strategy must consider the project phasing and material selection. Once system components are purchased it is usually too late to make modifications without a significant cost impact to the project.

The following items should be considered when coordinating the fire alarm system:

1. Sprinkler systems including wet, dry, pre-action, etc. interfaces.
2. Fire pump monitoring
3. Elevator recall.
4. HVAC equipment shutdown.
5. Activation of the post fire smoke purge system.
6. Emergency power for fire alarm equipment.
7. Monitoring of generator and transfer switch.
8. Smoke control system.
9. Stair pressurization.
10. Kitchen suppression system.
11. Access control system.
12. Door hardware for door releasing.
13. Gas detection systems.
14. Audio visual systems.

The designer is responsible for determining the quantity of inputs and outputs for each system requiring coordination. For example, an elevator requires coordination for the recall levels between the elevator controller and the fire alarm system, and in the case of multiple elevator cars located in the same bank may require an interface with each controller.

The installation must be coordinated between various contractors. In many cases there is usually wiring that is provided by one contractor, which is terminated at each end by a different contractor. There is also a need for the configuration and programming to occur on each of these systems.

8. ACCEPTANCE TESTING

The Massachusetts State Building Code requires that the fire alarm system be installed and constructed in accordance with NFPA 1 and, therefore, NFPA 72, National Fire Alarm and Signaling Code. The AHJ requires compliance prior to issuing a certificate of occupancy.

A summary of key issues follows this paragraph but the designer is expected to fully understand the testing requirements and to clearly explain them in the documents. The designer should understand that MIT will commission an independent third party test of all new or modified fire alarm systems and that this test is also required by the City of Cambridge. The contractor is expected to allow time and budget in his schedule and bid to support this testing and the designer is expected to make this requirement clear.

An NFPA 72 System Record of Completion is required for all projects. The form is available from NFPA (nfpa.org/72). The Contract Documents must make clear the requirement for this Record of Completion.

MIT in conjunction with Johnson Controls has created a Fire Alarm Acceptance Testing Procedure. A copy of that procedure is available from MIT. The following paragraphs summarize the key requirements of that testing procedure. These must be incorporated into the contract documents in a manner that ensures that the contractor allows sufficient time and budget to successfully comply with their requirements.

1. **General Instructions:** The acceptance testing must be completed by the system installer, typically the electrical subcontractor, and by a representative of the fire alarm provider. This provider is often but not always Johnson Controls. The results of the system testing must be recorded on the NFPA 72 System Record of Completion and NFPA 72 System Record of Inspection and Testing forms. A copy of the forms may be obtained from NFPA (<http://www.nfpa.org/72>).
2. **Off-Site Monitoring:** Most MIT building fire alarm systems will be connected to the MIT Supervising Station. The contractor is required to make the Operations Center aware of any testing and its expected duration. The MIT Supervising Station does not have the capability to log signals. Where acceptance testing can be extremely disruptive to staff in the Operations Center, the connection to report signals to the MIT Supervising Station is not permitted to occur until after contractor and third-party testing is completed.
3. **Occupant Notification:** In occupied buildings, the contractor is required to notify occupants of any testing that would impact them. The method of notification will vary by building and must be discussed with MIT. The contractor shall provide notification through the fire alarm system prior to beginning and when testing is completed at the end of the day. Individuals may enter the building after the announcement is made. Therefore, it is important that the contractor is responsible for providing signage at entrances when testing is occurring. It is not acceptable for the signs to remain when testing is not being completed.
4. **Fire Alarm Power:** A series of tests to confirm fire alarm normal and emergency power, grounding, circuit protection and other wiring is required. All fire alarm systems will have a battery backup and a connection to a circuit powered by an emergency generator, if a generator is present in the building. The NFPA 72 forms contain detailed information about the battery testing, care must be taken to ensure that these requirements are fully spelled out in the contract documents. Other details covering testing of fire alarm power are contained in the above referenced document.
5. **Fire Alarm Control Panel Testing:** Some control panel testing must be performed prior to powering the panel for the first time. Details of the control panel testing are given in the MIT and Johnson Controls document this also includes considerable detail on testing of fiber-optic cables which should also be communicated to the contractor. Additional panel testing will include notification appliance tones and indicator illuminations at the panel.

6. Testing of Electrically Supervised Circuits: A total of 10 percent of the devices on each circuit must be tested to be sure that a troubled condition is reported to the fire alarm control panel if the circuit is connected to ground or broken.
7. Functional Testing of Initiating Devices: Each initiating device must be verified for proper labeling using the input-output matrix. The fire alarm contractor shall verify that room numbers are present prior to beginning testing to confirm that the description for each device is correct. In existing buildings, the contractor should bring these locations to the attention of MIT and a sign will be provided. In major renovations and new buildings, temporary room numbers must be present for the fire alarm testing. The list of initiating devices will include but not be limited to:
 - a. Manual pull stations.
 - b. Smoke detectors.
 - c. Duct smoke detectors.
 - d. Heat detectors.
 - e. Flame detectors.
 - f. Projected beam smoked detectors.
 - g. Aspirating smoke detection systems.
 - h. Carbon monoxide detectors.

Sprinkler system flow switches require a testing procedure which is outlined in the above referenced document.

1. Functional Testing of Notification Appliances: This portion of the testing is intended to ensure that notification appliances can be seen and heard as required. This includes voice activation or mass notification systems and contains requirements for the intelligibility of announcements delivered over the systems. Require that the contractor prepare a drawing showing the ambient sound pressure level and the level achieved by the notification appliance in each space. If a space or a whole project is designated as one requiring voice intelligibility, then the drawing must indicate the means by which acceptable intelligibility is determined.
2. Other System Tests: Functional testing of other systems is required. These systems include but are not limited to:
 - a. Elevator recall.
 - b. Auxiliary relays.
 - c. Smoke door release.
 - d. Override switches.
 - e. Bypass switches.
 - f. Fan control and fan override systems.
 - g. Connection to the supervising station.

3. Documentation: Documentation required at the completion of testing includes:
 - a. As built drawings of the system.
 - b. A signed Record of Completion.
 - c. Record of Inspection and Testing
 - d. A copy of the test log results.
 - e. A complete copy of the points list.
 - f. A final copy of the input / output matrix in editable (XLS) form or on the drawing.
 - g. An engineer's performance acceptance certificate. This certificate is not a formality with MIT

The designer is required to review and approve the submitted documentation.

8.1 Third Party Testing

Third-party testing is mandated by the Cambridge Fire Department as allowed by NFPA 1.15 Technical Assistance. The need for third party testing shall be determined at the schematic phase.

For systems such as smoke control and other complex systems integrated testing may be required. Refer to NFPA 3 and 4.

The company performing the third-party testing of the fire alarm system is hired directly by MIT. The installing contractor of the fire alarm system will be responsible for supporting the third-party testing with staff, materials and programming expertise. The third-party testing contractor will not perform any work on the fire alarm. The contractor will need to be responsible for having a manufacturer's representative available during the third-party testing to review and make changes to the fire alarm system program as necessary.

The contract documents should include an estimated duration of the third-party testing. MIT can provide historical durations for third party testing for similar projects. This duration is dependent on the quality of the design documents and the installation. The duration is important, since it is one aspect that is not included initially in the project schedule and can delay occupancy of the building.

The third-party testing will include integrated thorough testing. The intent of the integrated testing is to confirm that the interconnections are complete and the anticipated functionality is verified. For example, the integrated testing for a fire alarm and stair pressurization system would confirm that the stair pressurization fans activate when a smoke detector activates, it is not the intent of the integrated testing to confirm that the pressure is sufficient and the door opening forces are within code requirements. Representatives for each of the interconnected systems need to be available for this integrated testing. The contract documents must reflect this requirement.

9. PRACTICES AND PROCEDURES

9.1 General Comments to the Fire Alarm System Designer

The designer must require that the contractor follow NFPA 241: Standard for Safeguarding Construction, Alteration and Demolition Operations and FM Global Property Loss Prevention Data Sheet 1-0, 'Safeguards During Construction, Alteration, and Demolition' during construction. Requirements will differ for each project and must be discussed with MIT

The fire alarm designer must require that the contractor maintain fire alarm equivalency during demolition and renovations. This will, generally, require that the contractor submit an impairment plan for MIT's approval. The designer must discuss this need with MIT prior to completion of the contract documents.

The fire alarm system designer must prepare a narrative and sequence of operations as required by the Massachusetts State Building Code for all fire alarm systems. This is to be presented in preliminary form at the Design Development stage of the project.

The designer must require that the contractor follow the MIT Shutdown Notification Procedure whenever any fire alarm system is to be impaired. The MIT project manager should be contacted for additional details on this procedure.

Narratives, drawings and supplemental design documentation will be required at each phase of the design process.

A fire alarm input / output matrix will be required for all fire alarm installations. A draft of this matrix will be required at the Design Development stage. This must be submitted in editable form such as Microsoft Excel, or AutoCAD and must be made available to the contractor in that same form as part of the contract documents.

The designer must require that the input / output matrices be updated by the contractor along with as-built drawing and approved by the design professional before final approval and payment to the contractor. The designer must require that a draft, actively marked up set of as-built documents and matrices be maintained on the job site and updated on a 48-hour basis.

The fire alarm design professional is required to periodically perform reviews of the work that include verification of as-built conditions and compliance with approved contract documents. The contract documents should specify the required content and format of the final close-out documents. These reviews are referred to as Construction Control in the Massachusetts State Building Code, 780 CMR: State Board of Building Regulations and Standards. These are reviews and spot-checks only.

Designers shall require that the contractor provide adequate time in his schedule and budget in his bid to accomplish the level of initial acceptance testing that is expected. This testing, while

not exceeding the requirements in NFPA 72, is expected to strictly conform to the requirements of that document. That expectation likely differs from that which most owners have.

Designers shall require that the contractor must maintain fire alarm and notification functionality during demolition and renovations. This usually requires submission of an impairment plan for MIT's approval. The designer must discuss this need with MIT prior to completion of the contract documents.

Designers shall require that the contractor coordinate testing of fire alarm, emergency power, HVAC, FCS, elevators and any other systems connected to the fire alarm system. . The contract documents need to require support from the contractors that are familiar with the systems that are interconnected with the fire alarm system.

The building must have full coverage of audible notification appliances. Visible notification appliances are to be provided in all public, common and high noise areas of the building. These must also provide clear voice intelligibility in the identified areas. These requirements are particularly important in a college environment where emergency notification may be required and in a lab environment where noise from testing machines or lab experiments may create difficulties in hearing an alarm or announcement. MIT's requirements in this area are strictly enforced and may cause the addition of notification devices if coverage is not seen to be sufficient. Additionally, a record of the contractors testing of the achieved sound pressure levels is required.

Stranded wire that is properly color coded is required for all fire alarm work. While the Code allows the use of solid wire, MIT does not. This requirement is based on MIT's experience in maintaining and repairing its own fire alarm systems. Stranded wire is more reliable and the color coding makes service considerably easier. Most owners contract out the maintenance and are indifferent to wire type or color coding.

Contractors sometimes install systems requiring special staging or ladders longer than standard stepladder for routine maintenance or testing. This is not acceptable at MIT Accessibility and maintainability must be prime criteria in locating fire detection devices, the specification must address this issue. Air sampling smoke detection may be required in high ceiling areas.

Design professionals shall coordinate with DOF prior to meeting with the fire department without MIT approval or without a representative from MIT in attendance.

9.2 Areas Where MIT Requirements May Differ from Common Practice

These differences must be understood by the designer and must be clearly spelled out in the contract documents. Failure of the contractor to understand these differences and a consequent bid and schedule based on common practice will result in delays, RFI's and potential change orders.

1. The contractor must provide adequate time in his schedule and budget in his bid to accomplish the level of initial acceptance testing that is expected. This testing, while not exceeding the requirements in NFPA 72, is expected to strictly conform to the requirements of that document. That expectation likely differs from that which most owners have.
2. The contractor must maintain fire alarm and notification functionality during demolition and renovations. This usually requires submission of an impairment plan for MIT's approval. The designer must discuss this need with MIT prior to completion of the contract documents.
3. The contractor must coordinate testing of fire alarm, emergency power, HVAC, FCS, elevators and any other systems connected to the fire alarm system. Projects for other owners may not require this work. The contract documents need to require support from the contractors that are familiar with the systems that are interconnected with the fire alarm system.
4. The building must have full coverage of audible notification appliances. Visible notification appliances are to be provided in all public, common and high noise areas of the building. These must also provide clear voice intelligibility in the identified areas. These requirements are particularly important in a college environment where emergency notification may be required and in a lab environment where noise from testing machines or lab experiments may create difficulties in hearing an alarm or announcement. MIT's requirements in this area are strictly enforced and may cause the addition of notification devices if coverage is not seen to be sufficient. Additionally, a record of the contractors testing of the achieved sound pressure levels is required.
5. Stranded wire that is properly color coded is required for all fire alarm work. While the Code allows the use of solid wire, MIT does not. This requirement is based on MIT's experience in maintaining and repairing its own fire alarm systems. Stranded wire is more reliable and the color coding makes service considerably easier. Most owners contract out the maintenance and are indifferent to wire type or color coding.
6. Contractors sometimes install systems requiring special staging or ladders longer than standard stepladder for routine maintenance or testing. This is not acceptable at MIT. Accessibility and maintainability must be prime criteria in locating fire detection devices, the specification must address this issue. Air sampling smoke detection may be required in high ceiling areas.
7. MIT has a close relationship with the Cambridge Fire Department. That relationship is often beneficial in explaining the special conditions that often exist in campus buildings. Design professionals should not meet with the fire department without MIT approval or without a representative from MIT in attendance.
8. MIT's residential fire alarm requirements have been explained elsewhere. These differ from common practice and must be clearly explained.
9. Items such as circuit loading and battery capacity differ from common practice. These requirements flow from the need to maintain extra capacity which will facilitate the many changes that MIT buildings undergo.

9.3 Areas Where MIT Requirements or Practice Differ from Code

Fire alarm systems must conform to the requirements of NFPA 72, the National Fire Alarm and Signaling Code and to Massachusetts 527 CMR 24.00.

1. The Code devotes 2-1/2 pages to discussion of the audible characteristics of notification appliances. It requires the documentation of required sound pressure levels for each space and, if required by the AHJ, the documentation of actual sound pressure levels achieved. MIT has adopted this latter requirement though CFD has not generally asked for such documentation. This requirement would have a modest cost impact.
2. The Code requires that voice intelligibility standards be met when the system will be used for Emergency Notification. Such a notification system is under consideration by Security and Emergency Management Office (SEMO) at this time. The fire alarm systems are not presently designed to support Emergency Notification but some decisions have been made to allow more cost effective implementation in the future. These decisions include the following:
 - a. Change wording on horn or speaker strobes from “fire” to “alert”, this has no cost impact.
 - b. Require some additional junction boxes in the notification circuit wiring to facilitate the addition of more speakers in the future. Modest cost impact.
3. Code allows either solid or stranded wire for fire alarm systems. MIT limits the contractor to stranded wire that must match the MIT color coding chart. No cost impact.

9.4 Fire Alarm Tagging Details and Wire List

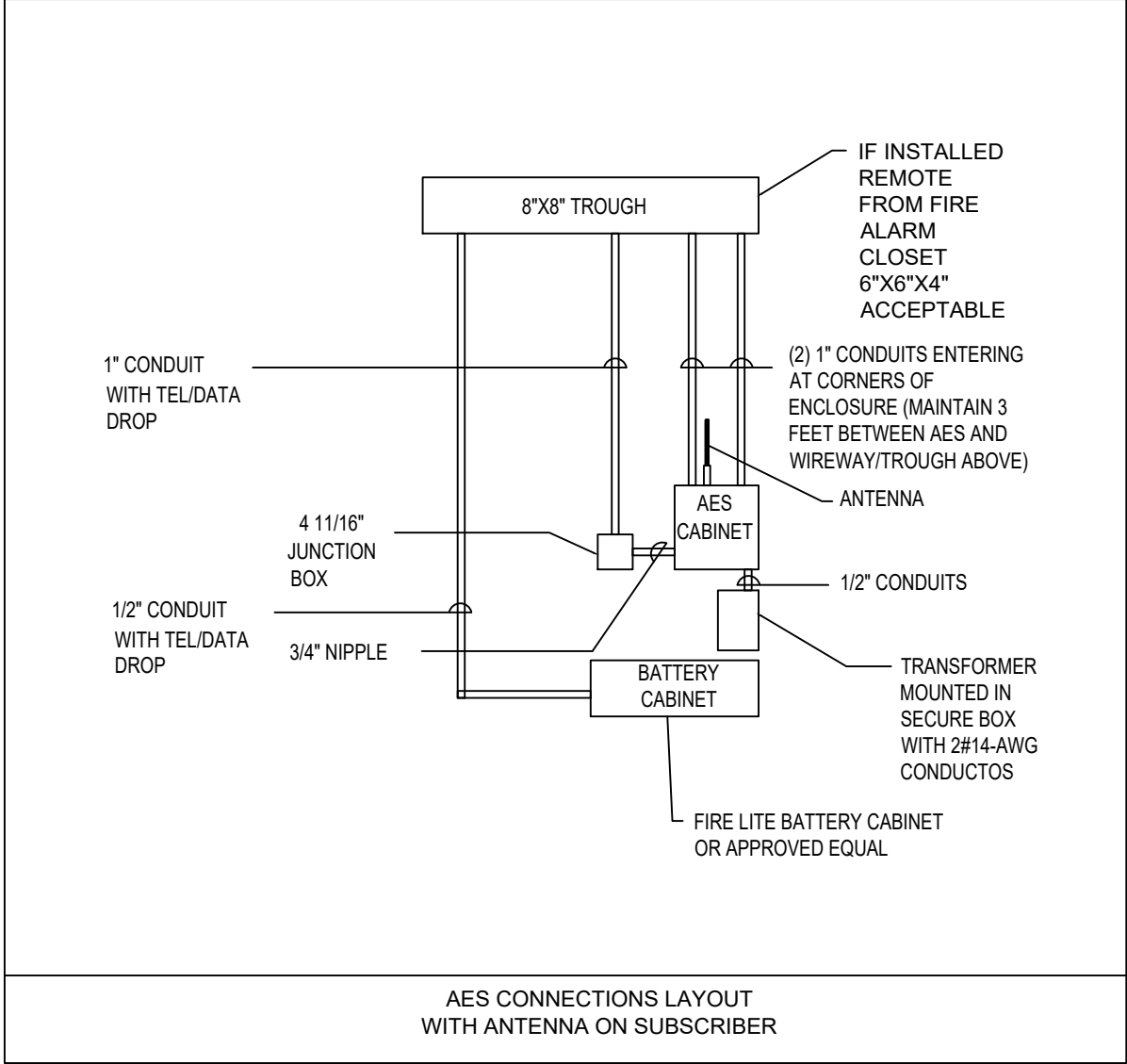


FIRE ALARM WIRE LIST (POWER LIMITED)			
SIMPLEX		NOTIFIER	
A	AUXILIARY POWER - 1 PAIR 14 AWG TWISTED OVERALL (STRANDED) RATED FOR USE AMINUTER THHN BLUE (+) & GRAY	A	AUXILIARY POWER - 1 PAIR 14 AWG TWISTED OVERALL (STRANDED) RATED FOR USE AMINUTER THHN BLUE (+) & GRAY
B	RUL/NZ COMMUNICATION - 1 PAIR 16 AWG TWISTED OVERALL SHIELD (STRANDED) RATED FOR USE RED & BLACK RETURN WITH A WHITE STRIPE	B	RUL/NZ COMMUNICATION - PER MANUFACTURER'S RATED FOR USE RED & BLACK RETURN WITH A WHITE STRIPE
D	DOOR HULLER CIRCUIT - 2 CONDUCTOR 14 AWG (STRANDED) RATED FOR USE AMINUTER THHN PINK (+) & GRAY	D	DOOR HULLER CIRCUIT - 2 CONDUCTOR 14 AWG (STRANDED) RATED FOR USE AMINUTER THHN PINK (+) & GRAY
L	REMOTE LED CIRCUIT - 2 CONDUCTOR 16 AWG (STRANDED) RATED FOR USE RED (+) & BLACK CONDUIT ONLY: TFFN	L	REMOTE LED CIRCUIT - 2 CONDUCTOR 16 AWG (STRANDED) RATED FOR USE RED (+) & BLACK CONDUIT ONLY: TFFN
M	MARNET/INNET CIRCUIT - 1 PAIR 16 AWG TWISTED (STRANDED) RATED FOR USE RED & BLACK RETURN WITH A WHITE STRIPE	M	SLC CIRCUIT - 1 PAIR 16 AWG TWISTED (STRANDED, NO SHIELD, NO DRAIN) RATED FOR USE RED & BLACK RETURN WITH A WHITE STRIPE
N	RS-485 COMMUNICATION TRUNK - 1 PAIR 16 AWG TWISTED OVERALL SHIELD (STRANDED) RATED FOR USE RED & BLACK RETURN WITH A WHITE STRIPE	N	RS-485 COMMUNICATION TRUNK - PER MANUFACTURER RECOMMENDATION RATED FOR USE RED & BLACK RETURN WITH A WHITE STRIPE
P	MARNET/INNET POWER CIRCUIT - 2 CONDUCTOR 14 AWG (STRANDED) RATED FOR USE AMINUTER THHN BLUE (+) & GRAY CONDUIT ONLY: THHN	P	SLC POWER CIRCUIT - 2 CONDUCTOR 14 AWG (STRANDED) RATED FOR USE AMINUTER THHN BLUE (+) & GRAY CONDUIT ONLY: THHN
R	RELAY CIRCUIT - 2 CONDUCTOR 14 AWG (STRANDED) RATED FOR USE AMINUTER THHN RED (+) & BLACK	R	RELAY CIRCUIT - 2 CONDUCTOR 14 AWG (STRANDED) RATED FOR USE AMINUTER THHN RED (+) & BLACK
S	SPEAKER CIRCUIT - 1 PAIR 16 AWG TWISTED OVERALL SHIELD (STRANDED) RATED FOR USE RED & BLACK TWISTED SHIELDED CIRCUIT A = RED & BLACK W/BLACK TRACER ON JACKET CIRCUIT B = RED & BLUE W/BUE TRACER ON JACKET CIRCUIT C = RED & BLACK W/YELLOW TRACER ON JACKET CIRCUIT D = RED & BLUE W/PURPLE TRACER ON JACKET CIRCUIT E = RED & BLACK W/ ORANGE TRACER ON JACKET CIRCUIT F = RED & BLUE W/ BROWN TRACER ON JACKET	S	SPEAKER CIRCUIT - 1 PAIR 16 AWG TWISTED OVERALL SHIELD (STRANDED) RATED FOR USE RED & BLACK TWISTED SHIELDED CIRCUIT A = RED & BLACK W/BLACK TRACER ON JACKET CIRCUIT B = RED & BLUE W/BUE TRACER ON JACKET CIRCUIT C = RED & BLACK W/YELLOW TRACER ON JACKET CIRCUIT D = RED & BLUE W/PURPLE TRACER ON JACKET CIRCUIT E = RED & BLACK W/ ORANGE TRACER ON JACKET CIRCUIT F = RED & BLUE W/ BROWN TRACER ON JACKET
V	VISUAL/SIGNAL CIRCUIT - 2 CONDUCTOR 14 AWG (STRANDED) RATED FOR USE AMINUTER THHN CONDUIT ONLY: THHN CIRCUIT A = YELLOW (+) & BROWN CIRCUIT B = BLUE (+) & BLACK CIRCUIT C = RED (+) & GRAY CIRCUIT D = ORANGE & BLACK CIRCUIT E = PURPLE & GRAY CIRCUIT F = PINK & BLACK	V	VISUAL/SIGNAL CIRCUIT - 2 CONDUCTOR 14 AWG (STRANDED) RATED FOR USE AMINUTER THHN CONDUIT ONLY: THHN CIRCUIT A = YELLOW (+) & BROWN CIRCUIT B = BLUE (+) & BLACK CIRCUIT C = RED (+) & GRAY CIRCUIT D = ORANGE & BLACK CIRCUIT E = PURPLE & GRAY CIRCUIT F = PINK & BLACK
Z	ZONE CIRCUIT - 2 CONDUCTOR 16 AWG (STRANDED) RATED FOR USE AMINUTER THHN CONDUIT ONLY: TFFN (2) #16 AWG WATERFLOW: PURPLE & ORANGE (FROM IAW) TAMPER: PINK & TAN (FROM IAW) (2) #16 AWG	Z	ZONE CIRCUIT - 2 CONDUCTOR 16 AWG (STRANDED) RATED FOR USE AMINUTER THHN CONDUIT ONLY: TFFN (2) #16 AWG WATERFLOW: PURPLE & ORANGE (FROM IAW) TAMPER: PINK & TAN (FROM IAW) (2) #16 AWG MANUAL STATION (2) #16 AWG LOW TEMPERATURE (2) #16 AWG DUCT DETECTOR (2) #16 AWG
	CONDUIT SIZE	CONDUCTOR AREA	CONDUIT SIZE
	CONDUCTOR AREA	CONDUIT SIZE	CONDUCTOR AREA
1/2"	0.12 SQ INCH *	1-1/4"	0.60 SQ INCH *
3/4"	0.21 SQ INCH *	1-1/2"	0.82 SQ INCH *
1"	0.34 SQ INCH *	2"	1.34 SQ INCH *
* SEE PL PER NEC		* SEE PL PER NEC	
THE CABLES SPECIFIED HERE ARE FOR REFERENCE OF REQUIRED ELECTRICAL CHARACTERISTICS AS WELL AS CODE REQUIREMENTS. ALTERNATE SUPPLIERS MAY BE SUBSTITUTED PROVIDING EQUIVALENT CHARACTERISTICS ARE MAINTAINED. ITEMS SUCH AS CAPACITANCE BETWEEN CONDUCTORS AND WIRE GAUGE CAN BE CRUCIAL TO THE CIRCUIT DESIGN OF THIS SYSTEM INSTALLATION.		THE CABLES SPECIFIED HERE ARE FOR REFERENCE OF REQUIRED ELECTRICAL CHARACTERISTICS AS WELL AS CODE REQUIREMENTS. ALTERNATE SUPPLIERS MAY BE SUBSTITUTED PROVIDING EQUIVALENT CHARACTERISTICS ARE MAINTAINED. ITEMS SUCH AS CAPACITANCE BETWEEN CONDUCTORS AND WIRE GAUGE CAN BE CRUCIAL TO THE CIRCUIT DESIGN OF THIS SYSTEM INSTALLATION.	

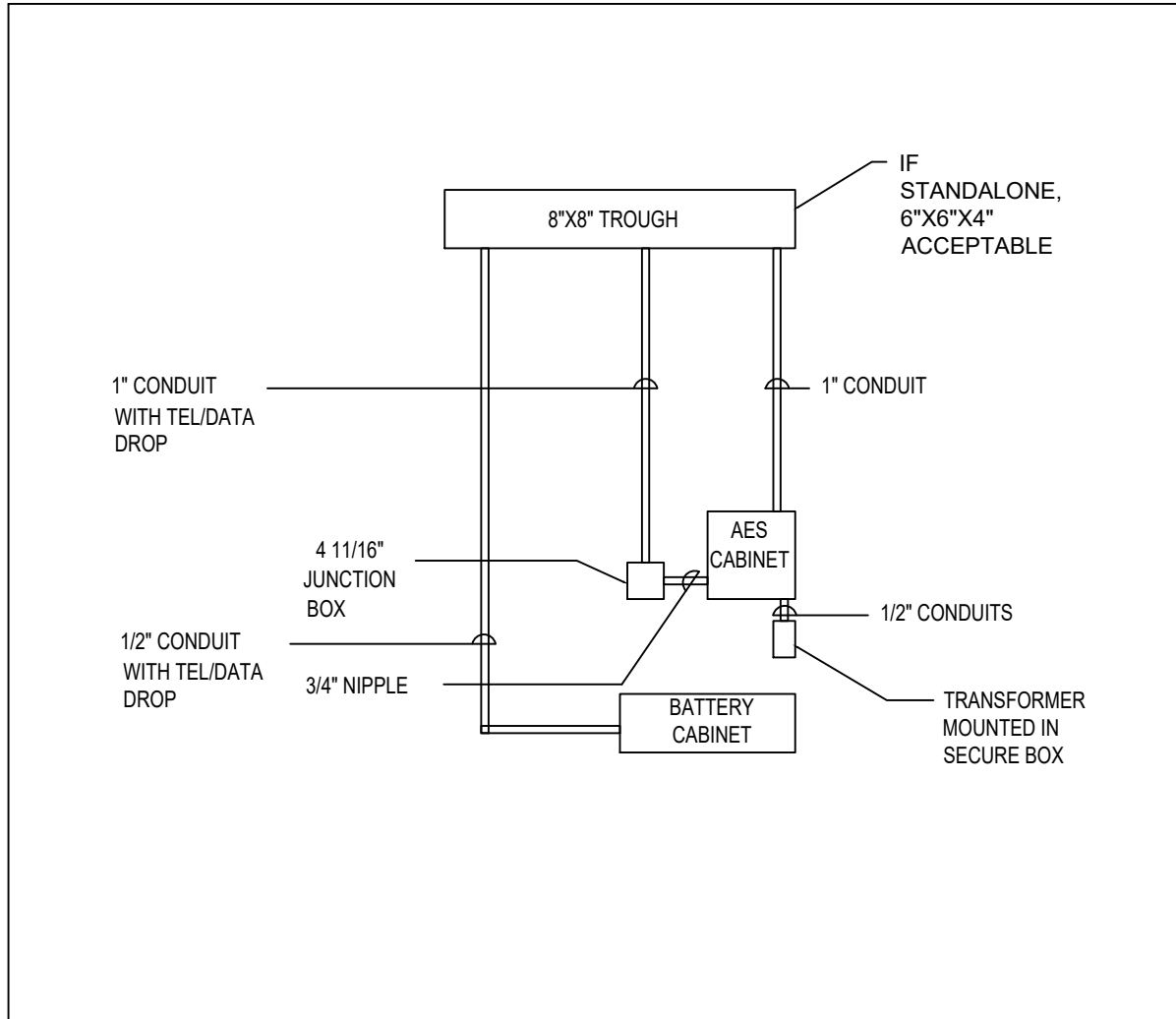
9.5 Fire Alarm and Antenna Details

As attached following this section

END OF DOCUMENT



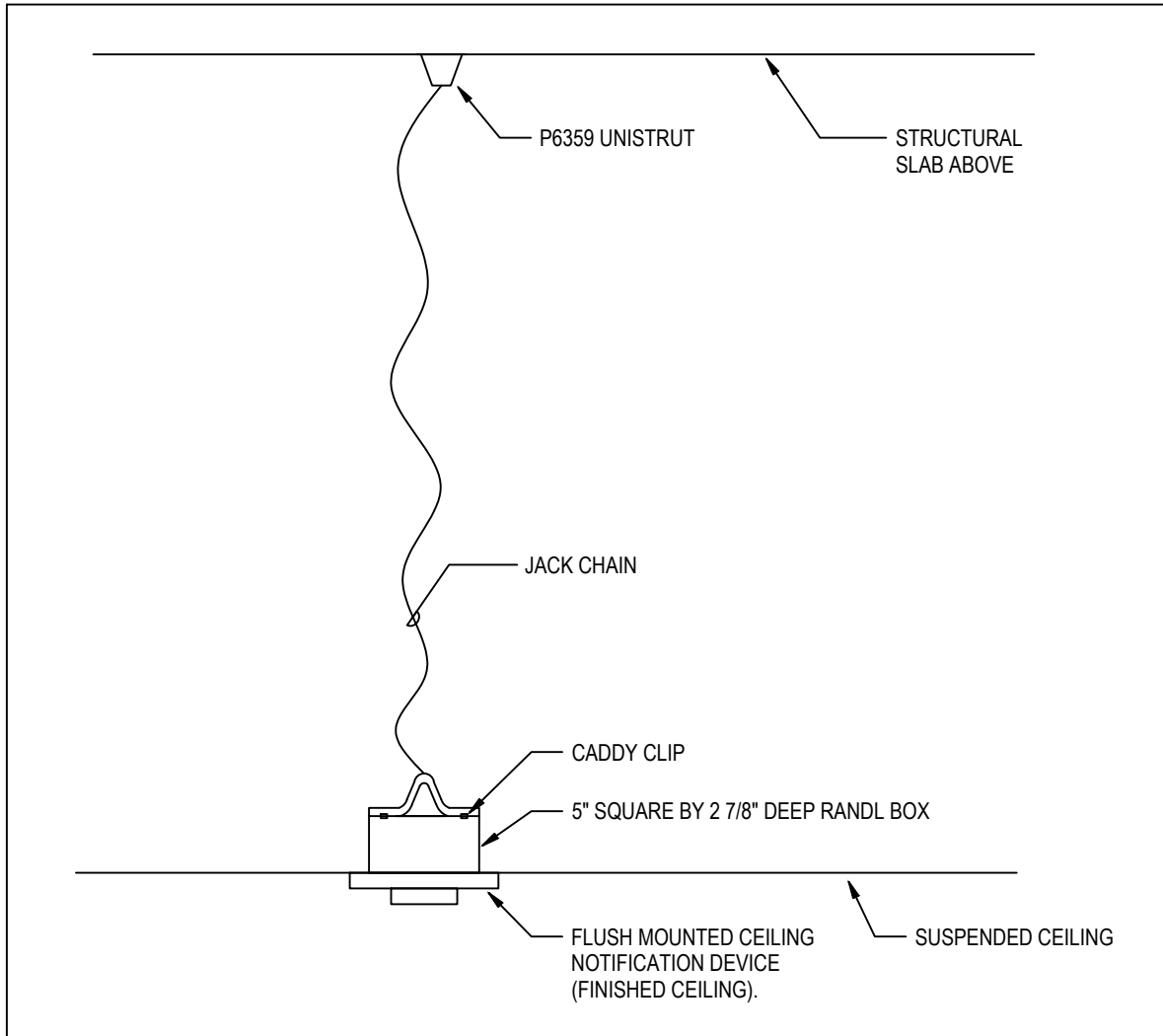
Department of Facilities
Massachusetts Institute of Technology



AES CONNECTIONS LAYOUT WITH OUTSIDE ANTENNA



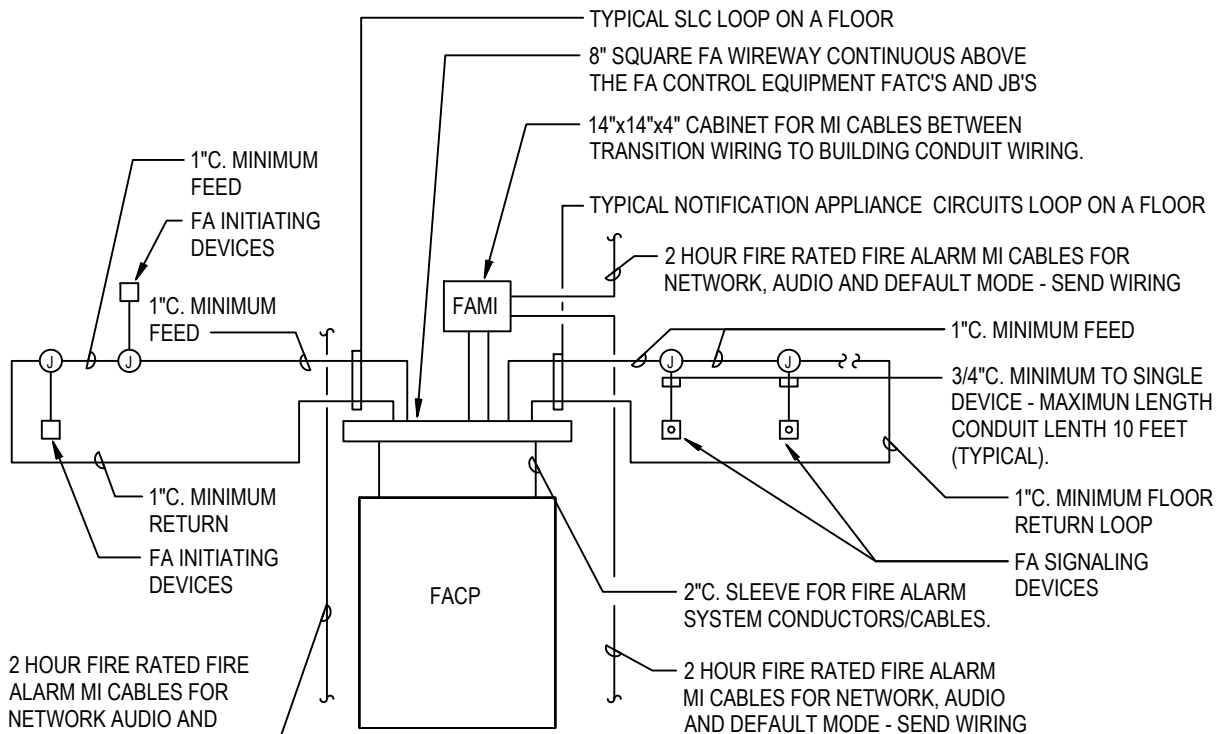
Department of Facilities
 Massachusetts Institute of Technology



TYPICAL RECESSED CEILING MOUNTED
FIRE ALARM NOTIFICATION APPLIANCE DEVICE



Department of Facilities
Massachusetts Institute of Technology



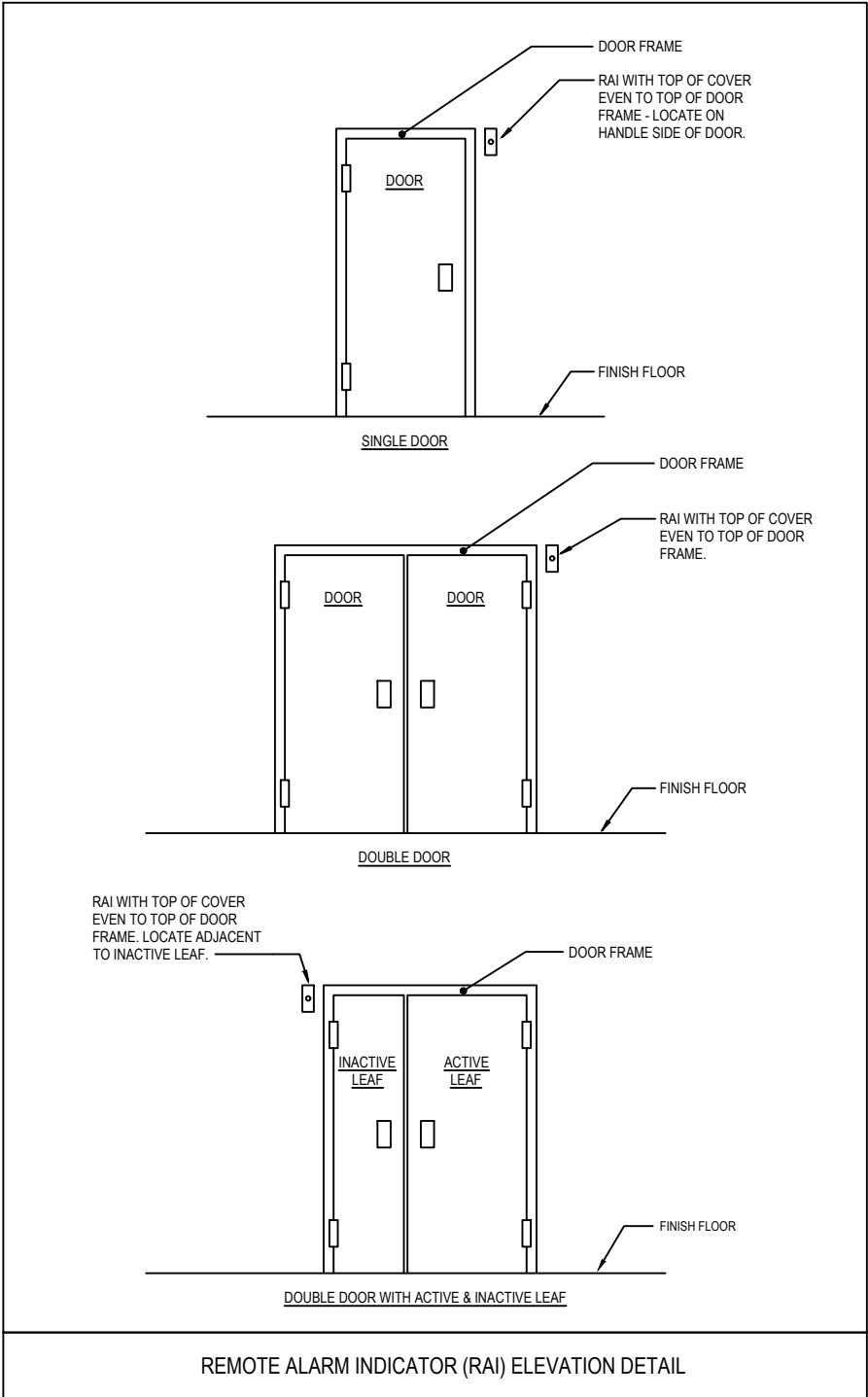
NOTE:

1. SIZES INDICATED ARE MINIMUM SIZES. LARGER CONDUIT SIZES SHALL BE PROVIDED AS INDICATED /REQUIRED.
2. REFER TO "TYPICAL FIRE ALARM CLASS A CIRCUIT MINIMUM CONDUIT SEPARATION PLANS" DETAIL ON DRAWING "EFA-203" FOR ADDITIONAL INFORMATION.

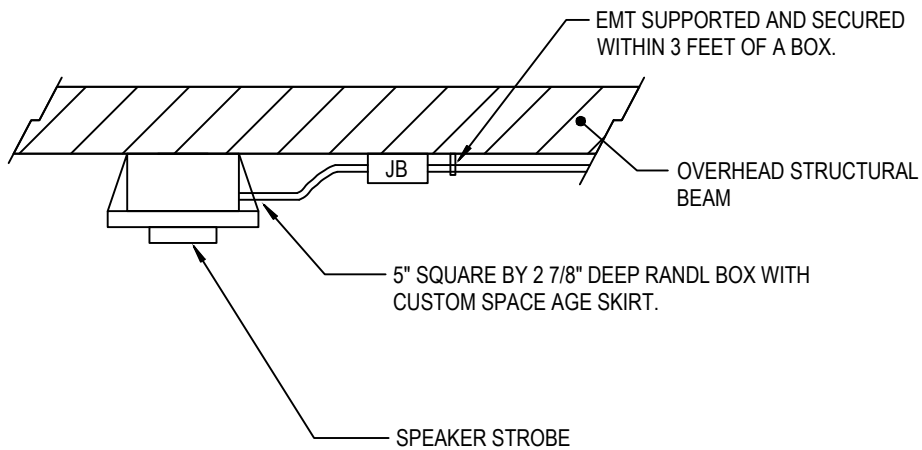
TYPICAL FIRE ALARM MINIMUM CONDUIT SIZES DIAGRAM



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NOTE:

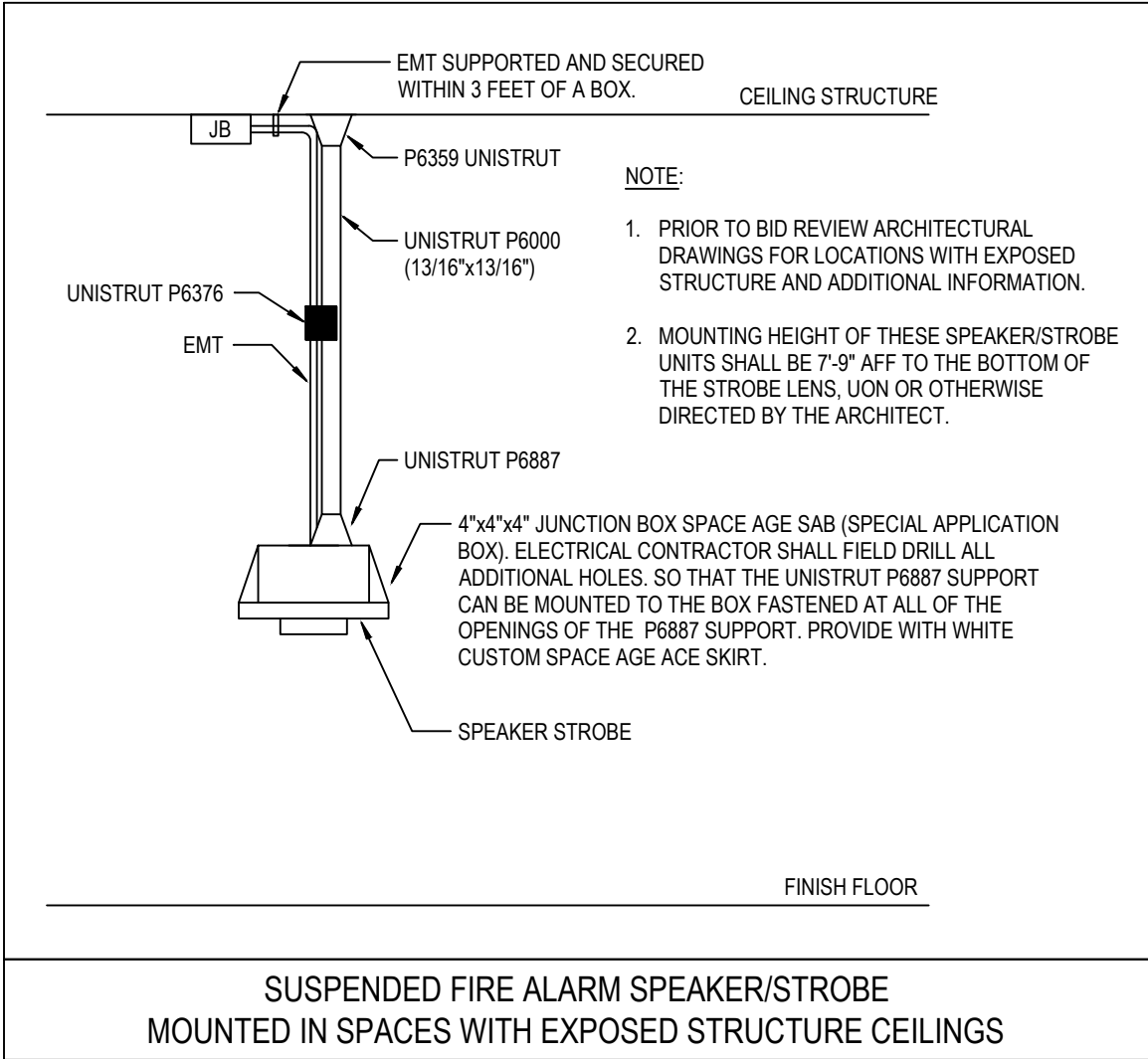
1. PRIOR TO BID REVIEW ARCHITECTURAL DRAWINGS FOR LOCATIONS WITH EXPOSED STRUCTURE AND ADDITIONAL INFORMATION.

FINISH FLOOR

SURFACE MOUNTED FIRE ALARM SPEAKER STROBES
 SURFACE MOUNTED TO BOTTOM OF OVERHEAD STRUCTURAL BEAM



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NOTE:

1. PRIOR TO BID REVIEW ARCHITECTURAL DRAWINGS FOR LOCATIONS WITH EXPOSED STRUCTURE AND ADDITIONAL INFORMATION.
2. MOUNTING HEIGHT OF THESE SPEAKER/STROBE UNITS SHALL BE 7'-9" AFF TO THE BOTTOM OF THE STROBE LENS, UON OR OTHERWISE DIRECTED BY THE ARCHITECT.



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MASSACHUSETTS INSTITUTE OF TECHNOLOGY - STANDARD FIRE ALARM CABLE SCHEDULE															
LINE SIGNAL CIRCUIT	CIRCUIT DESCRIPTION	CABLE TYPE	CONDUCTOR (COND)			CAPACITANCE		COLOR				KEYED NOTED	BASIS OF DESIGN MANUFACTURER & PART NUMBER	ALTERNATIVES	
			MATERIAL	STRANDS	AWG	DRAIN	COND TO COND	COND TO SHIELD	ID	-	-				JACKET
LINE SIGNAL CIRCUIT	CONTROL UNIT COMMUNICATION (NETWORK)	MM FIBER	FIBER	6	-	N/A	N/A	N/A	-	-	-	-	C		
	SIMPLEX - CONTROL UNIT COMMUNICATION (NETWORK)	FPLP-STP	COPPER	7	16	N/A	MAXIMUM: 0.58 P/FFT	N/A	-	RED	BLACK	RED	WHITE ON RETURN	-	
	ENET PLUS	FPLP-STP	COPPER	7	16	18 AWG (7 STRANDS) TYPICAL: 27.5 - 10% P/FFT	MAXIMUM: 0.58 P/FFT	TYPICAL: 49.0 - 10% P/FFT MAXIMUM: 0.80 P/FFT	-	RED	BLACK	RED	WHITE ON RETURN	A ANIXTER MIT162SH4C	
INITIATION DEVICE CIRCUITS	CARBON MONOXIDE DETECTOR	THHN	COPPER	19	14	N/A	N/A	N/A	-	PURPLE	ORANGE	N/A	N/A	B	
	DUCT SMOKE DETECTOR	THHN	COPPER	19	14	N/A	N/A	N/A	-	PURPLE	ORANGE	N/A	N/A	B	
	MANUAL FIRE ALARM BOX	THHN	COPPER	19	14	N/A	N/A	N/A	-	PURPLE	ORANGE	N/A	N/A	B	
	OTHER ZONE CIRCUITS	THHN	COPPER	19	14	N/A	N/A	N/A	-	PURPLE	ORANGE	N/A	N/A	B	
	SUPERVISORY SWITCHES	THHN	COPPER	19	14	N/A	N/A	N/A	-	PINK	TAN	N/A	N/A	B	
	WATER FLOW SWITCHES	THHN	COPPER	19	14	N/A	N/A	N/A	-	PURPLE	ORANGE	N/A	N/A	B	
	EXTERIOR RED LENS BEACON	THHN	COPPER	19	14	N/A	N/A	N/A	-	RED	BLACK	N/A	N/A	-	
NOTIFICATION APPLICATION CIRCUITS	EXTERIOR MAGENTA LENS BEACON	THHN	COPPER	19	14	N/A	N/A	N/A	-	PURPLE	GRAY	N/A	N/A	-	
	HORN	THHN	COPPER	19	14	N/A	N/A	N/A	-	RED	BLACK	N/A	N/A	-	
	REMOTE LED	THHN	COPPER	7	16	N/A	N/A	N/A	-	RED	BLACK	N/A	N/A	-	
	SOUNDER BASE	THHN	COPPER	19	14	N/A	N/A	N/A	-	BLUE	GRAY	N/A	N/A	-	
	SPEAKER	FPLP-STP	COPPER	7	16	18 AWG (7 STRANDS) TYPICAL: 27.5 - 10% P/FFT	MAXIMUM: 0.58 P/FFT	116.51 - 10% P/FFT	A	RED	BLACK	RED	BLACK	-	ANIXTER MIT162SH4C - NOTE 5
									B	RED	BLUE	RED	BLUE	-	ANIXTER MIT162SH4C-X - NOTE 5
									C	RED	BLACK	RED	YELLOW	-	ANIXTER MIT162SH4C - NOTE 5
									D	RED	BLUE	RED	PURPLE	-	ANIXTER MIT162SH4C-X - NOTE 5
									E	RED	BLACK	RED	ORANGE	-	ANIXTER MIT162SH4C - NOTE 5
									F	RED	BLUE	RED	BROWN	-	ANIXTER MIT162SH4C-X - NOTE 5
G									RED	BLACK	RED	BLUE	-	ANIXTER MIT162SH4C - NOTE 5	
H									RED	BLUE	RED	BLACK	-	ANIXTER MIT162SH4C-X - NOTE 5	
I									RED	BLACK	RED	GREEN	-	ANIXTER MIT162SH4C - NOTE 5	
SPEAKER RISER	FPLP-UTP	COPPER	7	16	N/A	MAXIMUM: 22 P/FFT	N/A	-	RED	BLACK	RED	N/A	-		
SPRINKLER BELL	THHN	COPPER	19	14	N/A	N/A	N/A	-	RED	BLACK	N/A	N/A	-		
STROBE	THHN	COPPER	19	14	N/A	N/A	N/A	A	YELLOW	BLUE	N/A	N/A	-		
								B	BLUE	BLACK	N/A	N/A	-		
								C	RED	GRAY	N/A	N/A	-		
								D	ORANGE	BLACK	N/A	N/A	-		
								E	PURPLE	GRAY	N/A	N/A	-		
								F	PINK	BLACK	N/A	N/A	-		
								G	YELLOW	BLACK	N/A	N/A	-		
								H	BLUE	GRAY	N/A	N/A	-		
								I	RED	BROWN	N/A	N/A	-		
EMERGENCY CONTROL FUNCTION INTERFACES	AUXILIARY POWER	THHN	COPPER	19	14	N/A	N/A	N/A	-	BLUE	GRAY	N/A	N/A	-	
	DOOR RELEASE	THHN	COPPER	19	14	N/A	N/A	N/A	-	PINK	GRAY	N/A	N/A	-	
	ELECTRICALLY LOCKED DOORS	THHN	COPPER	19	14	N/A	N/A	N/A	-	PINK	GRAY	N/A	N/A	-	
	ELEVATOR RECALL FOR FIREFIGHTER SERVICE	THHN	COPPER	19	14	N/A	N/A	N/A	-	BLACK	GRAY	N/A	N/A	-	
	HEATING, VENTILATION AND AIR-CONDITIONING (HVAC)	THHN	COPPER	19	14	N/A	N/A	N/A	-	BROWN	GRAY	N/A	N/A	-	
DGP DC	CONTROL UNIT TO DGP	THHN	COPPER	19	14	N/A	N/A	N/A	-	PURPLE	ORANGE	N/A	N/A	-	
	LOCAL MODE ALARM BETWEEN CONTROL UNITS	THHN	COPPER	19	14	N/A	N/A	N/A	-	PURPLE	ORANGE	N/A	N/A	-	
EXTERIOR CABLES	UNDERGROUND IN CONDUIT/AERIAL (REQUIRES MESSENGER)	STP	COPPER	7	14	N/A	N/A	N/A	-	-	-	N/A	N/A	-	WEST PENN AG295
		UTP	COPPER	19	14	N/A	N/A	N/A	-	-	-	N/A	N/A	-	WEST PENN AG295

THE ABOVE CABLE CAPACITANCE PROPERTIES ARE TO BE USED AS A GUIDE. CONTRACTOR IS RESPONSIBLE FOR PROVIDING CABLING THAT MEETS THE MANUFACTURER'S REQUIREMENTS.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY - PRE-ACTION SYSTEM WIRING SCHEDULE														
LINE SIGNAL CIRCUIT	CIRCUIT DESCRIPTION	CABLE TYPE	CONDUCTOR (COND)			CAPACITANCE		COLOR				KEYED NOTED	BASIS OF DESIGN MANUFACTURER & PART NUMBER	ALTERNATIVES
			MATERIAL	STRANDS	AWG	DRAIN	COND TO COND	COND TO SHIELD	ID	-	-			
LINE SIGNAL CIRCUIT	PREACTION SYSTEM WIRING SCHEDULE - DATANETWORK	FPLP-UTP	COPPER	7	16	N/A	N/A	N/A	-	RED	BLACK	RED	WHITE ON RETURN	-
	PREACTION SYSTEM WIRING SCHEDULE - FLASH SCAN	FPLP-UTP	COPPER	7	16	N/A	TYPICAL: 41 - 10% P/FFT	N/A	-	RED	BLACK	RED	WHITE ON RETURN	-

THE ABOVE CABLE CAPACITANCE PROPERTIES ARE TO BE USED AS A GUIDE. CONTRACTOR IS RESPONSIBLE FOR PROVIDING CABLING THAT MEETS THE MANUFACTURER'S REQUIREMENTS.

FIRE ALARM KEYED NOTES:

- A. LOW CAPACITANCE.
- B. PERMITTED TO BE REDUCED TO 16 AWG WHEN ORIGINATING FROM ADDRESSABLE INITIATOR MODULE.
- C. MULTI-MODE FIBER 62.5/125 MICRON CORE WITH TYPE ST CONNECTORS.

FIRE ALARM ABBREVIATIONS:

- STP = SHIELDED TWISTED PAIR
- SRP = STRAIGHT PAIR
- UTP = UNSHIELDED TWISTED PAIR

FIRE ALARM WIRING SCHEDULES NOTES:

1. WIRING COLORS AS PER SCHEDULE ARE FOR ALL NEW AND REPLACEMENT CIRCUITS. WHERE NEW DEVICES ARE CONNECTED TO EXISTING CIRCUITS THE WIRING COLOR CODE SHALL MATCH THE EXISTING CIRCUITS CONDUCTORS.
2. A, B, C, ETC. ARE INDICATED ON PLANS FOR GROUPING OF CIRCUITS AND TO PROVIDE FOR INTERLEAVED CIRCUITS. PRIOR TO START OF WORK CONFIRM EXISTING CIRCUITS FOR EACH NODE AND EXACT COLOR CODES FOR NEW/REPLACEMENT CIRCUITS.
3. SCHEDULE APPLICABLE FOR NEW AND REPLACEMENT CIRCUITS MATCHING COLOR CODES FOR THOSE CIRCUITS FOR WIRING FOR EXISTING CIRCUITS. SEE SIMPLEX DRAWINGS FOR EXACT CIRCUIT NUMBERS.
4. WIRE NUTS SHALL NOT BE USED FOR ANY FIRE ALARM SYSTEM WIRING. FOR SPECIFIC APPLICATIONS WHERE DEVICES HAVE FLYING LEADS SUCH AS REMOTE ALARM INDICATORS AND DAMPER END SWITCH CONNECTIONS, THESE CONTINUOUS CONDUCTORS CANNOT BE INSTALLED FROM POINT TO POINT, BUTT SPLICES OR WAGO CONNECTORS ARE ACCEPTABLE.
5. SPEAKER CABLES OR ANY EXTERIOR APPLICATIONS SHALL BE WEST PENN AQUASIA WITH BLACK COLOR INSULATION, AS SCHEDULED.
6. ACCEPTABLE MANUFACTURERS FOR FIRE ALARM WIRE ARE:
 - ANIXTER
 - COMTRAN
 - WINNY CITY WIRE
 SEE NOTE 5 FOR WIRE FOR EXTERIOR APPLICATIONS.

FIRE ALARM WIRING SCHEDULE EXAMPLE (REQUEST FULL SCALE FROM MIT OR VENDOR)



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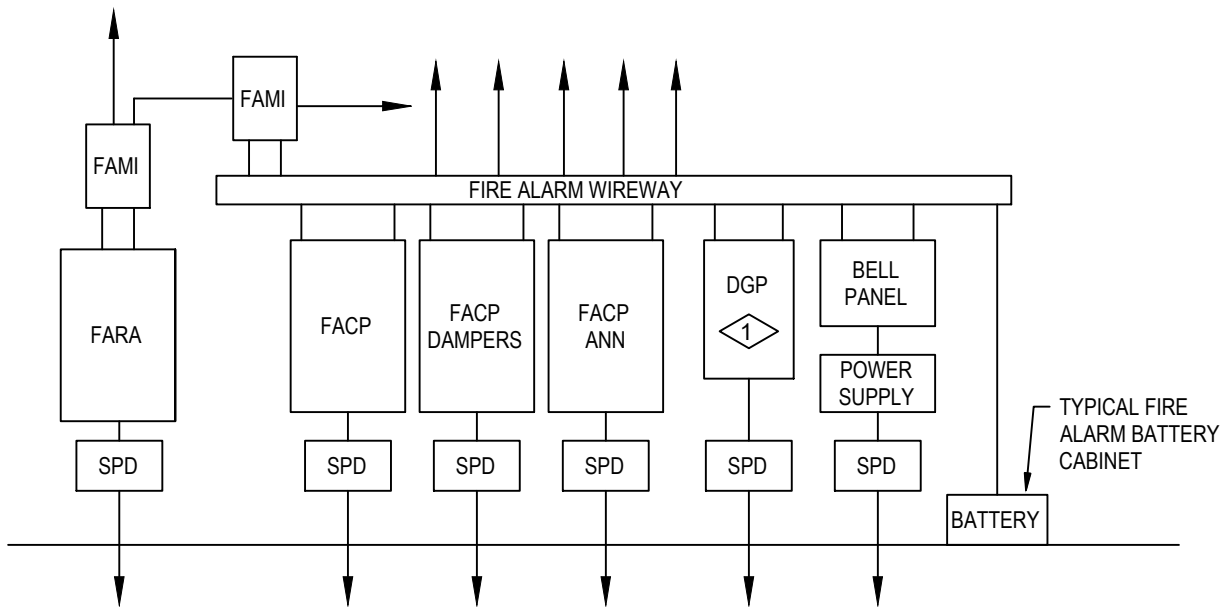
MIT BUILDING "NEW UNDERGRAD DORMITORY" IO MATRIX

	SYSTEM INPUTS	SYSTEM OUTPUTS																								CONTROL UNIT	MIT CAMPUS CENTER	NOTIFICATION	REQUIRED	SUPPLEMENTARY
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24					
INPUTS	1. MAIN PRESSURE SWITCH																													
	2. SMOKE DETECTOR - 2ND FLOOR																													
	3. SMOKE DETECTOR - 4TH FLOOR																													
	4. SMOKE DETECTOR - ROOF/PEN/HOUSE																													
	5. HEAT DETECTOR - 2ND FLOOR																													
	6. HEAT DETECTOR - 4TH FLOOR																													
	7. HEAT DETECTOR - ROOF/PEN/HOUSE																													
	8. MANUAL W/ELL STATION - 2ND FLOOR																													
	9. MANUAL W/ELL STATION - 4TH FLOOR																													
	10. MANUAL W/ELL STATION - ROOF/PEN/HOUSE																													
SUPERVISORY	11. WATERFLOW SWITCH - 2ND FLOOR																													
	12. WATERFLOW SWITCH - 4TH FLOOR																													
	13. WATERFLOW SWITCH - ROOF/PEN/HOUSE																													
	14. SMOKE DETECTOR - 1ST FLOOR ELEVATOR LOBBY																													
	15. BUGT SMOKE DETECTOR - 1ST FLOOR																													
	16. BUGT SMOKE DETECTOR - 3RD FLOOR																													
	17. BUGT SMOKE DETECTOR - 5TH FLOOR																													
	18. SPRINKLER CONTROL VALVE - 1ST FLOOR																													
	19. SPRINKLER CONTROL VALVE - 3RD FLOOR																													
	20. SPRINKLER CONTROL VALVE - 5TH FLOOR																													
FIRE ALARM SYSTEM	21. SPRINKLER CONTROL VALVE																													
	22. FA SYSTEM OPEN OR GROUNDED W/IRING OR SIGNALING CIRCUIT W/IRING																													
	23. FA SYSTEM FAILURE - COMMUNICATION FAILURE																													
	24. FA SYSTEM LOW BATTERY																													
	25. SMOKE DETECTOR SELF TEST FAIL																													
	26. MIT CAMPUS OPERATIONS CENTER DISCONNECT																													
	27. FIRE ALARM SYSTEM AMPLIFIER FAILURE																													
	28. SPD LOSS OF AC BATTERY POWER, GENERAL TROUBLE																													
	29. BATTERY POWER LOSS																													
	30. BATTERY VOLTAGE																													
MANUAL	31. BVA RECIEVER FAILURE																													
	32. MANUAL MAGNETIC DOOR RELEASE (AT FOOD)																													
	33. ALL EXAC SPEAKER CONTROL SWITCH																													
	34. MV DISCONNECT SWITCH																													
MISCELLANEOUS	35. WASH NOTIFICATION HIGH PRIORITY																													
	36. LOW TEMPERATURE MONITOR ALARM																													
	37. HEAT LOAD BANK TRANCE LOSS OF AC POWER																													
	38. W/IRN FUEL ROOM UNIT W/IRN TROUBLE																													
39. F/AM SYSTEM PRESSURE SWITCH																														
40. N/CHENET FIRE SUPPRESSION SYSTEM (PROGRAMMABLE WATER/CO2)																														
41. N/CHENET FIRE SUPPRESSION SYSTEM (PROGRAMMABLE AMPER SWITCH)																														

1. SEE ADDITIONAL SUBMATRICES (DIP HVAC, VOICE EVACUATION, PRE-ACTION AND GAS DETECTION) FOR CLARITY FOR INSTALLATION, PROGRAMMING AND TESTING.

FIRE ALARM SEQUENCE OF OPERATION EXAMPLE
(REQUEST FULL SCALE FROM MIT OR VENDOR)

1 DATA GATHERING PANEL (DGP) FOR FIRE ALARM COMMUNICATIONS TO MIT CONTROL MONITORING STATION. PROVIDE JACK OUT PANEL. COORDINATE WITH MIT.



FIRE ALARM SYSTEM HEAD EXAMPLE



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