

DESIGN REQUIREMENTS

FIRE DETECTION AND ALARM

GENERAL INFORMATION

- 1.1 In general, follow the guidelines below when designing and specifying addressable fire alarm systems. Unless specifically indicated otherwise, these guidelines are not intended to restrict or replace professional judgment.
- 1.2 Approved Fire Life Safety Consultants are:
 - Acotech Services, Inc.
 - Lizardos Engineering Assoc.
 - Syska Hennesy Group
 - Rolf Jensen & Associates, Inc.
- 1.3 All materials and work shall conform to the latest industry standards, the below references, and all applicable codes and requirements of the local authorities having jurisdiction. All products shall be UL-listed and labeled for the installed environment, comply with the listed UL standards and be approved for use in New York City.

AMSE A17.1 - Safety Code for Elevators and Escalators.
New York City Electrical Code.
New York City Building Code. New York City Fire Department Rules and Regulations.
NFPA 13 - Sprinkler Alarm and Supervision.
NFPA 20 - Fire Pump Supervision.
NFPA 72 - National Fire Alarm Code.
NFPA 90A - Installation of Air Conditioning & Ventilating Systems.
NFPA 101 - Life Safety Code.
OHSA - Occupational Safety and Health Administration Regulations.
UL 38 - Manual Signaling Boxes for Fire Alarm Systems.
UL 228 - Door Holders for Fire Protective Signaling Systems.
UL 268 - Standards for Safety for Smoke Detectors for Fire Protective Signaling Systems.
UL 268A - Smoke Detectors for Duct Application.
UL 346 - Waterflow Indicators for Fire Protective Signaling Systems.
UL 464 - Standards for Safety for Audible Signaling Appliances.
UL 864 - Control Units for Fire-Protective Signaling Systems.
UL 1480 - Speakers for Fire Protective Signaling Systems.
UL 1481 - Standard for Safety for Power Supplies for Fire-Protective Signaling Systems.
UL 1971 - Standard for Safety for Signaling Devices for the Hearing Impaired.
Factory Mutual (FM) Approval Guide.
ADA - The Americans with Disabilities Act

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- 1.4 The fire alarm system and its installation shall comply with all applicable requirements of The Americans With Disabilities Act.
- 1.5 **Manufacturer Qualifications:** A firm engaged in the production of the type of equipment specified for at least ten years with a fully equipped service organization that will respond within 24 hours from the initial contact for warranty or regular service work and within 4 hours of initial contact for emergency or off hours service work.
- 1.6 **Installer Qualifications:** The Contractor shall employ on staff, a minimum of one NICET Level 3 technician or a Professional Engineer, registered in New York State. Contractors unable to comply with these provisions shall present proof of engaging the services of a sub-Contractor with a NICET Level 3 technician qualified to furnish the required services.
- 1.7 **Distributor Qualifications:** If the fire alarm system is to be supplied by a manufacturer's distributor, the manufacturer shall provide all required technical and manpower support required by the distributor, in a timely manner, during the installation and warranty period at no cost to Columbia.

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- 1.8 All fire alarm system equipment furnished under this Specification shall be the most current version of Siemens, and shall be Underwriters Laboratories (UL) listed, under the appropriate category, as the product of a single manufacturer. All control equipment shall be listed under UL as a single control unit. The Contractor or his vendor shall be qualified by UL certifying the complete system meets UL upon completion of the installation. Devices shall be listed by UL for sensitivity testing at the FACU.
- 1.9 The Fire Alarm System shall be intelligent device addressable, analog detecting, power-limited and modular, with digital communication techniques, in full compliance with all applicable codes and standards. The system shall provide evacuation alarm signaling using sounding devices to sound the alarm evacuation signals, and strobe lights as visual notification devices.
- 1.10 The FACP shall detect changes in the status of monitored points utilizing distributed processing, peer-to-peer networking with remote system panels located throughout the facility.
- 1.11 Smoke detectors shall be cross-listed with the FACP.
- 1.12 All life safety alarm functions shall perform automatically. Control points shall be capable of operating manually at any time through the FACP. Switches shall be provided at the

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FACP that shall trigger integral programmable functions to allow personnel to manually operate pre-programmed control output functions as required.

- 1.13 Audible appliances and visual appliances shall be of sufficient number so that an alarm will be clearly audible and visible to all occupants of the building. Audible alarm signals shall produce a sound level at least 15 dBA above the average ambient sound level or 5 dBA above the maximum sound level having a duration of at least 60 seconds (whichever is greater) measured 5 feet above the floor in each area that is, or may be, occupied. The average sound level is the root-mean-square, A-weighted sound pressure measured over a 24 hours period. As a minimum, 75dBA shall be provided throughout all occupiable areas as defined by the New York City Building Code and within 75dBA at the pillow of designated sleeping areas. Where emergency voice communications systems are utilized for occupant notification, the alert signal preceding the voice message shall be measured at a minimum of 75 dBA.
- 1.14 Wall-mounted appliances shall have their tops above the finished floors at heights of not less than 90 inches and below the finished ceilings at distances of not less than 6 inches. In addition, wall mounted appliances shall be mounted such that the entire lens is not less than 80 inches and not greater than 96 inches above the finished floor.
- 1.15 All junction boxes shall be red and labeled "Fire Alarm". Wiring color code shall be maintained throughout the installation.
- 1.16 Wet or damp locations shall require a NEMA rated enclosure suitable for the environment in which an addressable field device or module are to be installed and be track mounted. (e.g. monitoring of sprinkler water flow, tamper switches and OS&Y valves)
- 1.17 Termination and control panel enclosures shall be, as a minimum, NEMA 12 rated.
- 1.18 Wiring for analog loop circuits, conventional detection circuits, speaker circuits and telephone circuits shall be based on the fire alarm manufacturer's wiring guidelines, but shall not be smaller than #16 AWG. Conductor size shall be increased as required to limit voltage drop to a maximum of 3 percent.
- 1.19 Cable shall be plenum rated for 150 degrees Celsius with an insulation of Teflon and labeled as approved by the New York City Fire Department.
- 1.20 Provide Carbon Monoxide (CO) detectors and alarm as required by Code. Wherever practicable, and especially in dormitories, use combination smoke and carbon monoxide detectors.
- 1.21 The following non-addressable devices shall be integrated into the fire alarm system via addressable interface modules:

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- a. Sprinkler water flow (alarm initiating).
 - b. Sprinkler valve tamper switch (supervisory).
 - c. Fire Pump Controller (supervisory, 3 points)
 - d. Emergency Generator (supervisory, 2 points)
 - e. Dry pipe, pre-action and other auxiliary systems (alarm and supervisory as required).
- 1.22 The following audible and visual signaling devices shall be controlled by the FACP:
- a. Horns.
 - b. Speakers.
 - c. Strobe Lights (synchronized).
 - d. Combination audible and visual notification devices.
- 1.23 The following devices shall be controlled by the FACP via remote system addressable relays and intelligent addressable interface module relays:
- a. Connections to the Central Office Connection and Columbia University Call Center for manual pull station alarm, sprinkler alarm, smoke alarm, heat alarm, supervisory and system trouble conditions.
 - b. Air handling fan shutdown operation and status.
 - c. Elevator Controls for elevator recall.
 - d. Smoke Dampers or Combination Fire Smoke Damper operation and status.
 - e. Stair Pressurization or Smoke Purge Systems operation and status.
- 1.24 The system as described shall be installed, programmed, tested, and delivered to Columbia in fully operational condition.
- 1.25 Training: Provide training as follows for a minimum of four representatives of Columbia:
- a. Training in the receipt, handling and acknowledgment of alarms, system operation, maintenance, system programming and arm/disarm procedures.
 - b. Training on system operation including manual control of output functions from the FACP.
 - c. Training in the testing of the system including logging of detector sensitivity, field test of devices and response to common troubles.

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- d. The total training requirement shall be a minimum of 8 hours, but shall be sufficient to cover all items specified.
 - e. The manufacturer shall provide a written schedule of training dates for factory training of Columbia's representatives. Include all fees, dates, times, phone numbers and contact individual.
- 1.26 Warranty/Services: The fire alarm system wiring and equipment shall be warranted to be free from inherent mechanical and electrical defects for a period of one (1) year from the latter of issuance of FDNY letter of approval and CUF system acceptance. CUF System acceptance is issued when the system has been online and issue-free for 30 consecutive days prior to FDNY Acceptance Testing.
- 1.26 Provide complete electronic as-built documentation. The floor plan drawings shall indicate all rooms by type; especially including electrical, mechanical and storage rooms; and any rooms or areas that are non-standard or unusual for the building; and the following:
- a. Location of all devices, circuits, equipment, risers and electrical power connections.
 - b. The digital address or sequential zone/device number of all initiating devices.
 - c. Schedule(s) outlining the number, size and type of each conductor and conduit used.
 - d. Point-to-point wiring connections showing individual circuits and circuit/conduit routing, number, type and size of conductors used and unique identification for each circuit. The use of "French Curve" lines to depict new conduit runs is prohibited. Conduit shall be drawn as installed. For systems in which existing conduit is planned to be reused, the shop drawings should differentiate reused existing conduit from new conduit to be installed.
 - e. Typical wiring diagrams (1/4-inch scale) for all alarm initiating devices and notification appliances, showing the number, size and type of conductors, wiring terminations and terminal identifications.
 - f. Detailed internal and external wiring diagrams for all control panels, remote transmitting panels, central station signaling equipment, auxiliary function relays and remote annunciation equipment showing size and type of conductors, wiring terminations and terminal identifications.
 - g. When data gathering panel power is derived from a "local" source of building emergency power, the shop drawings shall show wire routing and point of connection (location, panel number, description and circuit breaker number) to the building emergency circuit.
- 1.27 In addition to all tests required by the New York City Fire Department and Building Department, required field tests shall include:
- a. Wiring runs shall be tested for continuity, short circuits and grounds before system is energized.

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- b. System wiring shall be tested to demonstrate correct system response and correct subsequent system operation in the event of:
 - 1. Open, shorted and grounded intelligent analog signaling circuit.
 - 2. Open, shorted and grounded network signaling circuit.
 - 3. Open, shorted and grounded conventional zone circuits.
 - 4. Open, shorted and grounded speaker, telephone circuits.
 - 5. Intelligent device removal.
 - 6. Primary power or battery disconnected.
 - 7. Incorrect device at address.
 - 8. Printer trouble, off line or out of paper.
 - 9. Loss of data communications between system annunciators.
- c. System evacuation alarm indicating appliances shall be demonstrated as follows:
 - 1. All alarm notification appliances actuate as programmed
 - 2. Audibility and visibility at required levels.
 - 3. General alarm of all appliances in the building.
- d. System indications shall be demonstrated as follows:
 - 1. Correct message display for each alarm input at the control panel, remote alpha-numeric LCD display.
 - 2. Correct annunciator light for each alarm input at annunciator.
 - 3. Correct printer logging for all system activity.
- e. System on-site reporting functions shall be demonstrated as follows:
 - 1. Correct alarm custom message display, address, device type, date and time transmitted for each alarm input.
 - 2. Correct trouble custom message display, address, device type, date and time transmitted for each alarm input.
 - 3. Trouble signals received for disconnection of devices.
- f. Secondary power capabilities shall be demonstrated as follows:

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1. System primary power shall be disconnected for 24 hours. At the end of that period, an alarm condition shall be created.
 2. System primary power shall be restored for 48 hours and system charging-current shall be normal trickle charge for a fully charged battery bank.
 3. System battery voltages and charging currents shall be checked at the fire alarm control panel using the test codes and displayed on the LCD display.
 4. System annunciated for 45 minutes at maximum connected load for voice communications systems or 15 minutes for systems without voice communication.
- 2.1 Spare Keys: Three (3) keys of each type.
- 2.2 Spare Detectors: Three (3) of each type of automatic detector without base.

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3.1 SUBMITTALS

- a. Product Data: Provide catalog pages showing actual dimensions of the main FACP, additional system panels, remote annunciators or battery cabinets, descriptions of special installation procedures or mounting requirements, special physical installation requirements, dimensions, elevations, conduit entry, minimum access clearances and any other details required. State any specific points of the proposed system's operation or the equipment's quality differ in any way from this Specification. Include supervisory and alarm power usage.

- 3.2 Provide a signed letter and a notarized statement on the manufacturer's letterhead stating that the batteries are able to provide power to the fire alarm system for 24 hours followed by 15 minutes (without voice communication) or for 45 minutes (for voice/alarm operation) at the maximum connected load.

- a. Shop Drawings: Provide a riser diagram and floor plans showing, all equipment, all connections and number and size of all conductors and conduits. Shop Drawings shall be in a CAD format. Provide a schedule indicating the circuit numbers and the quantity of devices connected to each circuit.
- b. Function/Device Matrix: Provide an input/output function matrix indicating alarm, trouble and supervisory output events in association with initiating device input events. Indicate any departures from the specified requirements. Provide a list of devices within each input group and a list of outputs or devices within each output action. Provide a device

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matrix (NFPA 72-158/Annex A Figure {A.10.6.2.3 (9)}) for review by Columbia's representative prior to acceptance testing.

- c. Field Test Reports: Submit field test reports with all testing data including inspection procedures and test results. Include start-up inspection findings.
- 3.3 The FACP shall be equipped with the necessary components to communicate via a RS-485, peer to peer, Multiple Access Protocol, Carrier Sense, Multiple Access, Collision Detect, also known as CSMA/CD an ETHERNET type protocol. These systems devices may be connected as network "nodes" connecting each system nodes through a Network Interface Module (NIM). Status change in any network node shall be sent to all other nodes for processing and local operations as required for the project. Network data communications shall be NFPA Standard 72, Style 7, two-conduit system.
- 3.4 The FACP shall provide NFPA Standard 72, Style 4 (Class B) operation with loop isolator analog signaling circuitry required to communicate with, and receive alarms from up to sixty intelligent analog alarm initiating and sixty intelligent controllable output devices. Analog loops shall be configured with loop isolators and wired in a manner that prevents a catastrophic wiring event on a floor from affecting the performance of other floors. Analog loops shall be arranged such there is a minimum of 20% spare capacity on every loop to allow for future expansion. Systems allowing more than sixty input or output devices per addressable loop shall be wired in a Style 6 (Class A) configuration with raceway design configured to allow a maximum of one section of the loop within a single raceway. These loops must also be arranged such there is 20% spare capacity on every loop to allow for future expansion.
- 3.5 The FACP shall provide NFPA 72, Style Y, two-wire, supervised, alarm notification appliance circuits. General floor audible notification appliance circuits shall, as a minimum, consist of two (2) circuits per floor. Circuits shall be installed in an alternate style, so that 50% of the audible devices installed would be operationally functional should one circuit fail. Audible appliances and visual appliances shall be powered by dedicated circuits and not by the same indication circuit. Combination audible/visual devices may be used, but shall be wired separately. The system shall be programmed to allow silencing of alarm audible notification horn devices without turning off visual notification strobe devices. Alarm indicating strobe devices shall stop upon reset of FACP only.
- 3.6 Provide system power supplies, including necessary transformers, rectifiers, regulators, filters and surge protection required for system operation, with the capacity to power the system in a worst-case condition with all devices in alarm and all local indicating appliances active without exceeding 80% of the listed ratings. All system devices shall display normal and alarm conditions whether operating from normal primary power or

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secondary/battery power. Systems not displaying an alarm indication at each device when the system is in a standby power mode shall include an addressable remote LED indicator at the device to perform this function.

- a. **System Primary Power:** Primary power for the FACP and the secondary power battery chargers shall be obtained from a NYC approved Fire Alarm Cut-Out in accordance with Code requirements. The Fused Cut-Out shall be permanently labeled for function.
 - b. **Secondary Power Supply:** When the building has an emergency generator, the generator shall be the secondary power source routed through a dedicated automatic transfer switch to the Fire Alarm system. For other buildings, the secondary source shall be a battery supply.
 - c. **Battery Supply:** Provide a sealed gelled electrolyte battery back-up source for all Fire Alarm Systems regardless of whether or not a generator is used as the secondary power source. The batteries shall supply power for all fire alarm functions in the event other sources fail. The battery supply capacity shall operate the system in a supervisory mode for twenty-four (24) hours with no primary power applied, and after 24 hours, operate in an voice/alarm mode for forty-five (45) minutes at maximum connected load for systems with voice capability, or for fifteen (15) minutes of total system load for systems without voice capability. Batteries shall be sized at 125% of the calculated size to compensate for deterioration and aging during the battery life cycle. Provide battery-charging circuitry for each standby battery bank in the system. The charger shall be automatic in design, adjusting the charge rate to the condition of the batteries. All system battery charge rates and terminal voltages shall be visible using the FACP display in the service mode, indicating directly in volts and amps.
- 3.7 Manual Pull Stations shall be addressable, dual action and listed by UL. The Pull Station shall operate on any addressable detection circuit and be individually annunciated on the control panel. Pull Stations shall be red in color and mounted 48 inches to the station actuation handle from the finished floor.
- 3.8 Area Smoke Sensors shall be intelligent, addressable photoelectric type and listed by sensor shall be UL listed. The smoke sensor shall contain a long-life, light emitting diode (LED) as its light source, and a photo diode as the light receiver. An automatic gain control circuit shall compensate for detector aging and dirt accumulation. The sensor shall have an application specific detection sensitivity setting that shall be programmable. Each smoke sensor shall have a flashing LED indicator that shall flash a different color for alarm, trouble and normal operation. The smoke sensors shall have analog addressable communication with fire alarm control panel. Provide audible bases where required.
- 3.9 Duct Smoke Sensors shall include a housing and utilize an area smoke detector. Each detector and housing shall be self-compensating for the effects of air velocity,

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- temperature, humidity, and atmospheric pressure. Provide sampling tube to span entire duct width or provide additional detectors 2 feet on center for ducts wider than 3 feet. Each smoke sensor shall utilize solid state components and shall be provided with a form "C" remote relay with contacts rated at 3 amps 120 VAC or 24 VDC. Provide a remote LED indicating detector alarm status mounted in a visible location where the locations of the duct smoke sensors and alarm status indicator is not directly discernable.
- 3.10 Heat Detectors shall be intelligent, addressable, fixed temperature and/or 135 degrees Fahrenheit. rate compensation/fixed temperature thermistor element heat detector. Unit shall be UL listed for a maximum coverage area of 2,500 square feet. The rate-of-rise alarm threshold rate shall be 15 degrees Fahrenheit per minute and shall be self-restoring. The heat detector fixed element shall not be self-restoring. The detectors shall be individually annunciated on the control panel. Thermal detectors shall contain an integral alarm lamp.
- 3.11 High Temperature Heat Detectors shall be fixed temperature 200 degrees Fahrenheit conventional (non-addressable) rate compensation/fixed temperature element heat detector. Unit shall be UL listed for a maximum coverage area of 625 square feet of the fixed temperature element. The rate-of-rise alarm threshold rate shall be 15 degrees Fahrenheit per minute and shall be self-restoring. The heat detector fixed element shall not be self-restoring. The detectors shall be individually annunciated on the control panel by means of interfacing with an addressable conventional zone control module. The detectors shall contain an integral alarm lamp.
- 3.12 Addressable Interface Modules shall be intelligent, addressable type, listed by UL. The unit shall incorporate a custom microprocessor based integrated circuit that shall provide communication with main fire control panel. The interface module shall supervise and monitor normally open or normally closed dry contacts. The interface module shall report the contact's status to the control panel. The intelligent interface module shall be dynamically supervised and uniquely identifiable by the control panel. The intelligent interface module shall be used to uniquely identify field devices such as water flow switches, tamper switches, OS&Y valves, etc. The intelligent interface module shall be used when remote relay functions are required for system functional requirements, such as but not limited to, fan shut downs. Relay dry contacts shall be rated at 2 amps, 120 VAC resistive or 30 VDC resistive and shall be Form "C". Provide slave relays where required to control larger loads.
- 3.13 The Alarm Printer shall be a thermal type strip printer located within the FACP with the printout visible through an opening in the FACP door. The printer shall record all events including operator commands and shall be capable of providing a printed list of all system conditions.

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- 3.14 Combination Notification Appliances: UL 464 listed as audible fire alarm notification appliance and UL 1971 listed as visual fire alarm notification appliance. Low frequency horn with sound output of 92 dBA at 10 feet. Where multiple visual signals are visible from a location, circuitry and additional equipment shall be incorporated for synchronization of flash rate. The strobe intensity shall be rated per UL 1971 and ADA adjustable for 15/75, 30/75, 75, or 110 candela as required. Mounting height shall be 80 inches to the centerline of the device. For surface mounted devices, provide Siemens backbox. Provide a data logging port for manual connection of a printer to export logs.
- 3.15 Strobes: UL 1971 listed as a visual fire alarm notification appliance. Where multiple visual signals are visible from any location, circuitry and additional equipment shall be incorporated for synchronization of flash rate. The strobe intensity shall be rated per UL 1971 and ADA adjustable for 15/75, 30/75, 75, or 110 candela as required. For surface mounted devices, provide Siemens backbox.
- 3.16 Horns: UL 464 listed as audible fire alarm notification appliance. Low frequency horn with sound output of 92 dBA at 10 ft. For surface mounted devices, provide (Siemens) backbox.
- 3.17 Visual signals shall be installed in accordance with the requirements of UL 1971, NFPA 72 and the ADA. Where multiple visual signals are visible from any location, circuitry and equipment shall be incorporated for synchronization of flash rate.
- a. Comply with UL 1971 Listed for Emergency Devices for the Hearing Impaired in all public mode installations.
 - b. Strobes shall meet UL 1971 and produce a flash rate of one (1) flash per second minimum over the listed input voltage (20VDC - 31VDC) range.
 - c. All visual signals shall incorporate a Xenon flash tube enclosed in a rugged Lexan lens or equivalent with solid-state circuitry.
 - d. The strobe intensity shall be rated per UL 1971 and ADA for 15/75, 30/75, 60/75, 75 or 110 Candela applications.
 - e. Strobes shall be available as flush mounted in conjunction with audible signals as required.
- 3.18 The system shall provide status indicators and control switches. Status indication and control shall be arranged to reflect the actual status of the associated equipment or function accurately for all devices required including status indicators for sprinkling system water flow and valve supervisory devices.
- 3.19 Devices shall be listed by UL for sensitivity testing by means of the portable programmer/tester or by readout from the control panel. Device address and sensitivity

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assignments shall be predetermined electronically, devices requiring dip switch settings, rotary switch settings, staples or jumper settings are not acceptable.

- 3.20 Remote Diagnostics Module: The system shall be provided with remote diagnostics capability (Siemens, RDM) to provide remote dial-up and integration by the authorized fire alarm service facility. The RDM shall provide remote program review, sensitivities and well as troubleshooting capabilities. Provide a standard phone line connection to this unit.
- 3.21 Fire Finder Pager: The system shall be provided with a pager system (Siemens, CCU/M) to provide remote indication of alarms, troubles and various system diagnostics for selected individuals. Provide a standard phone line connection to this unit.
- 3.22 Digital transmitter for connection to central station and Columbia University Call Center shall be Radionics 81T2D DACT. Programming for DACT will be provided by Columbia University.

REFERENCE

- 4.1 The applicable CSI Specification Section is 283100.

Revision Approval:

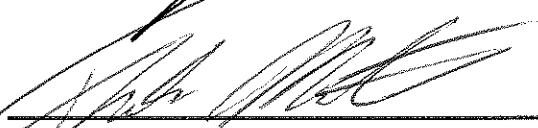
Revision #: _____



Joe Mannino

10-9-12

Date



Frank Martino

10/9/12

Date