



## **CHAPTER IV: SUPPLEMENTAL GUIDELINES**





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## I. SUPPLEMENTAL GUIDELINES

### C. SECTION C - EQUIPMENT GUIDELINES

#### 1. EHS DESIGN GUIDELINES FOR EMERGENCY GENERATORS

##### a) Background

Emergency generators are required for many of the new building designs based upon the State Building codes that address ventilation for toxic and highly toxic materials, elevators as means of egress, high rise buildings, fire pumps and more. The primary environment, health and safety issues relate to noise and generator air emissions. Most of the generators on the UNC Campus are powered by diesel fuel. Diesel generators emit NO<sub>x</sub>, hydrocarbons, particulates, CO and SO<sub>x</sub>. Diesel exhaust is considered a respiratory irritant and a suspect carcinogen. In the near future, tightening of air emission regulations are expected for stationary diesel engines as they are for on-road diesels engines.

##### b) Generator Location

Sighting the generator must begin in the Building Programming phase. All parties concerned with the generator should provide tentative approval for the “best” location of the generator and stack along with at least 2 alternate locations for the generator, stack or both. Each generator installation must meet the requisite NFPA, electrical and NC building code requirements, the local City noise ordinance (when close to the property boundary) and the manufacturer’s specifications.

##### c) Additional Design Location Requirements

- (1) The design should accommodate the following additional requirements. If a specification cannot be met, an explanation shall be provided for further evaluation by the EHS Department.
- (2) The generator exhaust must discharge vertically for maximum dispersion modeling.
- (3) The rain cap shall fully open without impeding the vertical discharge while the generator is operating.
- (4) Ensure the exhaust is clear of trees, combustible materials and pedestrian traffic to avoid fires and burn hazards (discharge temperatures are over 1000 degrees F).
- (5) Control noise exposures in adjacent occupied building spaces below 60 dB averaging for the speech frequencies of 500, 1000, 2000, 4000 and less than 80 dBA .
- (6) Noise levels 1 meter away from the generator and 1 meter from the ground shall be 82 dBA or less at all locations around the generator as installed.
- (7) Locate generator in area that is not subject to flooding.
- (8) In confined areas, provide for direct reading exposure monitoring for generator operators (NO<sub>x</sub>, CO, O<sub>2</sub>).
- (9) Provide for spill catchments for diesel tank storage filling operations.(overfills, drips etc.)
- (10) Position the exhaust point above roof level and away from air intakes.
- (11) Provide an above ground fuel tanks with integral secondary containment
- (12) Provide for sufficient equipment spatial clearances for maintenance and repair personnel to access all sides of the generator in confined buildings or vaults.
- (13) Exposure monitoring equipment may be required for generator maintenance personnel working on the generator in confined areas.
- (14) Plan for fueling accessibility and spill control during fueling
- (15) Guard the exhaust stack to prevent burns or fire hazards



d) Emissions Modeling

Based upon the “best” location, the architects/engineers will provide the EHS Office with the key information requested in the attached emergency generator form. The EHS Office will provide this detailed information on the generator to an Environmental Engineering consulting firm in order to mathematically model both environmental emissions and personnel exposures around the generator.

The Environmental Engineers will evaluate the emissions against;

(1) EPA standards for Ambient Air Quality

- (a) Proximity of receptors
- (b) Passersby
- (c) Open windows
- (d) Building air intakes
- (e) Confined spaces

(2) Recommended Personnel Exposure Limits

- (a) < 1ppm NO<sub>2</sub> in 15 min. (NIOSH STEL) {assume NO<sub>2</sub> is 34% of total NO<sub>x</sub> from RWDI- Science Complex Study ‘02}
- (b) <0.02 mg/M<sup>3</sup> respirable, Elemental Carbon (EC) (ACGIH Notice of Intended Changes) {assume 40% of total particulate matter is EC from [www.dieselnet.com/standards/us/ohs.html](http://www.dieselnet.com/standards/us/ohs.html)}
- (c) 4000:1 dilution or greater from the generator stack discharge- typically reduces the nuisance odors to nondetect levels for 50% of the population (from RWDI)

e) Approval

When the modeling is completed, a confirmation letter from EHS Department will be provided to the UNC Design Coordinator if all of the criteria are met. If the generator emissions exceed allowable limits, the deficiencies will be noted. Correcting the deficiencies could involve relocating the generator and/or providing additional engineering controls. If the generator or exhaust point is relocated, the emissions must be remodeled. If engineering controls are selected, the anticipated reductions in generated pollutants can be applied directly to the modeled emissions.

f) Additional Design Consideration

- (1) While not mandatory, these concepts will aid in future reconfigurations of emergency power infrastructure supplied to the campus buildings.
- (2) Design building electrical distribution to provide automatic load shedding to isolate critical emergency equipment and allow for potential sharing of emergency power units. It is far cheaper to install this equipment when the building is built than performing a retrofit.
- (3) Combine buildings to share larger generators which are located further from the buildings. Emission controls for the redesigned, larger diesel engines are actively under development and more readily available for purchase.
- (4) Identify generators that will run with a variety of fuels including ultra low sulfur diesel (<5 PPM sulfur), biodiesel and diesel/water mixtures
- (5) Potential emission control technologies include water injection, timing adjustments, catalytic conversion, particulate traps etc. If the additional cost is within budget,



consider purchasing control technology in confined areas where emissions are marginally acceptable. Modeling is a relatively crude tool and provides only a rough estimate of exposures.

- (6) Ensure that the new diesel engines to be purchase are adaptable to the emerging control technologies that may be required with new regulations.
- (7) At a minimum, specifications for new generators should comply with EPA off-road diesel engine Tier I-III standards.

g) Comments for Designers on Selecting New Generators (8/13/03):

- (1) UNC-Chapel Hill will be included in the RTP non-attainment area for the air pollutant ozone. Since diesel engines emit significant quantities of NO<sub>x</sub> that contributes to ozone production, they may be more closely regulated. Also, EPA has been regulating off-road diesel engines since 1996. In May 2003, EPA began rule making for the Tier 4 emission reductions required for off-road engines.
- (2) In most states, including NC, the regulations have been applied primarily to mobile sources. However, in California, they have adopted the EPA standards for stationary sources in 2003.
- (3) Because emergency generators have a long service life, it is prudent for the University to prepare for future regulations of emergency/standby generators by procuring the latest engine technology. Careful genset specification and purchasing will reduce air pollution now and will enable the addition of less costly emission controls in the future.

h) Desirable emission features for new generators are as follows:

- (1) The generator should meet at least the most stringent of the applicable EPA Tier 1-3 off-road diesel engine standards without the use of end of pipe exhaust treatment when burning #2 fuel oil. The phase-in schedule for the applicable EPA Tiered emission standards is based upon the engine power output and the calendar date. (Engines which meet EPA's voluntary "Blue Sky Series" requirements will operate even cleaner but may not be available for purchase at this time.)
- (2) Generator specifications should require that the engine would meet the corresponding emission Tier requirements in the year it is purchased. The manufacturers should be consulted to determine when their lower emitting engines would be available. Delaying a purchase by a few months to buy the next generation of generator could significantly reduce emissions. See [www.dieselnets.com/standards/us/offroad.html](http://www.dieselnets.com/standards/us/offroad.html) for details on EPA's emission standards reduction schedule including the Tier 4 proposal. Some manufacturers may try to reduce their emissions sooner than required for the benefit of the buyer. Special consideration should be given to the cleanest burning engines.
- (3) Emissions modeling will be based upon the generator specifications. Generators must not be substituted by the contractor after bidding without detailed review by EHS.
- (4) The generator engine must be capable of running on the full spectrum of diesel fuels from heating oil (diesel fuel #2), low sulfur, ultra-low sulfur, and no sulfur fuel to biodiesel.
- (5) Sufficient space should be provided around the generator for emissions equipment upgrades should they be required in the future.







## EMERGENCY GENERATOR DATA SHEET

The following information should be included to expedite the processing of the application for a Certification of Approval. If more than one emergency generator is being applied for, please fill out one of these data sheets for each emergency generator or include the information contained below in a summary table.

- A. Please provide a brief description of the intended use of the emergency generator.
- B. Where will the generator be located? (e.g., indoors, outdoors in enclosure)
- C. Identify the fuel being used (e.g., diesel oil, natural gas, etc.)
- D. What is the unit rated for? (in kW)
- E. Provide exhaust emission data and exhaust building/enclosure, then the exhaust flow rate (actual m<sup>3</sup>/s) and temperature (Celsius degrees) are required.
- F. Provide the stack exit diameter (in metres)
- G. Provide the stack height above the roof (in metres).
- H. Provide the stack height above grade (in metres).
- I. If the generator is located indoors, please provide the following:
  - 1. Building dimensions (including dimensions of all buildings within 5L of the generator (5L is 5 times the lesser of the height or projected width of the buildings).
  - 2. Building elevation(s)



3. Location of the exhaust stack
  4. Location of the property line
- J. If the generator is located outdoors in an enclosure, please provide the following:
1. Enclosure dimensions (length, width, height)
  2. If the enclosure is within 5 metres of any other structures, include the dimensions of that structure as well
  3. Location of exhaust stack
  4. location of property line
- K. Provide the distance from the ventilation openings for combustion air intake/exhaust or the combustion exhaust stack (whichever is closer) to the nearest residential property line (if the residences are located on-site, then provide the distance to the nearest residential receptor).
- L. If there are any sensitive receptors (e.g., hospital, school, nursing home, day care center) within 500 metres of the exhaust stack, please provide details of their location
- M. Provide exhaust emission information, if available. Include equipment data sheet, if available
- N. Is the required fuel readily available on campus?
- O. Provide the maximum sulfur content of fuel to be burned



## 2. FIRE ALARM SYSTEM

### a) GENERAL

#### (1) RELATED DOCUMENTS

- (a) Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

#### (2) SCOPE

- (a) This section of the specifications includes the furnishing, installation, and connection of the microprocessor controlled, addressable reporting fire alarm equipment required to form a complete coordinated system ready for operation. It shall include, but not be limited to, alarm initiating devices, alarm notification appliances, control panels, auxiliary control devices, annunciators, power supplies, and wiring as shown on the drawings and specified herein. It also includes the connections and appurtenances necessary to interconnect with the existing system as described above.
- (b) The University maintains and services all fire alarm equipment on campus. The Contractor shall provide any site specific and end user type training of the system. Additionally, where any specific computers, printers, cabling, software and/or license agreements are necessary for the University to have the capability to develop a database and/or modify any operating scenario for the buildings fire alarm system without permission from outside distributors, a schedule of available manufacture certification training shall be provided. This training and certification shall recognize the University as a trained and licensed Fire Alarm System installer independent of local distributors and shall not be included in the price of the base bid. The authorized representative will coordinate training arrangements, costs, and specific support equipment needs with the owner.

#### (3) QUALITY ASSURANCE

- (a) **Manufacturer's Qualifications:** Firms regularly engaged in manufacture of fire alarm systems of types, sizes, and electrical characteristics required, and whose products are Listed and Labeled by UL, Inc. All products, including initiating devices and notification appliances, shall be as produced or supplied by the same manufacture as the main fire alarm control panel. Products of firms that do not maintain factory authorized service organization and spare parts stock are not acceptable for use on this project.

Manufacturer's shall agree to make factory training/certification, product programs and/or operating systems, and continued product updates and/or Tech notes available to the University. Any licensing and/or proprietary agreements between the manufacture/distributor and the University must be completed and in place prior to the manufacture and/or product being acceptable for installation.

- (b) **Installer's Qualifications:** An experienced company who is an authorized representative of the FACP manufacturer for both installation and maintenance of all equipment is required for installation of the FACP and connection of all circuits for any project. The Installer shall have a



minimum of 5 years documented experience installing fire detection and alarm systems similar in size and scope to this project. The Installer technicians shall be individually certified NICET Level 2 and by the manufacturer of the equipment and trained and certified on the specific model being installed. The Installer shall have at least one technician on staff certified NICET Level 3. Certifications shall be current to latest release and must have occurred in the most recent 24 months. All connections to the FACP, system programming, and/or programming changes shall be accomplished only by the Installer technicians compliant with qualifications, and must be present for the 100% test, Engineer's inspection, and Owner inspections.

- (c) Codes and Standards: The codes and standards listed below are utilized as design criteria for "minimal" system coverage. The University may require additions to these codes and standards based on historical consensus criteria for design and installation of fire alarm systems specific to facility applications within University type settings.

- (i) NFPA Compliance: Comply with current applicable requirements of NFPA-72, National Fire Alarm Code.
- (ii) NEC Compliance: Comply with current applicable requirements of NFPA-70, National Electrical Code (NEC) standards pertaining to fire alarm systems.
- (iii) State Building Code Compliance: Comply with applicable requirements of the North Carolina State Building Code.
- (iv) Testing Laboratory Compliance: Comply with provisions of UL safety standards pertaining to fire alarm systems. Provide products and components, which are Listed and Labeled.
- (v) FM Compliance: Provide fire alarm systems and accessories, which are FM approved.
- (vi) Comply with Authority(ies) Having Jurisdiction (AHJ):

- (a) NC State code requirement issues: NC Department of Insurance
- (b) City of Chapel Hill code requirement issues: Chapel Hill Fire Marshall
- (c) University code requirement issues: UNC Health & Safety Fire Marshall
- (d) University policy and system application requirements: UNC Facilities Services Superintendent of Life Safety & Access Controls

- (d) Assumption of Existing System Responsibility/Liability: Any construction project additions and/or renovations that will require changing the current programming of an existing fire alarm system in any way shall require an official transfer of the entire FACP system responsibility to that contractor. This also includes significantly impairing any active system to accommodate phased construction projects where the FACP will either be: removed in its entirety at the completion of the project and/or significantly modified and/or totally replaced through a dual system coverage conversion type project. A signed letter transferring the responsibility of the system as well as an emergency contact list shall be provided to the owner prior to the start of any construction. (See Attachment C).

#### (4) SUBMITTALS - GENERAL



Submittals shall demonstrate compliance with technical requirements by reference to each subsection of this specification. Where a submitted item does not comply fully with each and every requirement of the specifications, the submittal shall clearly indicate such deviations and may be subject to rejection. Identification requirements for non-complying features of items are very specific.

- (a) **Installer Certifications:** Copies of manufacturer signed certifications and NICET certifications as required in section 1.3.B above.
- (b) **Product Data:** Submit Manufacturer's technical product data, including specifications and installation instructions, for all system components (i.e, boards, devices and/or modules, duct mounted smoke detectors, flow switches, tamper switches, supervisory switches, and/or other similar items which require mechanical installation.) that will support the entire fire alarm system. Submit technical product data on any required fire alarm system servicing and/or support equipment.
- (c) **Maintenance Data:** Submit maintenance data and parts lists for each type of fire alarm equipment installed, including furnished specialties and accessories. Include this data, product data, and shop drawings in maintenance manual.
- (d) **Shop Drawings:** Submit (2) bound, full size sets of shop drawings showing all equipment, all device/module locations, and connecting wiring of entire fire alarm system depicted on scaled architectural floor plans with Installer's border sheet. Include wiring and riser diagrams and battery calculations. See Attachment A for typical wiring and riser diagrams. Provide distance and proposed route for each Notification Appliance Circuits (NAC's). Electronic copy of such plans shall also be provided by the Engineer in a format compatible with the most recent release of AutoCAD if requested.
- (e) **Standby Battery Sizing Calculations:** Submittal shall list voltage drop allowed for main fire alarm panel and Notification Appliance Circuits panels (NAC's). Calculations must be submitted prior to installation of equipment. Battery calculation shall be based on "worst case" scenario of current draw, voltage available after 24-hours standby and 5 minutes of full alarm, shall be indicated on a battery chart. The UL minimum voltage allowed by panel shall be used to calculate NAC current draw and voltage drop. Submittals shall provide milliamp current draw data for each device submitted and UL Listed minimum voltage required to operate.
- (f) **Owner Training and Certification:** Provide the owner a current factory approved certification/ training schedule for the specific system installed.
- (g) **Maintenance Contract:** Provide maintenance contract per Alternate E1 if agreed to by all interested parties. Interested parties include: UNC Facilities Planning Project Manager, the Building Representative, and the Life Safety & Access Controls Superintendent.
- (h) **Network Interface Connection:** Provide product data, as required above, for network interface connection per Alternate E2 if required by contract.

## b) PRODUCTS

### (1) MANUFACTURER'S/MODELS

- (a) **Manufacturer's/Models:** Subject to compliance with requirements in section 1.3.A above, the current manufacturer's and corresponding panel models that are acceptable to be incorporated into the contract are limited to the following:



- (i) Edwards System Technology - (EST2, EST3),
- (ii) Notifier; Div. of Pittway Corp. - (AM3030),
- (iii) Seimens, Inc. - (MXL-IQ, MXL)

(b) FIRE ALARM CONTROL PANEL (FACP)

- (i) FACP - Minimum Requirements: The FACP shall contain an addressable microprocessor based Central Processing Unit (CPU), with a 24VDC nominal operating voltage. The CPU shall communicate with and control the following types of equipment used to make up the system: addressable detectors, addressable modules, local and remote operator terminals, printers, annunciators, and other system controlled devices. The main FACP shall perform the following functions:
  - (a) Supervise and monitor all addressable detectors and monitor modules connected to the system for normal, trouble and alarm conditions.
  - (b) Supervise all initiating, signaling, and notification circuits throughout the facility by way of connection to monitor and/or control modules.
  - (c) Detect the activation of any initiating device and the location of the alarm condition. Operate all notification appliances and auxiliary devices as programmed.
  - (d) Visually and audibly annunciate any trouble, supervisory or alarm condition on operator's terminals, panel display, and annunciators.
  - (e) The FACP shall include a full featured operator interface control and annunciation panel that shall include a backlit, 80 character liquid crystal display, individual, color coded system status LED's, and an alphanumeric keypad for the field programming and control of the fire alarm system.
  - (f) All programming or editing of the existing program in the system shall be achieved without special equipment and without interrupting the alarm monitoring functions of the fire alarm control panel, and shall be password protected with multiple access levels.
- (ii) System Capacity and General Operation: The system shall have the following capacities and general operation modes:
  - (a) Signal Line Circuits (SLC's): The FACP shall be capable of connecting the number of devices shown in the drawings to SLC's. Alarm, trouble and supervisory signals from all addressable reporting devices shall be encoded onto a Class A Signaling Line Circuit (SLC), (NFPA Style 6), with the capacity for expansion up to at least 198 total addressable devices per SLC and up to at least 2048 total annunciation points per system. The number of SLC's provided shall be as indicated on the Drawings, with a minimum of (1) one spare for future use. Each SLC shall not carry more than 80% of its rated load capacity on a new system installation.



- (b) Initiation Device Circuits: Initiation Device Circuits (IDC) shall be wired Class A (NFPA Style D).
- (c) Notification Appliance Circuits: Notification appliance circuits shall be wired Class B (NFPA Style Y).
- (d) Digitized Electronic Signals: Shall employ check digits or multiple polling. In general a single ground or open on any system signaling line circuit, initiating device circuit, or notification appliance circuit shall not cause system malfunction, loss of operating power or the ability to report an alarm.
- (e) Loss of Power: Alarm signals arriving at the main FACP shall not be lost following a power failure (or outage) until the alarm signal is processed and recorded.
- (f) System Response to an Alarm Condition: When a fire alarm condition is detected and reported by one of the system initiating devices or appliances, the following functions shall immediately occur:
  - (i) The system alarm LED shall flash.
  - (ii) A local piezo-electric signal in the control panel shall sound.
  - (iii) The 80-character LCD display shall indicate all information associated with the fire alarm condition including: the type of alarm point, the initiating device address and the description of its physical location within the protected premises.
  - (iv) History logging of all information associated with the event, including time and date of occurrence.
  - (v) Activate all system outputs, including program assigned via control-by-event equations, shall be executed by the particular point in alarm. Exact programming shall be provided by the Contractor to meet the Owners requirements.
  - (vi) Activate all fire alarm Notification Appliances in the building, sounding and flashing in synchronization continuously until manually silenced, or until the initiating device and control unit has been reset to normal condition.
  - (vii) Activate digital alarm communicator.
  - (viii) Deactivate door hold control relay such that all smoke doors are allowed to close.
  - (ix) Deactivate control relays allowing HVAC units to stop.
  - (x) Activate elevator recall sequence if smoke is detected in any elevator lobby or in the elevator equipment room.
  - (xi) Release all doors, which may be secured by "fail secure" methods.
  - (xii) Transmission of all data to any remote annunciation panels.

- (g) System Response to Trouble and Supervisory Conditions:





- (xiii) The system trouble and/or supervisory LED(s) shall flash.
- (xiv) A local piezo-electric signal in the control panel shall sound.
- (xv) The 80-character LCD display shall indicate all information associated with the trouble or supervisory condition including: the type of device point, the device address and the description of its physical location within the protected premises.
- (xvi) History logging of all information associated with the event, including time and date of occurrence.
- (xvii) Activate digital alarm communicator.
- (xviii) System AC power trouble signal shall not be sent unless maintained for 8 hours (or more).
- (xix) Provide adjustable time delay for all trouble signals prior to transmission.
- (xx) Transmission of all data to any remote annunciation panels.

(iii) System Features: The FACP shall be capable of providing the following features:

- (a) Upload/Download to PC Computer
- (b) Charger Rate Control
- (c) Drift Compensation
- (d) Automatic Day/Night Sensitivity Adjust
- (e) Device Blink Control
- (f) Pre-alarm Control Panel Indication
- (g) NFPA 72 Smoke Detector Sensitivity Test
- (h) Walk Test
- (i) System and Device Status and History Reports
- (j) Periodic Detector Test
- (k) Alarm Verification, by device, with tally
- (l) Printer and CRT Display Interface
- (m) Non-Alarm Module Reporting
- (n) Block Acknowledge
- (o) Smoke Detector Maintenance Alert - When any smoke detector approaches 80% of its alarm threshold due to gradual contamination.
- (p) Control-By-Time and Event

(iv) Operator's Terminal: Provide an operator's terminal, which allows the following minimum functions. In addition, the operator's terminal shall support any other functions required for system control and/or operation:

- (a) Acknowledge (ACK/STEP) Switch
- (b) Signal Silence Switch
- (c) System Reset Switch
- (d) System Test Switch
- (e) Lamp Test Switch





(v) Remote Transmissions: The FACP shall be interfaced to a separate, 4-channel minimum, Digital Alarm Communications Transmitter (DACT). An integral DACT shall be acceptable on the condition of total compatibility with the owners receiving station equipment. The DACT shall: be equipped with backup batteries with an automatic battery charging circuit, capable of performing a self test every 24 hours any failure shall initiate a trouble condition, generating a 24 hour test report to the receiving station equipment, and dual phone line capability. The following signals, in order of precedence shall be reported as applicable:

- (a) Fire
- (b) Trouble
- (c) Water-flow
- (d) Supervisory

\*The Bosch 7412G with the D928 dual line phone module is highly recommended to meet this requirement.

(vi) Power Supply(ies): The FACP power supply(ies) shall operate on 120 VAC, 60 Hz and shall be adequate to power all equipment and functions in full alarm continuously utilizing only 60% of the rated output. Signal circuits shall each be loaded no more than 60% of their rated capacity. All modules and drivers must be able to withstand prolonged short circuits in the field wiring, either line-to-line or line-to-ground, without damage.

(vii) Emergency Power Supply: Components include batteries, charger, and automatic transfer circuitry.

- (a) Batteries: Shall be completely maintenance free, sealed lead calcium construction with fully gelled electrolyte. Battery nominal life expectancy of 15 years, minimum, is required. Battery voltage and capacity shall be determined by the measured load calculations required by the FACP and related connected equipment. Battery shall have sufficient capacity to power the FACP for not less than twenty-four hours standby, plus 5 minutes of full alarm output upon a normal AC power failure.
- (b) Battery Charger: Solid state, fully automatic, variable-charging-rate type. Provide capacity for 150% of the connected system load while maintaining batteries at full charge. If batteries are fully discharged, the charger charges them completely within four hours. Charger output is supervised as part of system power supply supervision.
- (c) Integral Automatic Transfer Switch: Transfers the load to the battery without loss of signals or status indications when normal power fails.

(viii) Serial Interface Board: The FACP shall contain a serial interface board to provide an EIA-232 interface between the fire alarm control panel and the UL Listed Electronic Data Processing (EDP) peripherals. The serial interface board shall allow the use of multiple printers, CRT monitors, and other peripherals connected



to the EIA-232 ports. In addition, the serial interface board shall provide one EIA-485 port for the serial connection to annunciation and control subsystem components; LED's shall be provided to show operational status. All serial interface input/outputs shall be optically isolated to provide protection from surges and/or earth grounds.

- (ix) Network Interface Capability: Provide network interface capability per Alternate E2 if required by contract.
- (x) Enclosures: The FACP shall be housed in a UL listed cabinet suitable for surface or semi-flush mounting. Cabinet and front shall be corrosion protected, given a rust-resistant prime coat, and manufacturer's standard finish. The door shall provide a key lock and shall include a glass or other transparent opening for viewing of all indicators. For convenience, the door may be hinged on either the right or left side (field selectable). Where multiple enclosures are required in the same area, the cabinets shall all be the same size and color. Cabinet doors must be electrically bonded to enclosure it serves.

(c) AUXILIARY POWER SUPPLY PANELS (APS)

- (i) APS - Minimum Requirements: All APS(s) shall operate on 120 VAC, 60 Hz and shall have a continuous rating adequate to power all equipment and functions in full alarm continuously utilizing no more than 80% of the total rated ampere output capacity. Additionally, no more than 80% per individual output circuit ampere capacity shall be utilized. All modules and drivers must be able to withstand prolonged short circuits in the field wiring, either line-to-line or line-to-ground, without damage. The APS shall provide a battery charger for 24 hours of standby using dual-rate-charging techniques for fast battery recharge. The APS shall be capable of providing a minimum of 24 hours of standby power with an additional 5 minutes in full alarm output, for powering all connected devices. All APS's shall be capable of providing the following general requirements, features, and functions when utilized as an integral part of the system:
  - (a) Shall be capable of being externally triggered or initiated by the FACP, via an addressable control module, for all required output activations.
  - (b) Shall provide multiple regulated and conditioned +24VDC output circuits capable of being supervised with on board LED's for fault indication per output circuit.
  - (c) Shall provide at least (1) one +24VDC auxiliary type output.
  - (d) Shall be capable of battery supervision with an onboard LED fault indicator.
  - (e) Shall provide ground fault monitoring circuitry.
  - (f) Shall provide at least (1) Form "C" dry contact or other on board form of dry contact output that will change states during any fault condition detected, for connection to (1) one addressable monitoring device for individual APS, FACP supervision.



- (g) Output circuits shall have the capability of being selectively disabled, via on board switch configurations, during any AC power failures.
- (ii) Back-up Batteries: Shall be completely maintenance free, sealed lead calcium construction with fully gelled electrolyte. Battery nominal life expectancy of 15 years, minimum, is required. Battery voltage and capacity shall be determined by the measured load calculations required by the APS and related connected equipment. Battery shall have sufficient capacity to power the APS for not less than twenty-four hours standby, plus 5 minutes of full alarm output upon a normal AC power failure.
- (iii) Enclosures: The APS shall be housed in a UL listed cabinet suitable for surface or semi-flush mounting. Cabinet and front shall be corrosion protected, given a rust-resistant prime coat, and manufacturer's standard finish. The door shall provide a key lock. For convenience, the door may be hinged on either the right or left side (field selectable). Where multiple enclosures are required in the same area, the cabinets shall all be the same size and color. Cabinet doors must be electrically bonded to enclosure it serves.

(d) ALARM NOTIFICATION APPLIANCES

- (i) Programmable Electronic Sounders (Horns): Shall be located as shown on the Drawings; sounders located outdoors shall be listed for use in wet locations. Electric sounders shall have the following specifications:
  - (a) Voltage: Horns shall operate on 24 VDC nominal.
  - (b) Programming: Horns shall be field programmable without the use of special tools, to provide slow whoop, continuous, three pulse temporal or interrupted tones with an output sound level of at least 90 dBA measured at 10 feet from the device. Evacuation signal shall be the ANSI 53.41 three-pulse temporal pattern described in NFPA 72. Animal quarters and patient areas must be served by chimes. Animal quarters shall have means to bypass chimes with supervised override switch to facilitate testing of system.
  - (c) Mounting: Provide flush mounting devices wherever possible, surface mount devices as required. Ceiling mounted devices are not permitted without specific location approvals by the owner.
- (ii) Strobe Lights (Strobes): Strobes shall be located as shown on the Drawings. Strobes indicated for use exterior to the building shall be mounted at the indicated elevation and listed for use in wet locations. Strobe lights shall flash in synchronization and shall have the following specifications:
  - (a) Voltage: Strobe lights shall operate on 24 VDC nominal.
  - (b) Maximum pulse duration: 2/10ths of one second.
  - (c) Mounting: Provide surface mounting devices suitable for mounting in a standard single gang device box unless



otherwise indicated on the Drawings. Unless otherwise indicated on the Drawings, strobe lights shall be mounted at 6'-8" (2.3 M) Above Finished Floor (AFF) or 6" (15.3 Cm) Below Finished Ceiling (BFC), whichever is lower. Ceiling mounted devices are not permitted without specific location approvals by the owner.

- (d) Strobe intensity and flash rate: Must meet minimum requirements of UL 1971. Provide synchronous strobe lights with specific intensity Candela (Cd) rating of 15/75 Cd in all locations unless indicated otherwise on the drawings.
- (iii) Audible/Visual Combination Devices: Shall be located as shown on the Drawings and shall comply with all applicable requirements for both Programmable Electronic Sounders and Strobe Lights.
- (iv) Sounder Bases: Where indicated on the Drawings, provide bases with a built-in (local) sounder rated at 85 dBA minimum. Configure sounder bases such that sounders are activated under conditions as described or otherwise indicated on the Drawings.
- (v) Bells: Shall be 10" diameter vibrating type located as shown on the Drawings; bells located outdoors shall be listed for use in wet locations. Bells shall have the following specifications:
  - (a) Voltage: Bells shall operate on 24 VDC nominal.
  - (b) Mounting: Provide flush mounting devices suitable for mounting in a standard single gang device box unless otherwise indicated on the Drawings. Bell mounting elevation shall be as described on the Drawings.

(e) INITIATING DEVICES

- (i) Conventional Type Devices – General: Unless otherwise indicated on the Drawings all initiating devices shall be individually addressable. In some cases, the use of conventional devices with an addressable monitor type module is acceptable. These areas shall be identified on the Drawing with the acceptable device type for the specific locations. Affected areas may include where:
  - (a) Temperature Ratings: Addressable devices shall not be utilized in unconditioned spaces where temperature and/or humidity ranges can exceed the manufactures recommended ratings of the electronic component circuitry for proper operation. Acceptable substitutions with these conventional type devices may include:
    - (xxi) Thermal Detection Devices
    - (xxii) Manual Stations
    - (xxiii) Tamper Switches
    - (xxiv) Duct Smoke Detectors
  - (b) Harsh Environments: Areas that is environmentally detrimental to addressable type devices. Acceptable substitutions with these conventional type devices may include:



- (xxv) Explosion proof devices
  - (xxvi) Flame detection devices
- (ii) Addressable Type Devices – General: Unless otherwise indicated on the Drawings all initiating devices shall be individually addressable. Addressable devices shall comply with the following general requirements:
- (a) Address Setting: Addressable devices shall provide an address setting means inherent within the device. Devices, which are addressed by the FACP are also acceptable.
  - (b) Connections: Addressable devices shall be connected to a Signaling Line Circuit (SLC) with (2) two wires. Signaling Line Circuits shall originate at the FACP.
  - (c) Device Identification: Addressable devices shall store an internal specific identifying “type” code that the FACP shall use to identify the type of device.
  - (d) Temperature Ratings: Addressable devices shall not be utilized in unconditioned spaces where temperature and/or humidity ranges can exceed the manufactures recommended ratings of the electronic component circuitry for proper operation.
  - (e) Operational Indications: Addressable devices shall provide powered LED’s. LED’s shall flash under normal conditions, indicating that the device is operational and in regular communication with the FACP. LED’s shall be placed into steady illumination by the FACP to indicate that an alarm or off normal condition has been detected. The flashing mode operation of the detector LED’s shall be optional through the system field program. An output connection shall also be provided in the device base to connect an external/remote LED indication of an alarm or off normal condition in specific required locations.
  - (f) Device Mounting: Unless otherwise specified all devices shall provide the following mounting criteria:
    - (xxvii) All detectors shall be ceiling-mount type and shall include a separate twist-lock base with a tamper proof feature.
    - (xxviii) All other addressable devices, remote LED indicators, remote test switches, and isolation modules shall be wall-mount type.
  - (g) Test Means: Detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the FACP. Such a test may be initiated at the detector itself (by activating a magnetic switch), or initiated remotely through means of a test switch (either magnetically or key operated), or on command from the FACP when in the “test” mode of operation.



(iii) Addressable Manual Stations (Pull Stations): Unless otherwise indicated on the Drawings all pull stations shall comply with the following additional requirements:

- (a) All pull stations shall have a dual-action mechanism requiring two actions to initiate an alarm condition.
- (b) All pull stations shall provide a clear visual indication when operated, and shall utilize a key type reset for restoral to normal operation. Pull stations that employ a glass break rod are not acceptable.
- (c) Construction: Pull stations shall be constructed of Lexan or other material suitable to the installation environment with clearly visible operating instructions provided on the cover. The word FIRE shall appear on the front of the stations in raised letters, 1.75 inches or larger. Stations shall be suitable for surface mounting or semi flush mounting as shown on the plans.

(iv) Addressable Smoke Detectors: Unless otherwise indicated on the Drawings all smoke detectors shall comply with the following additional requirements:

- (a) All smoke/duct detectors shall be "intelligent" in that smoke detector sensitivity shall be set through the FACP and shall be capable of adjustment in the field through the field programming of the system. Sensitivity shall be capable of being automatically adjusted by the FACP program on a time-of-day basis. The FACP program must also be capable of automatically compensating for dust accumulation and other slow environmental changes that may affect performance of the smoke and/or duct detectors. The detectors shall be listed by UL as meeting the calibrated sensitivity test requirements of NFPA 72. Devices shall be capable of reporting obscuration levels and maintenance alerts when any smoke/duct detector approaches 80% of its alarm threshold due to gradual contamination.
- (b) All detectors shall be the plug in type with a separate base to facilitate testing and maintenance.
- (c) All detector bases shall provide locking tabs for all models located within 12' of floor and shall provide skirts for the bases to create a finished appearance. Terminals in the fixed base accept the system wiring.
- (d) Photoelectric Smoke Detectors: Photoelectric smoke detectors shall use the photoelectric (light-scattering) principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the analog level of smoke density. Unless otherwise indicated on the Drawings all smoke detectors shall be photoelectric type.
- (e) Ionization Smoke Detectors: Ionization smoke detectors shall use the dual-chamber ionization principal to measure products of combustion and shall, on command from the control panel, send data to the panel representing the



analog level of products of combustion. Ionization type smoke detectors are indicated on the Drawings by the designation ION adjacent to the smoke detector symbol.

- (v) Addressable Thermal Detectors (Heat): Unless otherwise indicated on the Drawings all heat detectors shall comply with the following additional requirements:

- (a) Heat Detectors shall be rated at 200°F. (93.3°C.) and unless otherwise indicated on the Drawings shall have a rate-of-rise element rated at 15°F. (-9.4°C.) per minute.
- (b) Heat detectors shall use an electronic sensor to measure thermal conditions caused by a fire and shall, on command from the FACP, send data to the panel representing the analog level of such thermal measurements.
- (c) Non-Rate of Rise Detectors (Fixed): Where indicated on the Drawings provide thermal detectors with fixed thermal elements. Fixed element detectors are typically rated at 135°F. (57.2°C.) and 195°F. (90.5°C.), and are usually installed adjacent to other detection devices.

- (vi) Addressable Duct Smoke Detectors: Unless otherwise indicated on the Drawings all duct smoke detectors shall be the photoelectric type.

- (a) Velocity Rated Detection: In-Duct Smoke Detector Housings shall accommodate a velocity rated intelligent photoelectric or ionization sensor, as described in Sections 2.5.D.4 and 2.5.D.5. The device, independent of the type used, shall provide continuous analog monitoring and alarm verification from the FACP. When sufficient smoke is sensed, an alarm signal shall be initiated at the FACP.
- (b) Air Sampling Tubes: The Duct detector must be equipped with the proper size sampling tubes, sized for each specific installation, and the proper vortex or ventury exhaust tubes.
- (c) Installation: Duct detectors and related items shall be furnished, connected and installed by the Division 16 (Electrical) Contractor.

#### (f) MONITOR AND CONTROL DEVICES

- (i) Addressable Dry Contact Monitor Modules: Addressable Monitor Modules shall be provided to connect (1) one non-addressable device or to supervise a non-addressable IDC zone (either Style D or Style B) of conventional type alarm initiating devices (any Normally Open [N.O.] dry contact device) to one of the Fire Alarm Control Panel Signaling Line Circuit Loops. Monitor modules shall be installed as required by the system configuration. All required monitor modules may not be shown on the Drawings.





- (a) Indication of Operation: Unless otherwise indicated on the Drawings an LED shall be provided that shall flash under normal conditions, indicating that the Monitor Module is operational and in regular communication with the FACP.
  - (b) Mounting Requirements: Monitor Modules shall be mounted in a standard 4-inch square, 2-1/8" deep electrical box at the same height requirement as Notification Appliance devices in a clearly visible location.
- (ii) Addressable Control Modules: Addressable Control Modules shall be provided to supervise and control the operation of (1) one conventional Notification Appliance Circuit (NAC) of compatible, 24 VDC powered, polarized Audio/Visual (A/V) Notification Appliances. For fan shutdown and other auxiliary control functions, the control module may be set to operate as a dry contact relay. The control module shall provide address-setting means using decimal switches and shall also store an internal identifying code that the control panel shall use to identify the type of device. An LED shall be provided that shall flash under normal conditions, indicating that the control module is operational and is in regular communication with the control panel. Control modules shall be rated for the load they control. (Inductive Loads require inductive rated modules.)
  - (a) Mounting Requirements: Control Modules shall mount in a standard 4-inch square, 2-1/8" deep electrical box, and shall only be installed in conditioned spaces.
  - (b) Configuration: The control module NAC circuit may be wired for Style Y Class B with up to 1 Amp of inductive A/V signal, or 2 Amps of resistive A/V signal operation, or as a dry contact (Form C) relay. The control module shall be suitable for pilot duty applications and rated for a minimum of 0.6 amps at 30 VDC. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to insure that 100% of all auxiliary relay or NAC's may be energized at the same time on the same pair of wires.
  - (c) Power Source: Audio/visual power shall be provided by a separate supervised power loop from the main fire alarm control panel or from a supervised, UL listed remote power supply. A/V power sources and connections are not shown on the Drawings
  - (d) Test Switch: A magnetic test switch shall be provided to test the module without opening or shorting its NAC wiring.
- (iii) Isolator Modules: Isolator Modules shall be provided to automatically isolate wire-to-wire short circuits on an SLC loop. The Isolator Module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the SLC Loop.





- (a) Operation: Isolator Modules shall operate such that if a wire-to-wire short occurs, the Isolator Module shall automatically open-circuit (disconnect) the SLC loop. When the short circuit condition is corrected, the Isolator Module shall automatically reconnect the isolated section. The Isolator Module shall not require any address setting, and its operations shall be totally automatic. It shall not be necessary to replace or reset an Isolator Module after its normal operation.
- (b) Locations: Provide (2) Isolator Modules at the FACP for both ends of each SLC loop. Provide a minimum of one (1) Isolator Module in the field at the mid-point of the device loop. Provide additional modules necessary to limit the number of devices between isolators to 24. See Attachment A for further clarification.
- (c) Mounting: The Isolator Module shall mount in standard 4-inch square, 2-1/8" deep electrical boxes, wall mounted at the same height as A/V devices in a clearly viewable area in corridors. It shall provide a single LED that shall flash to indicate that the Isolator is operational and shall illuminate steadily to indicate that a short circuit condition has been detected and isolated.

(g) MISCELLANEOUS SYSTEM ITEMS

- (i) Remote Display Annunciators: The FACP should be located at the main entrance to the facility in concurrence and request of the UNC Health and Safety Department and the Chapel Hill Fire Department. On rare instances when the fire alarm panel cannot be placed at the main entrance, a remote annunciators shall be installed with the following capabilities:
  - (a) Alphanumeric Display Annunciators: Shall be supervised and remotely located as specified on the Drawings.
    - (xxix) Unit shall have a back-lit LCD display containing a minimum of (80) eighty characters for alarm annunciation in clear English text.
    - (xxx) The LCD annunciator shall display all alarm, trouble, and supervisory conditions in the system and provide duplicate "active" manual switching functions of the FACP, including: Acknowledging, Signal Silencing, System Reset, and Test/Drill.
    - (xxxi) The annunciator shall be in a lockable cabinet keyed the same as the FACP.
    - (xxxii) Connections: The annunciator shall connect to a two-wire EIA-485 interface. The two-wire connection shall be capable operation at distances of 6,000 feet. Provide interface to fiber optic cable systems and/or repeater units where such are indicated on the Drawings.
    - (xxxiii) System Capacity: The system shall allow a minimum of four LCD annunciators. In addition



to annunciation functions, each LCD annunciator shall be capable of the following software programmed system functions: Acknowledge, Signal Silence and Reset.

- (b) Serially Connected LED Annunciator: Annunciator shall communicate with the fire alarm control panel via an EIA-485 communications loop (four-wire) and shall individually annunciate all zones in the system. System zones shall be as indicated on the Drawings.

- (xxxiv) Annunciator Indicators: The annunciator shall provide a red Alarm LED per zone, yellow Trouble LED, and Supervisory Trouble LED per zone. The annunciator shall also have an "ON-LINE" LED, local piezo sounder, local acknowledge/lamp test switch, and custom zone/function identification labels. Annunciator switches may be used for System control such as, Global Acknowledge, Global Signal Silence, and Global System Reset. All annunciator switches and indicators shall be software programmable.

- (xxxv) The annunciator shall be in a key lockable cabinet.

- (c) LED Graphic Display Panel: In high rise, complex, or higher square footage facilities, a Graphic Annunciator shall be installed. The University must approve the application and manufacturer of the annunciator.

- (xxxvi) Annunciator Indicators: The annunciator shall provide a red Alarm LED per zone, yellow Trouble LED, and Supervisory Trouble LED per zone. The annunciator shall also have an "ON-LINE" LED, local piezo sounder, local acknowledge/lamp test switch, and custom zone/function identification labels. Annunciator switches may be used for System control such as, Global Acknowledge, Global Signal Silence, and Global System Reset. All annunciator switches and indicators shall be software programmable.

- (xxxvii) Framed under glass graphic shall provide a LED lamp zone matrix/grid displaying each type of initiating device (manual stations, smoke detectors, thermal detectors, elevator lobby detectors, water flow, and supervisory) for each floor contained in the facility. The University must approve the specific floor labeling prior to construction. Floor references may vary per facility (i.e. Ground Floor may be referred to as 1st Floor).



- (xxxviii) The annunciator shall be in a key lockable cabinet.
- (d) Remote Annunciator Indicator Light (RAIL): Remote annunciator indicator lights shall be provided in locations where indicated on the Drawings. In addition, RAIL's shall have the following features:
- (xxxix) RAIL's shall be provided with a key type switch for testing of the annunciated device.
  - (xl) Voltage: RAIL's shall operate on 24 VDC nominal.
  - (xli) Mounting: Provide flush mounting devices suitable for mounting in a standard single gang device box unless otherwise indicated on the Drawings. They shall be mounted in the wall at the same height as A/V devices. Do not mount in ceiling tiles.
- (ii) Doors Controlled by the FACP: For life safety reasons, any exit access doors that are locked to impede free and immediate egress, per the "Special Locking Arrangement" section of the NC Code (Vol. I, 1012.6), must utilize one of the following types of locking hardware:
- (a) Magnetic Lock (fail-safe) utilizing 24 VDC magnet and contact plate.
  - (b) Electromechanical Lock (fail-safe) with reverse bevel type dead bolt.
  - (c) These doors must immediately unlock upon fire alarm signal, loss of building AC power, disablement of the fire alarm system (defined as loss of its 24 VDC power), or upon manual operation of an unlock switch at a constantly attended location.
  - (d) Where installed on smoke or fire doors, power failure shall cause these mechanisms to default to egress mode with normal mechanical latching.

NOTE: This is to assure the smoke or fire doors continue to perform their vital function in power failure situation, instead of swinging open and allowing the passage of smoke and fire between compartments.

- (e) Smoke doors: Shall be held open by 24 VDC wall/floor mounted magnets powered by the FACP, and released upon alarm. The resulting current drain must either be included in the standby battery calculations or the system programmed to drop the door load upon loss of 120 VAC power (unless restored in 60 seconds).

NOTE: Wall-mounted magnetic door holders and separate heavy-duty closers are recommended for control of smoke doors, instead of combination frame-mounted units that



include an integral smoke detector and control mechanism, due to long-term reliability problems with the later. Although AC-powered electromagnets are available, they have several disadvantages including the need for many additional addressable control relays, the Code requirement to separate power limited and non-power limited circuits, safety considerations for fire alarm maintenance personnel (some magnets are 120VAC) and noticeable door hum caused by magnets operating on self-rectified voltage (“raw”, unfiltered dc).

NOTE: Relevant NFPA Standards require that smoke door to floor clearance not exceed  $\frac{3}{4}$  inch and that the gap between door pairs not exceed  $\frac{1}{8}$  inch.

(f) Door Hold-Open Magnets: Door hold open magnets shall be suitable for mounting in a single gang electrical device box. Door hold open magnets shall be furnished with keepers, door chains, and other accessories as required to properly hold open doors as indicated on the Drawings. Holding force of the magnet shall be appropriate for the door to be held open. Proper attachment of door magnet hardware to doors is the responsibility of the Division 16 contractor. Door hold open magnets shall operate in a fail-safe manner, i.e., the door shall release in event of a failure of voltage to the device.

(xlii) Power Supply: Door hold open magnets shall be configured to operate from a nominal 24 VDC system as supplied by the FACP or other power supply listed for the purpose. All hold open magnet supply sources, whether a part of the FACP or whether derived from a separate power supply, shall be supervised. Door hold open magnets which use step-down transformers, 120 VAC, or local relays are not acceptable. Magnets shall release on a power failure.

(xliii) Device box support: Door hold open magnet device boxes shall be securely attached to the building structure by effective means. Boxes attached directly to only one metal stud or boxes supported by means of expansion type fasteners are not acceptable.

(g) Rolling Fire or Smoke Doors: Rolling Fire or Smoke Doors shall be motor operated. No manual reset doors are permitted. For life safety reasons, all rolling steel fire doors must descend at a constant rate of 1 foot/second maximum, whether released by their thermal link or closed by FACP command. Also, in response to strong requests from many facility managers, these fire doors must either: (1) Automatically reset when raised to their normal position, or (2) Have a motor down – motor up mechanism controlled by the FACP.



NOTE: Contact the AHJ for guidance on programming the fire alarm system to determine which fire alarm initiation devices should cause release of these doors. The customary setup is to have this done for selected smoke detector and/or water-flow alarm in adjacent spaces, rather than upon general alarm, to minimize the potential disruption of possible nuisance alarms in remote parts of the building. We recommend avoid having these doors drop for a single smoke alarm. Also, the FACP should have an appropriate information placard regarding this function, to avoid nuisance drops during routine system maintenance operations.

(xliv) Remote Power Supplies: Where remote power supplies are required, they shall meet the same requirements as those for the main fire alarm control panel, including the requirements for batteries.

(xlv) Keys and Locks: All panels, terminal cabinets, and pull stations shall be keyed alike. Coordinate key/lock with the Owner's requirements.

(h) Fire Fighter Telephones: Are not required at UNC for installation, per direction of the Town of Chapel Hill Fire Marshall's Office. (See Attachment B)

(i) Wire:

(xlvi) Non-Power-Limited Circuits: Copper conductors with 600V rated, THHN/THWN, color coded insulation.

- Low Voltage Circuits: STRANDED, #18 AWG, minimum.
- Line Voltage Circuits: SOLID, #12 AWG, minimum.

(xlvii) Power Limited Circuits: NFPA70, Types FPL, FPLR, or FPLP, as recommended by the manufacturer. Data Loop wire shall be shielded pair #18 AWG, 30 pf/ft capacitance or less, unless specifically prohibited by the manufacturer and stated on the wiring submittal.

c) EXECUTION - SYSTEM INSTALLATION, CONFIGURATION, AND APPLICATION REQUIREMENTS

(1) Fire Alarm Control Panel (FACP):

(a) General Installation (FACP): In addition to the requirements covered previously, in this specification, fire alarm systems shall comply with the following requirements with regard to installation, configuration, application, and operation:



- (i) The Fire Alarm Panel should be placed at the main entrance to the facility in concurrence and request of the UNC Health and Safety Department and Chapel Hill Fire Department for convenient, rapid access. On rare instances when the fire alarm panel cannot be placed at the main entrance, or be located in a public or normally occupied area, an active Remote Annunciator (RA) with display and FACP controlling features shall be installed.
- (ii) A copy of the final building floor plans with all device locations and assigned system addresses shall be permanently mounted at the location of the main FACP. All AV circuit EOL's, riser cabinets, and Isolation Modules shall also be included on these drawings. A separate sheet shall be provided for each floor. Plans shall be reduced in size from engineering plans in order to fit on 11 x 17 sheets. Sheets shall be laminated. Provide legend for symbols. Provide an additional unlaminated copy of these drawings for the Owner 100% acceptance inspection upon completion.
- (iii) All external modules required to be mounted at the main FACP location shall be housed in a UL listed cabinet suitable for surface or semi-flush mounting. Cabinet and front shall be corrosion protected, given a rust-resistant prime coat, and manufacturer's standard finish. The door shall provide a key lock. For convenience, the door may be hinged on either the right or left side (field selectable). Where multiple enclosures are required in the same area, the cabinets shall all be the same size and color. Cabinet doors must be electrically bonded to enclosure it serves.
- (iv) All equipment and components shall be installed in strict compliance with manufacturers' recommendations. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc., before beginning system installation. Refer to the Riser/Connection diagram for all specific system installation/termination/wiring data.
- (v) The system shall be new and furnished with a warranty (parts & labor) of at least one year from the date of final inspection and acceptance by the Owner. Equipment, initiating devices, and alarm appliances shall be arranged as described in the Drawings; annunciator zones shall be configured as described in the Drawings.
- (vi) All system components shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place (e.g., detectors shall not be supported solely by suspended ceilings). Fasteners and supports shall be adequate to support the required load. Adhesives are not permitted to mount fire alarm system components to building surfaces or structure.
- (vii) Installation, all connections to the FACP, system programming, and/or programming changes shall be accomplished only by an experienced technician who is an authorized representative of the installation company, meeting the requirements previously listed in this specification, who additionally stocks a full complement of spare parts for the system. The Installation technician shall be individually certified NICET Level 2, and trained and certified by the manufacturer of the equipment on the specific model being installed. Certifications shall be current to latest release and must have occurred in the most recent 24 months. Upon completion of the system installation the installation technician must perform a



100% system test and submit the applicable completed NFPA72 forms to the Engineer. The installation technician must also be present for the Engineer's inspection and the Owner's 100% acceptance inspection.

- (viii) All addressable loop controller circuits must be "Class A" and shall have a minimum of 20% spare addresses for future use. Loops shall be confined to one floor of coverage and shall not include any devices/modules located or serving other floor areas of coverage. Loop 1 shall be assigned to the lowest elevation level of the building. Loop numbers shall increment with elevation levels of the building floors. Device numbering starts the loop with address 001 and increments sequentially accordingly as electrically connected in the circuit to the return of the loop.
  - (ix) The FACP must have an Alarm Silence switch, and be equipped with the Subsequent Alarm (alarm resound) feature. Any remote annunciators or graphic displays located away from the alarm area must also include an audible signal with alarm resound feature and must be silence-able from the main panel.
  - (x) A supervised programmable "Hot Key" for defeating or bypassing all AV circuits, including sounder base units, must be provided in the FACP. The switch must indicate "Normal" or "Off Normal" position.
  - (xi) If the system design includes any type of door control features, a supervised programmable "Hot Key" for defeating or bypassing all door hold open circuits and fire shutter doors or smoke curtains must be provided in the FACP. The switch must indicate "Normal" or "Off Normal" position.
  - (xii) If the system design includes any elevator controlling equipment, a supervised programmable "Hot Key" for defeating or bypassing all elevator capture and shunt trip features must be provided in the FACP. The switch must indicate "Normal" or "Off Normal" position.
  - (xiii) If the system design includes AHU shutdown or smoke removal startup, silencing the alarm (without resetting) must not reverse them. A supervised programmable "Hot Key" for all AHU Shutdown Defeat modules must be provided in the FACP. The switch must indicate "Normal" or "Off Normal" position. In addition, provide supervised Hand-Off-Auto switch(es) at the FACP for any building smoke control equipment (pressurization, smoke purge or exhaust fans).
  - (xiv) The coverage of each fire alarm loop as described in the Drawings shall be indicated on the FACP and any remote annunciator. This may be accomplished by engraved labels, framed directories, and/or graphic displays. Label tape or handwritten labels are not acceptable.
  - (xv) System shall provide printer data connection.
- (b) Remote Annunciation: When required, remote annunciation shall be accomplished by and installed per the following:
- (i) LCD Alphanumeric Display Annunciator: In a simple floor plan building, an Alphanumeric LCD Annunciator with acknowledge, silence and reset capabilities to control the FACP system shall be installed. The Alphanumeric display annunciator shall be a supervised, remotely located back-lit LCD display containing a





minimum of eighty (80) characters for alarm annunciation in clear English text. The LCD annunciator shall display all alarm, trouble, and supervisory conditions in the system. The system shall be capable of connecting up to four (4) LCD annunciators the EIA-485 communications loop. The two-wire connection shall be capable of operation at distances of 6,000 feet. Provide interface to fiber optic cable systems and/or repeater units where such are indicated on the Drawings.

In a moderate or more complicated facility we require an annunciator as described above with floor plan drawings including all fire alarm devices/modules with individual system addresses. The drawings shall be framed under glass and mounted adjacent to the annunciator by means such that the charts cannot be removed without a flat head screwdriver.

This annunciator shall be in a lockable cabinet keyed the same as the FACP.

- (ii) Serially Connected LED Annunciator: Annunciator shall communicate with the fire alarm control panel via an EIA-485 communications loop (four-wire) and shall individually annunciate all device types and floor/zone locations in the system. System floors shall be as indicated on the Drawings. The system shall be capable of connecting up to ten (10) LED Annunciators to the EIA-485 communications loop.

The annunciator shall provide a red Alarm LED per zone, yellow Trouble LED, and Supervisory Trouble LED per floor/zone. The annunciator shall also have an "ON-LINE" LED, local piezo sounder, local acknowledge/lamp test switch, and custom floor/zone function identification labels. Annunciator switches may be used for System control such as, Global Acknowledge, Global Signal Silence, and Global System Reset. All annunciator switches and indicators shall be software programmable.

- (iii) Graphic Annunciators: In high rise, complex, or higher square footage facilities, a Graphic Annunciator shall be installed. The University must approve the application and manufacturer of the annunciator.

(c) Power Requirements:

- (i) All fire alarm equipment 120 VAC supply power shall be fed from the facility "Emergency Power" circuit. Systems are to be provided with a separate and independent source of emergency power. Switching to emergency power during alarm shall not cause signal drop-out. Batteries must meet the appropriate NFPA capacity requirements, with a 25% safety factor. This requirement is in effect even if generator power is supplied to the Fire Alarm Control Panel.





- (a) Provide an engraved label in the FACP identifying its 120 VAC power source. This label shall include panelboard location, identification and circuit number.
    - (b) Any circuit breaker supplying 120 VAC to any fire alarm equipment shall have a locking tab installed at the breaker.
  - (ii) The system shall be equipped with the following protective devices to prevent damage or nuisance alarms by nearby lightning strikes, stray currents, or voltage transients. The devices are to be provided by the fire alarm equipment supplier:
    - (a) On AC Input: A feed-through (not a shunt-type) branch circuit transient arrestor such as: EFI HWM-120, Leviton OEM-120EFI, Northern Technologies TCS-HW, Transtector ACP100BWN3, or other equivalent Listed device shall be installed. Install at panelboard and trim excess lead lengths. Wind a small coil in branch circuit conductor, within panelboard, downstream of the suppressor connection. Coil is to be about 1" diameter, 7 to 10 turns, and tie-wrapped.
    - (b) On DC Circuits Extending Outside Building: Near the point of entry to or exit from each building, provide a "pi" filter on each leg. The filter shall consist of a primary arrestor, typically a gas tube, a series impedance of 1 mH or more, and a fast acting secondary arrestor, which clamps between 30 and 40 Volts. Acceptable models include Simplex 2081-9027 and 2081-9028, Transtector TSP8601, Ditek DTKxLVL series, Citel America B280-24V, and Northern Technologies DLP-42, or equivalent Listed device shall be installed.
  - (iii) Provide 120V receptacles for printer use at the main panel. Provide printer data connection at the main panel.
- (d) Wiring:
- (i) Style 6 Circuits Required: Systems with one or more addressable sub-panels that (1) have an integral addressable loop controller, or (2) monitor multiple conventional initiation zones, shall comply with the NFPA 72 requirements for Style 6 circuits.
  - (ii) All wiring shall be color coded in accordance with the following scheme, which shall be maintained throughout the system, without color change in any wire run:

Addressable Devices	Approved Manufacture Data
Signal Line Circuit cable	Red jacket with Red(+)/Black(-)
Alarm Indicating Appliance Circuits	Blue (+)/Black (-)

Conventional Type Devices or Circuits connected directly to the FACP or to Monitored or Controlled Addressable Devices



Initiating Circuits, General*	Red (+)/White (-)
Initiating Circuits, Smoke Detectors Only*	Violet (+)/Gray (-)
AHU Shutdown Circuits	Yellow (+)/Brown (-)
Door Control Circuits	Orange
Elevator Capture Circuits	Brown

- (iii) There shall be NO splices in the system other than at terminal blocks in a hinged enclosure. "Wire nuts," crimp splices, or insulation piercing type connectors are not acceptable. All terminal block screws shall have pressure wire connectors of the self-lifting or box lug type.
- (iv) Permanent wire markers shall be used to identify all splices and terminations for each circuit. For splices, use markers or other means to indicate which conductors leads to the FACP. All junction boxes and covers shall be painted red, unless in finished areas.
- (v) In multistory buildings, all circuits leaving the riser on each floor shall feed through a labeled terminal block in a hinged enclosure, located for convenient access. Each floor shall be on a separate data loop from the panel with individual loop controller at the panel. Each floor shall have 20% spare capacity for new devices on each loop serving the floor. (The spare intent is to apply between line isolators as well).
- (vi) Device Numbering: Device number shall correspond to the way cable is installed (sequentially).
- (vii) All wiring and cable must be in EMT, 3/4" minimum diameter, unless indicated otherwise on the Drawings or elsewhere in the Specifications. All fire alarm system raceway, couplings, and connectors must meet the performance and installation requirements of Section 16000 "RACEWAYS". Couplings shall be steel compression type and connectors shall be steel compression type with insulated throats.
- (viii) The exterior of all junction boxes containing fire alarm conductors shall be painted RED; box interiors shall not be painted. Box covers for junction boxes containing fire alarm conductors shall be painted RED on both sides. All painting of junction boxes and junction box covers shall be accomplished prior to installation of the boxes to avoid possible problems with overspray.
- (ix) Box covers shall be labeled to indicate the circuit(s) or function of the conductors contained therein. Labels shall be neatly applied black lettering on a clear background. Handwritten labels or labels made from embossed tape are not acceptable.
- (x) Wire shall be new AWG #14 minimum stranded copper, type THHN/THWN for notification appliance circuits. Addressable loop (signaling line) circuits shall be wired with type FPL/FPLR/FPLP fire alarm cable, AWG minimum, low capacitance, twisted shielded copper pair. Cable shield drain wires are to be connected at each device on the loop to maintain continuity, taped to insulate from ground, and terminated at the FACP.



- (xi) Acceptable cables include Atlas 228-18-1-1STP, Belden YQ28541, BSCC S1802s19 (same as EEC 7806LC), West Penn D975, D991 (AWG 16), D995 (AWG 16), D995 (AWG 14), or equal wire having capacitance of 30pf/ft. maximum between conductors. The cable jacket color shall be red, with red (+) and black (-) conductor insulation.

EXCEPTION #1: Unshielded cable, otherwise equal to the above, is permitted to be used where the manufacturer's installation instructions unequivocally require, or state a preference for, the use of unshielded cable of all systems, AWG #16 minimum.

EXCEPTION #2: In underground conduit, use Type TC or PLTC cable (PE insulated) to avoid problems from moisture.

- (xii) Detection or alarm circuits must not be included in raceways containing AC power or AC control wiring. Within the FACP, any 120 VAC control wiring or other circuits with an externally supplied AC/DC voltage above the nominal 24 VDC system power must be properly separated from other circuits and the enclosure must have an appropriate warning label to alert service personnel to the potential hazard.
- (xiii) All wiring shall be checked for grounds, opens, and shorts, prior to termination at panels and installation of detector heads. The minimum resistance to ground or between any two conductors shall be ten megohms (10 MW), as verified with a megger. Provide advance notice to the A/E of these tests.
- (xiv) The system shall be electrically supervised for open or (+/-) ground fault conditions in SLC, alarm circuits, and control circuits. Removal of any detection device, alarm appliance, plug-in relay, system module, or standby battery connection shall also result in a trouble signal. Fire alarm signal shall override trouble signals, but any pre-alarm trouble signal shall reappear when the panel is reset.

## (2) Auxiliary Power Supply Panels (APS):

General Installation: In addition to the requirements covered previously, in this specification, auxiliary power supplies shall comply with the following requirements with regard to installation, configuration, application, and operation:

- (a) Each APS utilized in the system shall be supervised individually by the FACP. This may be accomplished by:
  - (i) On board means of setting the FACP assigned address.
  - (ii) Utilization of a system addressable monitor type module.
- (b) Specific items of supervision include: AC power failure, battery fault, ground fault, and individual output circuit faults.

## (3) Alarm Notification Appliances:



General Installation: In addition to the requirements covered previously, in this specification, alarm notification appliances shall comply with the following requirements with regard to installation, configuration, application, and operation:

- (a) Both audible and visible alarm signals shall be provided. Visible signals must be the strobe (flash discharge) type, with white or clear lens, and shall comply with current NFPA72 and ADA requirements for intensity, synchronization, and placement.
- (b) All AV circuits shall have supervised means to bypass.
- (c) Sounder Base Units: All areas that require the installation of Sounder Base Units shall be configured to function as follows:
  - (i) The sounder base power shall be supervised by the FACP.
  - (ii) Individual sounder bases must be silence-able from the FACP and be capable of alarm resound.
  - (iii) The sounder base shall individually sound on a 1st alarm condition generated by the initiating device it is connected to.
  - (iv) The sounder base shall sound on any general alarm condition.
- (d) In ADA designated locations, where placement of additional specialized AV devices are required, those device shall follow the action of the room sounder base.

(4) Initiating Devices:

- (a) General Installation: In addition to the requirements covered previously, in this specification, initiating devices shall comply with the following requirements with regard to installation, configuration, application, and operation:
  - (i) Device Remote Annunciation: When required, individual device remote annunciation shall be accomplished by and installed per the following:
    - (a) Remote Annunciator Indicator Lights (RAIL's): Remote annunciator indicator lights shall be provided in locations where indicated on the Drawings. RAIL's shall be provided with a key type switch for testing of the annunciated device. In addition, RAIL's shall have the following features:
      - (b) Voltage: RAIL's shall operate on 24 VDC nominal.
      - (c) Mounting: Provide flush mounting devices suitable for mounting in a standard single gang device box unless otherwise indicated on the Drawings. They shall be mounted in the wall at the same height requirements per NFPA72 as AV devices. Do not mount in ceiling tiles.
  - (ii) Sounder Base Unit Devices: All areas that require the installation of Sounder Base Unit Devices shall be programmed to perform the following sequence of operation:
    - (a) The initiating device connected to the sounder base unit shall be supervised by the FACP.



- (b) The sounder base initiating device shall report the 1st alarm condition to the FACP, which in turn shall sound that individual sounder base and any special ADA AV device additionally required in that area, ONLY.
  - (c) The 1st alarm received by the FACP shall initiate the DACT.
  - (d) All sounder bases shall sound on any general alarm condition initiated by any common area initiating device including: smoke detectors, thermal (heat) detectors, manual stations, water-flow, duct detectors, or by a 2nd or subsequent alarm from any other sounder base initiating device.
- (iii) Initiating devices shall not be located in areas where temperature and/or humidity levels may exceed the manufacturer's recommendations for proper operation. In such cases, use conventional devices monitored with an addressable monitor type module. Mount addressable monitor type module in nearest conditioned space and indicate its address on the outside of the enclosure by means of a label.
  - (iv) Devices used for elevator capture are identified on the Drawings by the designation EL adjacent to the detector. Primary and/or alternate recall points are indicated on the drawings. Elevator capture or control signals must come from the FACP as relayed by control modules. Use of detector auxiliary contacts for elevator capture is not acceptable or permitted.

(b) SMOKE DETECTORS

- (i) In facilities that are fully sprinklered the University requires additional smoke detection in Telecommunication closets, Electrical closets, and rooms that contain significant electronic equipment such as computer server rooms and Audio and/or Video projection rooms.
- (ii) Must be the plug-in type, each having a separate base, to facilitate replacement and maintenance. When installed in a room, detectors shall be oriented so their alarm light is visible from the nearest door to the corridor.
  - (a) In areas where smoke detector placements are not easily visible a Remote Alarm Indicator Light (RAIL) must be provided, or in areas that will allow, a RED circle shall be painted on the floor directly below the detector with the device system address.
- (iii) Spot type smoke detectors mounted within 12 feet of a walking surface shall have their built-in locking device activated.
- (iv) Unless suitably protected against dust, paint, etc., detectors shall not be installed until the final construction clean-up has been completed. Contaminated detectors must be REPLACED by the Contractor at no additional cost to the Owner.
- (v) Identification of individual detectors is required. These device numbers, which must also be shown on the shop drawings, shall be permanently affixed to the detector base. Device labels may not be



affixed to the device. Identification labels must be printed labels with black lettering on a clear background. Handwritten labels or labels made from embossed tape are not acceptable.

- (vi) Smoke detector guards, where indicated on the Drawings shall be Listed for use with the specific model of smoke detector being protected. All smoke detector guards are to have a separate base which must be very securely anchored to wall or ceiling. The cover must be readily removable by the Owner for periodic detector cleaning and servicing but, to prevent unauthorized entry, must be secured to the base by a lock or tamper resistant screws approved by the A/E. Metal guards must be 16 gauge or heavier steel.

#### (c) DUCT SMOKE DETECTORS

Duct detector sampling tubes shall extend the full width of the duct. Those over 36 inches long must be provided with rear support. The preferred method for doing this is to have the tube go through the far side of the duct, with the point of penetration tightly sealed to prevent air leakage around the tube. This facilitates smoke testing and tube cleaning. Duct smoke detector mounting position and air sampling tube orientation, are critical for proper operation. The Manufacturer's detailed installation instructions must be followed. The contractor shall mark the direction of airflow on the duct at each duct detector location. Provide duct access doors.

- (i) Air duct/plenum detectors must have a RAIL with a keyed Alarm Test switch, located in the nearest corridor or public area and identified by an engraved label affixed to the wall or ceiling. RAIL's shall not be mounted to the ceiling tile.
- (ii) These detectors shall be installed in a manner that provides suitable access for required periodic cleaning and calibration.

#### (d) ALARM VERIFICATION FOR SMOKE DETECTORS

- (i) The fire alarm system shall be equipped with logic method of verifying the presence of smoke.
- (ii) Alarms from other than spot type smoke detectors must not be delayed by Alarm Verification. Alarm Verification is NOT to be applied to linear beam, duct smoke detectors, elevator lobby and machine room detectors, nor to any software configured "cross-zoned" detection devices. When programming the system, activate the automatic drift compensation feature for all spot-type smoke detectors. Whether or not to activate the alarm verification feature for such detectors is to be determined by the design engineer/ owner's representative.

NOTE: Most applications of analog addressable smoke detectors do not require alarm verification to prevent nuisance alarms, unless there are transient ambient conditions, which may create problems. A short operational test period will usually provide information to determine this.

- (iii) Systems with Alarm Verification must be permanently labeled to indicate that fact.



- (iv) While a verification cycle is in progress, an alarm, which occurs on another zone, must not cause the verification cycle under way to be restarted or extended. It may have the same effect on the system as a verified alarm.
- (v) The equipment must be Listed for Alarm Verification purposes. It must either be installed at the factory, or field programmable and tested by the Manufacturer's authorized representative.

(e) Manual Stations:

In facilities that are fully sprinklered the University requires additional manual stations at all exit locations from the building, and at all exits per floor within the building.

(5) Monitor and Control Devices:

General Installation: In addition to the requirements covered previously, in this specification, monitoring and control devices shall comply with the following requirements with regard to installation, configuration, application, and operation:

- (a) To minimize the impact of a wiring fault on the system, isolation modules must be provided as follows:
  - (i) After each 25 devices/control points on any addressable circuit.
  - (ii) For each circuit extending outside the building.
  - (iii) In the FACP, at each end of the loop.
  - (iv) On loops containing less than the 25 devices place an isolator at each end of the loop and one in the electrical center of the loop.
- (b) Supervision required: The connection between individual addressable modules and their contact type initiating device(s) must be supervised.

(6) Miscellaneous System Items:

- (a) General Installation: In addition to the requirements covered previously, in this specification, miscellaneous system devices shall comply with the following requirements with regard to installation, configuration, application, and operation:
- (b) EMERGENCY VOICE/ALARM COMMUNICATIONS
  - (i) Where emergency voice communications systems are indicated on the Drawings, provide systems with the following characteristics and features:
  - (ii) Systems with voice capability shall comply with NFPA 72 concerning one-way Public Address (PA), especially with regard to survivability requirements.
  - (iii) One-way voice/alarm systems shall be dual channel, permitting the application of an evacuation signal to one or more zones simultaneously with manual voice paging to the other zones. Communication zones shall be capable of being selected in any combination.
  - (iv) Provide duplicate tone generators, pre-amps, and power amplifiers. Failure of any of these shall automatically result in the defective





unit being promptly switched off-line and replaced with the backup so that operation as described elsewhere is uninterrupted.

- (v) Normal amplifier power shall be a minimum of 125% RMS of the full speaker load, per channel. For purposes of this calculation, use the amplifier's continuous two-tone output rating and assume one watt per speaker. A copy of this calculation shall be included with the submittals.
- (vi) All one-way voice communication circuits shall be wired with AWG #18 minimum twisted pair copper conductors in shielded cable, Belden 8790, West Penn 293, or equivalent in larger AWG size, 7 strands maximum. The shields shall be continuously connected from the amplifiers to the end of line. Thoroughly tape the shield splice at each speaker to insulate from ground. All shields must be single point grounded, at the amplifier only. Cable color shall be grey, with red (+) and black (-) conductors.
- (vii) Communications equipment shall be housed in the FACP and/or in adjacent cabinets(s) of matching appearance and size. All connections between the FACP and the voice communications panel shall be made via cables or harness assemblies, which have been prewired and tested by the system manufacturer.
- (viii) Evacuation signal shall be a "three-pulse" temporal pattern complying with ANSI S3.41-1990.
- (ix) Existing Wiring: Where existing wiring is reused provide a written guarantee that it is acceptable for use with the equipment provided under this contract. Existing wiring may be used only with the owner's written permission.

#### (c) REMOTE ALARM TRANSMISSION REQUIREMENTS

- (i) Each system with automatic fire detection, or which monitors a sprinkler system shall be equipped with a NFPA 72 type, dual line, Digital Alarm Communicator Transmitter (DACT) for transmission of its fire alarm, supervisory, and trouble signals to the University's Proprietary Receiving Station. As a minimum, where applicable, the following signals shall be transmitted:
  - (a) Fire alarm
  - (b) Fire alarm system trouble
  - (c) The precedence of DACT / Proprietary alarm system transmission shall be as follows:
  - (d) Fire
  - (e) Supervisory
  - (f) Trouble
- (ii) The "trouble" signal for AC power loss must not be sent unless maintained for 6 hours or more to avoid nuisance transmissions due to momentary 120 VAC power outages or alarm verification cycles.
- (iii) Provide a DACT which is fully compatible with the Owner's Proprietary alarm receiving equipment or the listed central station as indicated on the Drawings. DACT's requiring programming of Electronic memory ( PROM " burn in" ), are not acceptable. Connect each DACT to the appropriate telephone or communications lines. Communicator shall be programmable, dual





line and capable of daily report. System shall be capable of proper call in, signal exchange and disconnect with the University's receiving station, using the Ademco Slow 3-1 format. The vendor must provide all equipment, software and training necessary for the University to program or reprogram the unit at no cost to the University.

- (iv) Drawings provide a polarity reversal type alarm module. Note that polarity reversal type alarm modules report only Alarm, Line Trouble, and OK conditions.

(d) AUTOMATIC SMOKE DOOR AND AUTOMATIC LOCK REQUIREMENTS

- (i) Wall-mounted magnetic door holders and separate heavy-duty closers shall be used, instead of combination door control units. The electromagnets shall be controlled by the building's smoke detection system FACP. Individual smoke detector auxiliary contacts shall not be used to release door holders.
- (ii) Automatic door locks controlled by the system must be either fail-safe magnetic locks or fail-safe electro-mechanical with reverse bevel dead bolts.
- (iii) All lock protected doors must immediately unlock upon fire alarm, loss of AC power, disablement of the fire alarm system (defined as loss of 24 VDC power) or upon manual operation of an unlocked supervised switch at a constantly attended location.

(e) SPARE PARTS REQUIREMENTS

- (i) Spare Parts: Provide the following spare parts with the system, each individually packaged and labeled. For multi-building projects, calculate separately for each building:

Fuses	2 of each size used in system
Isolation Modules	2% of installed quantity
Manual Stations	2% of installed quantity
Indoor Horns/Strobes	4% of installed quantity
Spot Smoke Detectors, Bases	6% of installed quantity
Heat Detectors	6% of installed quantity
Monitor/Relay Modules	2% of installed quantity

- (ii) Increase decimal quantities of spare parts to the next higher whole number. For example if a system has 20 spot-type smoke detectors provide 2 spare detectors with bases.

d) SYSTEM TESTING & CERTIFICATION

(1) Contractor/Installer Testing and Certification



- (a) Database and Drawing Inspection: The Contractor/Installer must 100% test all site-specific software functions for the system and provide a written test report or detailed check list. This documentation must include a system operation matrix showing the actual FACP response for each initiating device input. Drawings shall be verified for accurate device locations and system addresses.
  - (i) The complete final configuration database (site-specific programming) for the system must be permanently stored on a computer disk or CD and archived by the manufacturer or authorized distributor. A disk or CD copy of that database must also be provided to the Owner when the system is commissioned.
  - (ii) The Manufacturer or authorized distributor must maintain software version (VER) records on the system installed. The system software shall be upgraded free of charge if a new VER is released for any reason during the warranty period. For any new VER to correct problems, free upgrade shall apply during the entire life of the system.
- (b) Contractor/Installer Field Testing: Upon completion of the installation the Division 16 Contractor and the Manufacturer's authorized representative together shall 100% test each and every alarm initiating device for proper response and annunciation, every alarm signaling appliance for effectiveness, and all other functions such as elevator capture, control of smoke doors/dampers, proper operation of HVAC systems, and pressurization fans. ALL supervised circuits must also be tested to verify proper supervision. All site-specific software shall be tested and verified by contractor. (Control circuits and remote annunciation lines are among those required to be supervised.) The documentation shall be part of the programming reports. The contractor shall keep history of all deficiencies determined. All deficiencies shall be corrected and retested. Once this has been accomplished, the contractor shall submit to the A/E all documentation of all problems and corrections and request the A/E to inspect and test the system.

In occupied facilities all Audio Visual device tests shall be scheduled with the Owner.

- (c) Upon successful completion of the Pre-final Inspection and correction of all deficiencies, the manufacturer's authorized representative shall issue a test report to: the A/E, the Facilities Services Life Safety Shop, and the UNC Health and Safety Officer detailing and certifying the test, including those requirements as specified in this document.

## (2) A/E Testing and Certification

- (a) A/E System Inspection: In an effort to expedite the inspection process for projects already seriously behind schedule, the A/E can request UNC Construction Management to schedule the Facilities Services Life Safety Shop Owner acceptance commissioning field inspection and test to be performed in conjunction with the A/E inspection. This is not recommended and has proven to produce lengthy punch-lists and numerous re-inspections by the Owner.



- (b) Once the A/E has inspected, tested and is satisfied the system is 100% operational, and has met all aspects of the A/E design, the A/E shall notify UNC Construction Management to schedule the Facilities Services Life Safety Shop owner acceptance commissioning inspection and test. At that time the A/E shall also submit the following:
  - (i) The latest copy of Detector Sensitivity Report.
  - (ii) A printout of the current installed site-specific database.
  - (iii) Signed NFPA “Record of Completion” form per NFPA 72.
  - (iv) Current copy of as-built drawings with correct room numbers and device system addresses. Room numbers must be installed.
  - (v) Copy of battery calculations.
  - (vi) Copy of record for the Signal Line Circuit voltage measurements taken at the EOL devices during the A/E test. Take readings at the start of the test and every 15 minutes during NAC test. Test shall be 30 minutes minimum. Test shall be conducted with AC power off and under battery power only.

### (3) Owner Testing and Inspection

- (a) Database and Drawing Inspection: The Facilities Services Life Safety Shop will require all the above and a minimum of 3 days for review of the system database and drawing review, prior to scheduling any on-site test.
  - (i) Upon completion of the system database and drawing review any discrepancies will be documented and forwarded to UNC Construction Management requiring action and corrections from the A/E's system installer/programmer. When the required actions and corrections have been addressed and performed a corrected printout of the installed site-specific database and drawings shall be forwarded to the Life Safety Shop for re-review. After review and satisfaction that the corrections have been made, then and only then, will the Life Safety Shop schedule their field inspection and test. The Life Safety Shop will notify UNC Construction Management of the scheduled date and time.
- (b) Owner acceptance commissioning field inspection: A 100% fully functional test of all aspects of the system will be conducted. Therefore, it is expected that the system shall be complete in all aspects. Each function and aspect of system will be tested along with each and every initiating device. Also, all other system functions shall be verified, including but not limited to (where applicable): elevator capture features, control of HVAC systems, door locks, pressurization fans, fire or smoke doors/dampers/shutters, sprinkler systems, etc. The trades' personnel representing the various aspects must be present. The A/E representative does not have to attend but may attend if so desired. The fire alarm vendor's technician who programmed the system must be present.

NOTE: If at any time, during the owner's acceptance commissioning field inspection and test, it appears that the installation contractor has not performed a prior 100% performance test, the current test will be terminated and rescheduled.



Upon completion of the acceptance commissioning field inspection and test, the Facilities Services Life Safety Shop will forward a list of discrepancies in the form of a formal "Punch List" to UNC Construction Management for comment and/or inclusion in the A/E's punch-list of items requiring action and/or corrections from the effected systems contractors/installers. Once the contractors/installers have corrected these items, the A/E shall notify UNC Construction Management and schedule a re-inspection by the Facilities Services Life Safety Shop. When the systems are verified to be satisfactory by the Life Safety Shop, the A/E shall be notified by UNC Construction Management to schedule an inspection and test with the Office of State Construction. On or before the day of the Office of State Construction the following must be completed and/or provided to the Owner:

- (i) Copy of current database installed in the system on CD or floppy disk.
- (ii) All drawings shall be posted.
- (iii) All spare parts and test equipment as described in the specification shall be turned over to the owner.
- (iv) All training requirements shall be met or scheduled.
- (v) All required software on CD or disk shall be turned over to the owner.
- (vi) All certifications.
- (vii) A new signed and dated NFPA "Record of Completion" form per NFPA 72, if required.
- (viii) The FACP shall be turned on but not reporting to the UNC Central Alarm Receiving System (CARS).

(4) System Acceptance

- (a) Office of State Construction inspection: The above items must be completed before the Office of State Construction inspection. Upon completion of Office of State Construction inspection any items or discrepancies must be corrected. When this obligation has been met the warranty shall begin on the day the A/E notifies the Office of State Construction and the Facilities Services Life Safety Shop to that effect.

Beneficial or partial occupancy acceptations shall require the system contractor/installer to remain responsible for the "live" system. A daytime and after hours contact list shall be provided to the Life Safety Shop which will include the names and phone numbers for three (3) responsible individuals until Final acceptance has been granted.

- (b) UNC Central Alarm Receiving System (CARS) Activation: The Life Safety Shop will activate the FACP account in the UNC Central Alarm Receiving System (CARS). In the event of malfunctions or excessive nuisance alarms, the Contractor must take prompt corrective action. The Owner may require a repeat of the Contractor's 100% system test, or other inspections. Continued improper performance during the warranty period shall be cause to require the Contractor to remove the system and replace it.
- (c) The contractor shall notify the supervisor of the Facilities Services Life Safety Shop prior to performing any work on the system after the final acceptance by the Office of State Construction.

e) SYSTEM DOCUMENTATION, TRAINING, & MAINTENANCE



(1) System Documentation

The Contractor/Installer shall provide the A/E: with three (3) copies of the following:

- (a) As-Built Drawings: Submit bound full size sets of scaled architectural as-built floor plans depicting final device/module and equipment locations with corresponding system addresses, all circuiting, and pathways, and terminal cabinet locations, including wire color code and/or label numbers, and showing all interconnections in the system. Include wiring and riser diagrams with actual field measured battery calculations for the main fire alarm panel and all individual circuits of the Notification Appliance Circuit panels (NAC's). In addition provide an electronic copy on CD in format compatible with the most recent release of AutoCad, if requested.

- (i) Electronic circuit diagrams of all control panels, modules, annunciators, communications panels, etc.
  - (ii) Technical literature on all major parts of the system, including control panels, batteries, detectors, manual stations, alarm indicating appliances, power supplies, and remote alarm transmission means.

(b) The Contractor/Installer shall provide the Owner: with the following:

- (i) A current factory approved certification/ training schedule for the specific system installed.
  - (ii) As-Built Drawings: Submit (1) bound full size set, and (1) one 11"x17" set, and an electronic copy in format compatible with the most recent release of AutoCad, of scaled architectural floor plans depicting final device/module and equipment locations with corresponding system addresses, all circuiting, and pathways, and terminal cabinet locations. Include wiring and riser diagrams with actual field measured battery calculations for the main fire alarm panel and all individual circuits of the Notification Appliance Circuit panels (NAC's).

- (a) Electrical and Electronic circuit diagrams of all control panels, modules, annunciators, communications panels, riser panels, etc.

- (iii) Three (3) copies of all software required, both for the installed fire alarm system and for any personal computer (PC) necessary to access the fire alarm system for trouble shooting, programming, modifications, monitoring, de-bugging, or similar functions.
      - (iv) Three (3) copies of the complete maintenance, installation, and programming manuals for the installed fire alarm system. If available a CD version is desired and acceptable. Also provide all technical literature on all major parts of the system, including control panels, batteries, detectors, manual stations, alarm indicating appliances, power supplies, and remote alarm transmission means.
      - (v) Three (3) of each interconnection cables that are required to connect the fire alarm system to a PC.



- (c) The Equipment Manufacturer's shall provide the Owner: with the following:
  - (i) Agreement to License and/or factory certification system training for the Facilities Service Life Safety Shop technicians to maintain and service the equipment installed under this contract.
  - (ii) Direct access and support for the Facilities Service Life Safety Shop technicians from the Manufacturer's or Factory's Technical Services.

(2) System Training and Maintenance

- (a) During the design specification review process, the Design Manager and the Life Safety & Access Controls Superintendent will jointly review the proposed specifications to determine if training is required for the proposed life safety system. Training requirements, scheduling, and purchasing of computers will be coordinated by the Life Safety & Access Controls Division directly with the installation equipment Contractor/Installer and the equipment Vendor/Factory. All cost involved with training travel (transportation, accommodations, meals, etc.) will not be assessed to the Contractor/Installer as part of the contract, but will be funded separately by UNC from allocated reserves.
- (b) The Equipment Manufacturer's shall provide the Contractor/Installer and/or the Owner: with the following:
  - (i) The schedule of available dates when classes are available to obtain License and/or factory certification system training for the Facilities Service Life Safety Shop technicians to maintain and service the equipment installed under this contract.
  - (ii) Training Content: Factory/Manufacture classes, training and testing shall provide what is necessary to certify and/or authorize attendees to program and service the fire alarm system installed for this project, including system hardware and software. Additionally, the training shall cover the following topics as a minimum:
    - (a) Preventative maintenance service techniques and schedules, including historical data trending of alarm and trouble records.
    - (b) Overall system concepts, capabilities, and functions. Training shall be in depth, so that the owner shall be able to add or delete devices to the system and to take any device out of service and return any device to service without need for Manufacturers approval.
    - (c) Explanation of all control functions, including training to program and operate the system software.
    - (d) Manuals, drawings, and technical documentation.
    - (e) The actual system software used to support the fire alarm system installed for this project shall be provided on 3.5-inch floppy disks or CDs, and any required "software keys" to successfully operate the software on the technicians computers shall be provided to the Owner's technicians upon successful completion of the training.



(iii) The Contractor/Installer shall provide the Owner: with the following:

(a) The contractor shall submit a complete site specific system orientation training schedule including dates, times and location for approval by the owner and engineer. which shall include:

(xlviii) Preventative maintenance and any special servicing and/or maintenance techniques, including methods and means of troubleshooting and replacement of all field wiring and devices and, methods and procedures used for troubleshooting the main fire alarm control panel, including field peripheral devices as to programming, bussing systems, internal panel and unit wiring, circuitry and interconnections.

(xlix) Overall system concepts, capabilities, and functions.

(l) Explanation of all control functions, input or output.

(li) Any device and/or equipment locations that are not easily found.

(lii) Any programming peculiarities that is inherent in the system.

(b) The Contractor/Installer is responsible for ensuring that the manufacturer's authorized representative shall provide a schedule of the available manufacture certification training for attendance by the Owner's designated employees. The training will include the proper programming procedures, operation of the system, troubleshooting and maintenance aspects, and all required periodic maintenance.

(liii)The authorized representative will coordinate training arrangements with the Owner's schedule.

(liv)Location: On-site certification training is preferred and UNC will make available classroom space as needed by the manufacturer. If travel is required, the Life Safety & Access Controls Division will determine the personnel required to be trained.

(c) The Contractor/Installer is responsible for ensuring the manufacturer provides the Owner with the following:

(lv) Licenses and/or certifications to maintain and service the equipment installed under this contract.

(lvi)Direct access and support for the University Technicians to the Manufacturers Technical Services.





- (d) Equipment: The Contractor/Installer is responsible for providing a list of all required support equipment necessary to support the fire alarm system installed for this project. This list shall include computers (laptop or desktop), software, connecting cables, accessories and auxiliary equipment necessary to effectively operate the life safety system.

f) ALTERNATES AND ATTACHMENTS

(1) ALTERNATES

- (a) Alternate E1 - Submit a quote for a maintenance contract to provide all maintenance, test, and repair described below and/or in accordance with NFPA-72, "Inspection, Testing, and Maintenance". Include also a quote of unscheduled maintenance/repair, including hourly rates including travel cost, for technicians trained on this equipment, and including an "on call" type response time within one (1) hour from time of notification 24-7, 365 days a year. Submittals that do not identify all post contract maintenance costs will not be accepted. Rates and costs shall be valid for the period of five (5) years after expiration of the warranty. Inspections and testing shall be performed as prescribed below. A preventive maintenance schedule shall be provided by the Contractor that shall describe the protocol for preventive maintenance. The schedule shall include:
  - (i) Quarterly inspections of any radiant energy fire detectors, supervisory signal devices, and water-flow devices. Functional testing of entire system batteries and battery charging circuits.
  - (ii) Semiannual inspections of entire system batteries and battery charging circuits, transient suppressors, control unit trouble signals, emergency voice / alarm communications equipment, remote annunciators, initiating devices, interface equipment, alarm notification appliances, and the digital communicator (DACT). Functional testing of entire system batteries and battery charging circuits, radiant energy fire detectors, waterflow devices and valve tamper switches. systematic examination, adjustment and cleaning of all detectors, manual fire alarm stations, control panels, power supplies, relays, and water flow switches and all accessories of the fire alarm system.
  - (iii) Annual inspection and functional testing of all control equipment, entire system batteries and battery charging circuits, control unit trouble signals, emergency voice / alarm communications equipment, remote annunciators, initiating devices, interface equipment, special hazard equipment, alarm notification appliances, and the digital communicator (DACT).
- (b) Alternate E2 - Network Interface Capability: The system must provide the network interfacing means and capability to communicate with Notifier "ONYXWorks" including, the Category 5 cabling to the buildings campus LAN Network closet, for remote monitoring and limited control. The Notifier Network Input Output Node (NION) is highly recommended to meet this requirement.

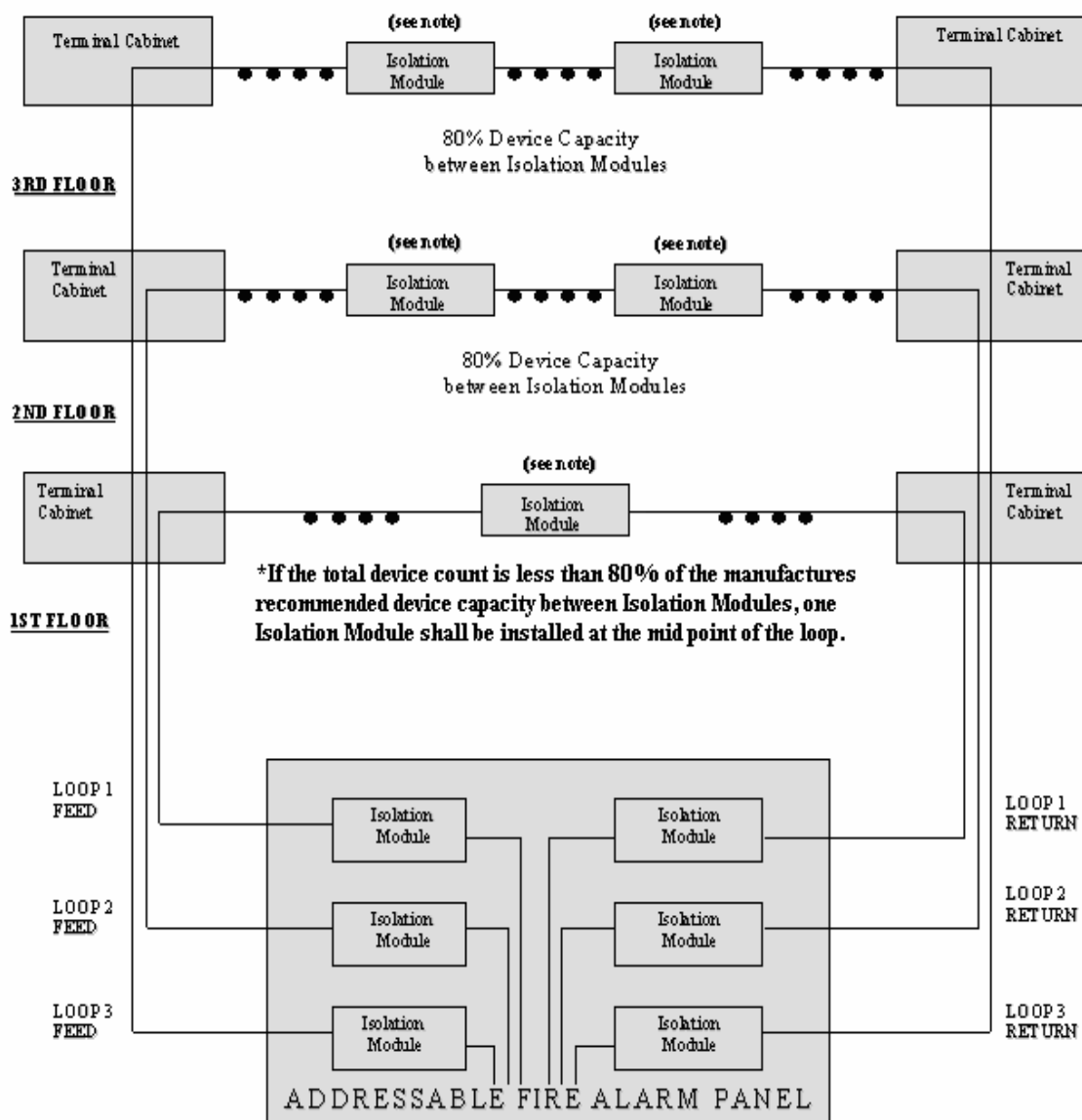




[Attachment A](#)

**REQUIREMENTS FOR FIRE DETECTION AND ALARM SYSTEMS**

**Typical Addressable Fire Alarm System Riser in Large, Multi-story Buildings**



**\*NOTE:** Isolation modules mounted outside terminal cabinets shall be mounted per the same specifications and guidelines described by NCDOI for audio/visual devices.



Attachment B:



FIRE DEPARTMENT

Town of Chapel Hill  
403 Martin Luther King Jr. Blvd.  
Chapel Hill, NC 27514

phone (919) 968-2781 fax (919) 932-2956  
[www.townofchapelhill.org](http://www.townofchapelhill.org)

September 12, 2006

Mark Bristol, Life Safety Accessibility Supervisor  
Division of Facility Services  
University of North Carolina at Chapel Hill  
103 Airport Dr. 168 /CB#1800  
Chapel Hill, NC 27514

Dear Mr. Bristol,

Based on our previous discussion and your request of the following, as it relates to the NC Fire Code which states in 907.2.12.3 Emergency voice/alarm communication system - An approved two way, fire department communication system designed and installed in accordance with NFPA 72 shall be provided for fire department use. It shall operate between a fire command center complying with Section 509 and elevators, elevator lobbies, emergency and standby power rooms, fire pump rooms, area of refuge and inside enclosed exit stairways. The fire department communication device shall be provided at each floor level within the enclosed exit stairway. Exception: Fire department radio system where approved by the fire department.

In my professional opinion, as the Fire Marshal we will allow the Exception as it relates to University High-rise Buildings and the use of our radio system. This letter will hopefully suffice any future building plan/code issues unless the NC Fire Code changes the exceptions in the future as it relates to fire department communication.

We want to continue fostering and excellent working relationship in all of our efforts of health and safety with the Hospital and University Property. If I can be of any future assistance, please call me at 919-969-2006.

Sincerely,

Alvin Ward (Fire Marshal)

Deputy Fire Chief

Cc D. Jones, Fire Chief



Attachment C:



THE UNIVERSITY  
of NORTH CAROLINA  
at CHAPEL HILL

MARK B. BRISTOL  
SUPERINTENDENT, LIFE SAFETY & ACCESS  
CONTROLS  
Facilities Services  
CB #1800  
Chapel Hill NC 27599-1800

TEL: 919-843-5577  
FAX: 919-962-6260  
Email: [mbristol@fac.unc.edu](mailto:mbristol@fac.unc.edu)

### Life Safety System Transfer of Responsibility

\_\_\_\_\_  
BUILDING NAME

\_\_\_\_\_  
EFFECTIVE DATE

The current status of the Life Safety System that serves this facility is in the following condition:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

The following parties have acknowledged the condition and status of the Life Safety System in this facility and have accepted the transfer of responsibility and liability of this system in its present condition with the understanding that the system will be returned to the University in the same or better condition.

\_\_\_\_\_  
Life Safety Shop Supervisor Releasing System

\_\_\_\_\_  
Date

\_\_\_\_\_  
Vendor/Contractor Accepting System

\_\_\_\_\_  
Date

\_\_\_\_\_  
Life Safety Shop Supervisor Re-Accepting System

\_\_\_\_\_  
Date





DAYTIME WORKING HOURS

Name:

Phone and or Pager #:

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_

NIGHTS, WEEKENDS, AND HOLIDAYS

Name:

Phone and or Pager #:

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_



