## SECTION 280513 - FIRE ALARM SYSTEM

1.0 This section is intended to define the general configuration, layout, installation and testing requirements for the various fire alarm systems at the University of Pennsylvania. At a minimum, Local and National Codes that govern the layout and installation of the system shall be used during the design process.

2.0 References: National Fire Protection Association (NFPA):

A. 70 National Electrical Code (NEC).
B. 72 National Fire Alarm Code.
C. 90A Installation of Air Conditioning and Ventilating systems.

3.0 All fire alarm and fire detection equipment shall be designed and installed in accordance with the current edition in effect of the following publications:

A. UL 268 Standard for Smoke Detectors for Fire Alarm Signaling Systems.
B. UL Fire Protection Equipment Directory.
C. UL Electrical Construction Materials Directory.
D. UL 38 Standard for Manual Signaling Boxes for Fire Alarm Systems.
E. UL 464 Audible Signal Devices for Fire Alarm Signaling Systems including Accessories.
F. UL 521 Standard for Heat Detectors for Fire Protective Signaling Systems.
G. National Electrical Manufacturers Association (NEMA) Publications.
H. FM Global System: Approval Guide.
I. Local Fire Code – Philadelphia Fire Code or Local Jurisdiction Code
J. Americans with Disabilities Act.

4.0 Quality Assurance:

A. Existing systems: All devices to be connected to the fire alarm system signaling and notification circuits shall be UL listed for use with the existing system as installed, and shall bear the “UL” label. Unlisted substitutes will not be accepted.
B. New System: All components of the fire alarm system shall be **FM approved**/UL listed by the fire alarm system manufacturer under the appropriate category by Underwriters Laboratories,Inc. for use with the specified fire alarm system, and shall bear the "UL" label. All control equipment shall be listed under UL as a single control system.

5.0 System Description:

A. General:

1. Operation shall be such that actuation of any initiating device (manual station, automatic sprinkler system, heat detector, automatic smoke detector, etc.) shall cause the system to enter alarm mode.
   **a.) Exception: duct detectors shall initiate a supervisory signal.**
2. The system shall be electrically supervised for operational integrity of all initiating circuits, alarm signal sounding/notification circuits and powersupply circuits, as well as all addressable initiating devices.

B. Operation: The actuation of any manual or automatic device shall:

1. Cause a signal(s) to sound at Operations Control Center (OCC) and at PENNCOMM University's Monitoring System (4040 Chestnut Street).

2. General evacuation of the building shall be initiated automatically by sounding local

audible and visual notification devices within the building. Coordinate with the University Department of Fire and Emergency Services (FES) for direction on specific evacuation procedures that will apply to the project.

Initiating devices shall provide the appropriate pre-alarm, supervisory, or trouble signals as follows:

| | Signal | OCC | PENNCOMM |
|---|---|---|---|
| a) | Trouble | X | |
| b) | Supervisory | X | **X Duct Detector** |
| c) | Alarm | X | X |

C. All alarm initiating devices shall indicate individually on each alphanumeric display. Devices will have a descriptive message and condition message, and will identify the area **(exact floor and room number)** causing an alarm, supervisory, or trouble condition.

D. The Penn Siren Outdoor System (S.O.S.) and Emergency Voice/Alarm Communication Systems (EVACS) shall be **integrated into all new installations and upgrades of fire alarm systems.**

6.0 Alarm Zones: Each manual pull station, area or duct smoke detector, heat detector, sprinkler system water flow switch, and tamper switch shall annunciate as a uniquely identified point, and shall identify the device ID, location and zone assignment of the device. The notification plan shall be determined by FES.

7.0 Coordination:

A. Provide the approved installer's approval drawings to the University Project Manager, who will submit same to FM Global for review and approval prior to hardware procurement.

B. At no time shall an existing fire alarm system be impaired without notifying PennComm and OCC. Either a fire watch shall be maintained when an existing system is made inoperable shut down, or a temporary system shall be installed. Provide proper notification so that the Operations Control Center will notify FM Global and FES will notify the Philadelphia Fire Department under such conditions.

C. The building fire alarm system shall report to the University's monitoring system known as the Penn Fire Alarm Network (PFAN). This connection shall include all work (surge suppression devices, wiring, control modules, programming, etc.) to tie into the existing Digitize 3505 System Campus Reporting System. In general, the tie in will require a direct fiber connection and the purchase and installation of a dedicated communication panel, switch, and emergency power receptacle. The specific tie-in scheme will be determined jointly by the University Engineering Department, FES and the University Information Systems and Computing (ISC) department.

D. All fire alarm panel graphics, alarm logs, device address mnemonics, and other information shall be fully coordinated with building room numbers as defined on the active architectural plans. Any changes made to room numbers, or to the fire alarm system as a result of a building retrofit or modification project shall include a requirement for the fire alarm system to be updated to correspond to the new room number assignments. All firealarm graphics and documentation shall be updated and in place prior to re- commissioning the fire alarm system after the modifications.

E. The design documents shall include a sequence chart or matrix that defines the fire alarm system response to the various initiating devices that are connected to the system.

F. All new or retrofitted fire alarm system panels shall include program disconnect switches (Gamewell #ASM-16) on the panel, set up to disable system inputs and outputs from alarming the system or initiating actions, during testing and programming, as follows:

1. Addressable monitors on the sprinkler system flow and tamper switches, per piping riser.

2. Smoke detectors, by floor.
3. Special hazard panel inputs (FM-200, Ansul, etc.)
4. Elevator recall control relays, per elevator.
5. Horn-strobes or speaker-strobes, by floor.
6. When the program disconnect switches are in the disable position, a system trouble status warning shall be generated.

8.0 Products: Manufacturer system components shall be the standard products of Gamewell-FCI. Alternates will not be accepted.

A. Fire Alarm Control Panel:

1. The fire alarm control panel shall be Gamewell-FCI E3 Series or newer version as determined by the University Engineering Department.

B. The FACP shall be of the addressable type and come equipped with features necessary to perform required functions and as specified as follows:

1. 80 character, backlit liquid crystal display (Gamewell # LCD-E3).
2. Individual red system alarm LED.
3. Individual yellow supervisory service LED.
4. Individual yellow trouble LED.
5. Green "power on" LED.
6. Alarm Acknowledge Key.
7. Supervisory Acknowledge Key.
8. Trouble Acknowledge Key.
9. Alarm Silence Key.
10. System Reset Key.
11. LED testing.
12. Alarm verification functions.
13. Alarm trouble and abnormal condition listing.
14. Enabling and disabling of each monitor point separately.

C. Control panel shall comply with all the applicable requirements of UL 864. The loss of primary power or the sequence of applying primary or emergency power, shall not affect the transmission of alarm supervisory or trouble signals.

9.0 System Expansion:

A. The initial design of audible and visual notification circuit loading shall be such that all devices receive full power and such that no circuit contains more than 60 percent of the manufacturer’s rated quantity of devices.
B. The initial design of addressable signaling circuits shall be loading such that no addressable circuit or loop contains more than 75 percent of the manufacturer’s rated quantity of devices.

10.0 Power Supply: Power Requirements:

A. Provide sufficient standby battery capacity to operate the entire system upon loss of normal power for a period of 24 hours in a standby mode plus 10 minutes in alarm mode. In addition, provide an additional 20 percent spare standby battery capacity. All battery charging and recharging operations shall be automatic. Batteries shall be brought from fully discharged to fully charged condition within 48 hours.
B. Standby battery capacity must be capable of supporting the FACP, communications board, and emergency power for the switch which connects the panel to the Penn Fire Alarm Network (PFAN) to ensure alarm signals are transmitted in an emergency power condition.
C. Batteries: Storage batteries shall be sealed (valve-regulated), lead calcium type requiring no additional water.

D. Battery charger shall be completely automated with high/low charge rate. Charger shall be located in FACP.

E. The fire alarm system power supply shall be connected to the building's emergency (life safety branch) power circuits.

F. Provide a power disconnect safety switch located next to the fire alarm panel(s), that disconnects AC power from the fire alarm panel, as well as each supplementary or other panel that is fed by AC power.

11.0 Addressable Devices – General Requirements:

A. Communication with Addressable Devices: The system must provide communication with all initiating and control devices individually. All of these devices are to be individual-ly annunciated at the control panel and all the remote annunciators. Annunciation shall include the following conditions for each point.

1. Alarm.
2. Open.
3. Short.
4. Ground.
5. Device fail/or incorrect device.

B. All addressable devices shall have the capability of being disabled or enabled individually.

C. Identification of Addressable Devices:

1. Each addressable device shall be uniquely identified by an address code. The use of jumpers to set the device address will not be acceptable due to the potential of vibration and poor contact. Device identification schemes that do not use uniquely set addresses but rely on electrical position along the communication channel are unacceptable. The system shall accommodate the addition of an addressable device between existing devices and shall not require re-addressing reprogramming of existing devices.

12.0 Manual Pull Stations:

A. The stations will be red with painted white, raised lettering. The station will mechanically latch upon operation and remain so until manually reset by opening with a key common to all system locks. Pull stations will be double action.

B. The front of the station is to be hinged to a backplate assembly and must be opened with a key to reset the station. The key shall be common with the door locks on the fire alarm control panels. Stations which use Allen wrenches or special tools to reset, will not be accepted.

C. Each pull station shall be identified with the following sign: "IN CASE OF FIRE SOUND ALARM AND CALL FIRE DEPARTMENT" and Signs shall be provided by the installing Contractor.

D. Pull stations shall be addressable type – Gamewell # MS 7AF

13.0 Heat Detectors: Automatic heat detectors shall be of the analog addressable type with fixed temperature or rate-of-rise sensors as required by the application.

14.0 Smoke Detector: Ceiling mounted smoke detector shall be of the analog addressable photoelectric type with plug-in base and auxiliary relay contacts.

15.0 Addressable Monitor Modules: Used for interfacing all non-addressable dry-contact type input devices to the addressable signaling circuits.

16.0 Addressable Control Relays: Used for interfacing the fire alarm system to external devices and systems where fire alarm system control or status is required. Provide control relays with external circuit supervision function where integrity of the external circuit must be monitored.

17.0 Notification devices:

A. ADA Strobe: Strobes shall be of the synchronized type. Candela output shall be adjustable to settings that are in accordance with ADA, UL 1971 and NFPA-72 requirements.
B. Horns and speakers shall provide a sound level of 96 dBA at 10'. In residential units, the sound level shall be a minimum of 70 dBA at the pillow as confirmed by field testing at the time of installation of the devices. Installations that fail to meet this requirement shall be revised to add additional devices, and retested to confirm compliance.
C. New Installations and Retrofits shall use speakers and not horns to allow use of a voice system that accommodates the S.O.S./EVACs integration.

18.0 Remote Annunciator: Alphanumeric liquid crystal display (Gamewell #LCD-E3) type. Provide a minimum of 1 per system, to be located at the building main entrance, or as directed by FES. All new or upgraded building fire alarm systems shall include an outdoor strobe unit, placed in a highly visible location near the building entrance that contains the firefighter's remote annunciator panel as well as an additional clear strobe on the outside of the building that signals the activation of the S.O.S system within the building.

19.0 Identification and Labeling - Conductors:

A. All circuit conductors shall be identified within each enclosure where a tap, splice or termination is made.
B. Each cable shall be identified as to service within each enclosure, pull box and junction box.
C. Conductor and cable identification shall be by single piece, plastic coated self-laminating printed markers, or by heat-shrink type sleeves. Markers shall be attached in a manner that will not permit accidental detachment.
D. All fire alarm system cables run exposed or in mechanical spaces shall be installed in RGS conduit – ¾" minimum trade size. Fire alarm system cables run in above ceiling spaces or concealed in wall cavities may use fire alarm system MC-type cable.

20.0 Training:

A. Training sessions shall be held for the University's Electrical Operators (ELOPS), Operations Control Center (OCC) personnel, and FES personnel employees. All training shall be held in a classroom type atmosphere. The amount of training and the duration of each training session shall be coordinated with the University. Training manuals shall be provided for all attendees.

21.0 Testing - General:

A. Testing of the fire alarm system shall meet the requirements set forth in NFPA 72. Testing shall be performed in the presence of N-Tech Company and FES.
B. Each portion of the fire alarm system shall be tested prior to being placed into service.
C. At the conclusion of the work and prior to final payment, a complete system acceptance test shall be conducted. This includes both initial installation work as well as all subsequent modification work.
D. Tests shall include interfaces from the fire alarm system to the elevator system, door interlocks, and other interconnected systems.
E. A battery capacity test shall be conducted to prove that the system has the necessary battery capacity for both standby and alarm modes.
F. The system shall not be accepted until all testing is complete and the entire system is fully functional.
G. Performance testing is the responsibility of the installer and will be witnessed by FES. The installer shall provide all equipment required for testing and provide three (3) copies of the point list and set of location plans to FES. Also include an editable copy of the point list in MS Excel format.

22.0 Software and Documentation:

A. Three (3) copies of the software and program configuration shall be given to the University Project Management to distribute to OCC, University Engineering Department, and operating personnel.
B. The installer is responsible for producing detailed system layout and wiring diagrams, as well as calculations for battery capacity, signaling and notification circuit wire sizing and voltage drop. These documents shall be provided in a timely fashion in order to support obtaining the necessary electrical construction permits.
C. A back-up copy of the fire alarm panel (and all supplementary panel) software configuration files shall be placed on the fire alarm system computer, located in the Operations Control center (OCC).

23.0 Layout and Design Considerations

A. Locations of devices: According to NFPA 72 and other applicable codes and standards.
B. In mechanical rooms no smoke detectors shall be installed. Provide only heat detectors and horn strobes.
C. Minimum amount of smoke detectors required by code. Only photoelectric smoke detectors are permitted in occupied areas of buildings.
D. All devices shall be accessible including those located in lobbies or high reach areas. Beam detectors shall be installed in areas where area smoke detectors cannot be easily reached for service and maintenance.
E. Horn strobes must be audible or visible in all parts of building including mechanical rooms, etc. The use of horns should be limited in exit stairwells, especially in high rise buildings where building occupants must remain in the stairwells while exiting during an emergency. Strobes should be considered as an alternate.
F. When connecting to an existing system:

1. During the design process advice and permission shall be obtained from the University Engineering Department Office.
2. Recertification and testing of the entire building's fire alarm system will be required by the City of Philadelphia.