

SECTION 28 3113 - DIGITAL ADDRESSABLE FIRE DETECTION AND ALARM SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 - 1. Division 21 Sections: Automatic Sprinkler Systems, Clean Agent Systems, and Chemical Suppression systems.
 - 2. Division 23 Sections: HVAC systems.
 - 3. Division 25 Section: Integrated Automation.
 - 4. Division 26 Sections: Electrical
 - 5. Division 33 Sections: Utilities
- C. (Future use).

1.2 SUMMARY

- A. Section Includes: ***(edit for project requirements)***
 - 1. Fire-alarm control unit / panel.
 - 2. Manual fire-alarm boxes.
 - 3. System smoke detectors.
 - 4. Heat detectors.
 - 5. Aspirating smoke detection.
 - 6. Carbon Monoxide detectors
 - 7. Notification appliances.
 - 8. Device guards.
 - 9. Firefighters' two-way telephone communication service.
 - 10. Firefighters' smoke-control station.
 - 11. Magnetic door holders.
 - 12. Remote annunciator.
 - 13. Campus Wide Emergency Communication System
 - 14. Graphical annunciator workstation.
 - 15. Addressable interface device.
 - 16. Digital alarm communicator transmitter.
 - 17. Radio alarm transmitter.
 - 18. Network communications.
 - 19. System printer.
- B. Applicable Codes and Standards
 - 1. *(Section to be completed by engineer).*
- C. Related Requirements:

1. (For future use).

1.3 ACRONYMS

- A. EMT: Electrical Metallic Tubing.
- B. FACP: Fire Alarm Control Panel.
- C. NICET: National Institute for Certification in Engineering Technologies.
- D. PC: Personal computer.

1.4 ACTION SUBMITTALS

- A. The fire detection and alarm system shall comply with these specifications and all applicable Codes and Standards. All annex and referenced materials shall be considered mandatory requirements. Acceptance of a submittal does not exempt the Contractor from full compliance with the contract documents.
- B. Product Data: For each type of product, including furnished options and accessories.
 1. Include construction details, material descriptions, dimensions, profiles, and finishes.
 2. Include rated capacities, operating characteristics, and electrical characteristics.
 3. Manufacturer's data sheets for all equipment to be provided. All equipment shall be provided in bound booklet form and include a complete bill of materials. Where more than one component, finish, etc., is indicated on a particular data sheet, the specific item provided shall be clearly identified by highlighting or clouding the specific item.
- C. Shop Drawings: For fire-alarm system.
 1. Comply with requirements and annex material in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
 2. Include plans, elevations, sections, details, and attachments to other work.
 3. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and locations. Indicate conductor sizes, indicate termination locations and requirements, and distinguish between factory and field wiring.
 4. Detail assembly and support requirements.
 5. Include voltage drop calculations for notification-appliance circuits.
 6. Include battery-size calculations.
 7. Include input/output matrix.
 8. Include statement from manufacturer that all equipment and components have been tested as a system and meet all requirements in this Specification and in NFPA 72.
 9. Include performance parameters and installation details for each detector.
 10. Verify that each duct detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
 11. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale; coordinate location of duct smoke detectors and access to them.
 - a. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators.
 - b. Show field wiring required for HVAC unit shutdown on alarm.

- c. Show field wiring and equipment required for HVAC unit shutdown on alarm and override by firefighters' control system.
 - d. Show field wiring and equipment required for HVAC unit shutdown on alarm and override by firefighters' smoke-evacuation system.
 - e. Locate detectors according to manufacturer's written recommendations.
 12. Include voice/alarm signaling-service equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.
 13. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits and point-to-point wiring diagrams.
 - D. General Submittal Requirements:
 1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.
 2. Shop Drawings shall be prepared by persons with the following qualifications. The individual responsible for the drawings shall affix their NICET stamp / seal and signature to each drawing.
 - a. Trained and certified by manufacturer in fire-alarm system design.
 - b. NICET-certified, fire-alarm technician; Level IV minimum.
 - c. Licensed or certified by authorities having jurisdiction.
 - E. Delegated-Design Submittal: For notification appliances and smoke and heat detectors, in addition to submittals listed above, indicate compliance with performance requirements and design criteria, including analysis data signed and sealed by a qualified professional engineer registered in the State of Illinois and responsible for their preparation.
 1. Drawings showing the location of each notification appliance and smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of the device.
 2. Design Calculations: Calculate requirements for selecting the spacing and sensitivity of detection, complying with NFPA 72. Calculate spacing and intensities for strobe signals and sound-pressure levels for audible appliances.
 3. Indicate audible appliances required to produce square wave signal per NFPA 72.
- 1.5 INFORMATIONAL SUBMITTALS
- A. Qualification Data: For Installer.
 - B. Field quality-control reports.
- 1.6 Sample Warranty: For special warranty.
- 1.7 CLOSEOUT SUBMITTALS
- A. Contractor Record (As-Built) Drawings
 1. The Contractor shall maintain on the site an up-to-date record set of approved shop drawing prints which shall be marked to show each change made to the fire alarm system from the original approved shop drawings. This shall not be construed as authorization to deviate from or make changes to the shop drawings approved by the Engineer without

written instruction from the Engineer in each case. This set of drawings shall be used only as a record set. These drawings shall be made available to the Engineer and NU upon request.

2. Upon completion of the work the record (as-built) set of prints shall be used by the Contractor to prepare complete, accurate final record drawings reflecting any and all changes and deviations made to the fire alarm system. "Red-lined" shop drawings will not be accepted.
3. Include the following and deliver copies to authorities having jurisdiction:
 - a. Provide "Fire Alarm (*and Emergency Communications System*) Record of Completion Documents" according to the "Completion Documents" Article in the "Documentation" section in NFPA 72.
 - b. As-built drawings shall be provided before acceptance of the work and final payment. The As-Built drawings shall be prepared in AutoCAD format. A reproducible set and four (4) copies are required. Submit a CDROM copy of all CAD files in addition to the drawings. File format shall be suitable for use with Auto Cad. Confirm the revision requirements with the Northwestern University Project Manager.
 - c. The As-Built drawings shall locate as a minimum the following: FACP, annunciators, initiating devices, notification appliances, suppression systems, power supplies.
 - d. Complete wiring diagrams showing connections between all devices and equipment. Each conductor shall be numbered at every junction point with indication of origination and termination points.
 - e. Riser diagram.
 - f. Device addresses.
 - g. A sequence of operations input/output matrix or narrative which reflects the actual programming at the time of completion.

B. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Division 1 Section "Operation and Maintenance Data," include the following and deliver copies to authorities having jurisdiction:
 - a. Manufacturer's required maintenance related to system warranty requirements.
 - b. Abbreviated operating instructions for mounting at fire-alarm control unit and each annunciator unit.

C. Test Record

1. Documentation for system testing shall be prepared and submitted by the Contractor for review and approval by Northwestern University at least 14 days prior to the final acceptance test. Test documentation shall be provided in a documentation cabinet located near the FACU.
2. The following shall be included in the submittal package and delivered to authorities having jurisdiction:
 - a. Comply with the "Record of Completion" section of NFPA 72.
 - b. Provide "Inspection and Testing Form" according to the "Inspection, Testing and Maintenance" chapter in NFPA 72, and include the following:
 - 1) Equipment tested.
 - 2) Frequency of testing of installed components.

- 3) Frequency of inspection of installed components.
- 4) Requirements and recommendations related to results of maintenance.
- 5) Manufacturer's user training manuals.

D. Software and Firmware Operational Documentation:

1. Record copy of site-specific software.
2. Software operating and upgrade manuals.
3. Program Software Backup: On magnetic media or compact disk, complete with data files.
4. Device address list.
5. Printout of software application and graphic screens.

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. The spare parts shall be turned over to Northwestern University's Supervising Electrician and receipt acknowledging this shall be required before final payment to contractor.

1. Lamps for Remote Indicating Lamp Units: Quantity equal to **10** percent of amount installed, but no less than one unit.
2. Lamps for Strobe Units: Quantity equal to **10** percent of amount installed, but no less than one unit.
3. Smoke Detectors, Fire Detectors: Quantity equal to **10** percent of amount of each type installed, but no less than one unit of each type.
4. Detector Bases: Quantity equal to **two** percent of amount of each type installed, but no less than one unit of each type.
5. Keys and Tools: One extra set for access to locked or tamper-proofed components.
6. Audible and Visual Notification Appliances: **One** of each type installed.
7. Fuses: **Two** of each type installed in the system. Provide in a box or cabinet with compartments marked with fuse types and sizes.

1.9 QUALITY ASSURANCE

- A. The installation shall be performed by a company specializing in installing the products specified in this Section with a minimum of five years of experience and certified by the State of Illinois as fire alarm installers.
- B. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.
- C. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level IV technician.
- D. NFPA Certification: Obtain certification according to NFPA 72 by a UL-listed alarm company.
- E. NFPA Certification: Obtain certification according to NFPA 72 by [**City of Chicago**] [**City of Evanston**].
- F. Each and all items of the fire alarm system shall be listed as a product of a single fire alarm system manufacturer under the appropriate category by Underwriters' Laboratories, Inc. (UL), and shall bear the "U.L." label. Partial listings, or multiple listings for various major sections of the control, shall not be acceptable.

- G. Comply with FM Global requirements.
- H. Comply with most current edition of the Northwestern University Design Standards.

1.10 PROJECT CONDITIONS (*Edit for Project Requirements*)

- A. **[Perform a full test of the existing fire alarm system prior to starting work. Document any equipment or components not functioning as designed.]**
- B. **[Interruption of Existing Fire-Alarm Service: Do not interrupt fire-alarm service to facilities occupied by the University or others unless permitted under the following conditions and then only after arranging to provide temporary guard service according to requirements indicated:**
 - 1. **Notify the University no fewer than ten (10) days in advance of proposed interruption of fire-alarm service.**
 - 2. **Do not proceed with interruption of fire-alarm service without the University's written permission.]**
- C. **[Prior to performing any work which may impair any portion of an on line fire alarm system equipment or components the contractor must submit a request for system shutdown to the University's project manager. The contractor must inform the University of the specific location affected and list the circuits which may be inoperable during the outage and the length of time the system will be impaired.]**
- D. **[During an impairment, either the sprinkler system or a temporary fire alarm system must be active.]**
- E. **[Provide a fire watch for the system that is out of service.]**
- F. **[Demolition of existing equipment should begin by the fire alarm contractor disconnecting the existing circuits at the control panels, terminal cans or junction boxes as appropriate and rerouting any active circuits around the construction area utilizing the previously installed temporary wiring.]**
- G. **[Existing Fire-Alarm Equipment: Maintain existing equipment fully operational until new equipment has been tested and accepted. As new equipment is installed, label it "NOT IN SERVICE" until it is accepted. Remove labels from new equipment when put into service, and label existing fire-alarm equipment "NOT IN SERVICE" until removed from the building.]**
- H. **[Equipment Removal: After acceptance of new fire-alarm system, remove existing disconnected fire-alarm equipment and wiring.]**
- I. **[Use of Devices during Construction: Protect devices with factory supplied covers during construction unless devices are placed in service to protect the facility during construction.]**

1.11 WARRANTY

- A. Comply with Division 1 requirements.

- B. Special Warranty: Manufacturer agrees to repair or replace fire-alarm system equipment and components that fail in materials or workmanship within specified warranty period.
1. Warranty Extent: All equipment and components not covered in the Maintenance Service Agreement.
 2. Warranty Period: Five years from date of Substantial Completion.
 3. This warranty shall include a response to emergency service calls in a time period not to exceed four hours from time of notification, parts and labor, and maintenance per all applicable NFPA codes and the City of [Evanston] [Chicago] Mandates.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide products by one of the following:
1. Chicago: Siemens – Fire Safety.
 2. Evanston: Johnson Controls.
- B. For existing building systems, match existing system.
- C. Being listed as an acceptable Manufacturer in no way relieves obligation of the Contractor to provide all equipment and features in accordance with these specifications.

2.2 SYSTEM DESCRIPTION

- A. The fire alarm system shall comply with these specifications and all applicable codes. Acceptance of the fire alarm system submittal does not exempt the contractor from full compliance with the contract documents.
- B. Source Limitations for Fire-Alarm System and Components: Components shall be compatible with, and operate as an extension of, existing system. Provide system manufacturer's certification that all components provided have been tested as, and will operate as, a system.
- C. Non-coded, UL listed, addressable system, with multiplexed signal transmission and [voice] [horn] [strobe] evacuation. Class I and Class II and equipment must be {City of Chicago} {City of Evanston} approved for use in the alarm system class being installed.
- D. Automatic sensitivity control of certain smoke detectors.
- E. All components provided shall be listed for use with the selected system.
- F. Electrical Components, Devices, and Accessories: Listed as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.3 SYSTEMS OPERATIONAL DESCRIPTION (*Edit for Project Requirements*)

- A. Fire-alarm signal initiation shall be by one or more of the following devices and systems:

1. Manual stations.
2. Heat detectors.
3. Smoke detectors.
4. Carbon monoxide detectors.
5. Automatic sprinkler system water flow.
6. Pre-action system.
7. Fire-extinguishing system operation.
8. Fire standpipe system.
9. Dry system pressure flow switch.
10. **<Insert alarm-initiating devices and systems>**.

B. Fire-alarm signal shall initiate the following actions:

1. Continuously operate alarm notification appliances, including voice evacuation notices.
2. Identify alarm and specific initiating device at fire-alarm control unit, connected network control panels, off-premises network control panels, and remote annunciators.
3. Transmit an alarm signal to the Electric Shop and Police Station.
4. Unlock electric door locks in designated egress paths.
5. Release fire and smoke doors held open by magnetic door holders.
6. Activate voice/alarm communication system.
7. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode on dedicated devices.
8. Activate smoke-control system (smoke management) at firefighters' smoke-control system panel on dedicated devices.
9. Activate stairwell and elevator-shaft pressurization systems on dedicated devices.
10. Close smoke dampers in air ducts of designated air-conditioning duct systems on dedicated devices.
11. Activate pre-action system on dedicated devices.
12. Recall elevators to primary or alternate recall floors on dedicated devices.
13. Activate elevator power shunt trip on dedicated devices.
14. Activate emergency lighting control on dedicated devices.
15. Activate emergency shutoffs for gas and fuel supplies on dedicated devices.
16. Record events in the system memory.
17. Record events by the system printer.
18. Indicate device in alarm on the graphic annunciator.
19. **<Insert signal-initiating actions>**.

C. Supervisory signal initiation shall be by one or more of the following devices and actions:

1. Valve supervisory switch (**for Chicago report to Valve Supervisory Control Panel**).
2. High- or low-air-pressure switch of a dry-pipe or pre-action sprinkler system.
3. Duct smoke detector.
4. Elevator shunt-trip supervision.
5. Fire pump running. (**for Chicago report to Valve Supervisory Control Panel**)
6. Fire-pump loss of power. (**for Chicago report to Valve Supervisory Control Panel**)
7. Fire-pump power phase reversal. (**for Chicago report to Valve Supervisory Control Panel**)
8. Engine-generator running. (**for Chicago report to Valve Supervisory Control Panel**)
9. Engine-generator loss of power. (**for Chicago report to Valve Supervisory Control Panel**)
10. Independent fire-detection and -suppression systems.
11. User disabling of zones or individual devices.
12. Loss of communication with any panel on the network.
13. **<Insert supervisory signal-initiating devices and actions>**.

D. System trouble signal initiation shall be by one or more of the following devices and actions:

1. Open circuits, shorts, and grounds in designated circuits.
2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices. **(for Chicago Tamper Switches report to Valve Supervisory Control Panel)**
3. Loss of communication with any addressable sensor, input module, relay, control module, remote annunciator, printer interface, or Ethernet module.
4. Loss of primary power at fire-alarm control unit.
5. Ground or a single break in internal circuits of fire-alarm control unit.
6. Abnormal AC voltage at fire-alarm control unit.
7. Break in standby battery circuitry.
8. Failure of battery charging.
9. Abnormal position of any switch at fire-alarm control unit or annunciator.
10. Voice signal amplifier failure.
11. Hose cabinet door open.
12. Failure of a device upon automatic testing.
13. **<Insert trouble signal-initiating devices and actions>**.

E. System General Signal Actions:

1. Identify specific device initiating the event at fire-alarm control unit, connected network control panels, off-premises network control panels, and remote annunciators.
2. Record the event on system printer.
3. After a time delay of **<Insert time delay>**, transmit a trouble or supervisory signal to the remote alarm receiving station.
4. Transmit system status to building management system.
5. Display system status at the graphic annunciator workstation.

2.4 (Future use)

A. .

1. .

2.5 FIRE-ALARM CONTROL PANEL **(Edit for Project Requirements)**

A. General Requirements for Fire-Alarm Control Panel:

1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864.
 - a. System software and programs shall be held in nonvolatile flash, electrically erasable, programmable, read-only memory, retaining the information through failure of primary and secondary power supplies.
 - b. Include a real-time clock for time annotation of events on the event recorder and printer.
 - c. Provide communication between the FACP and remote circuit interface panels, annunciators, and displays.
 - d. The FACP shall be listed for connection to a central-station signaling system service.
 - e. Provide nonvolatile memory for system database, logic, and operating system and event history. The system shall require no manual input to initialize in the event of

- a complete power down condition. The FACP shall provide a minimum 500-event history log.
- f. Spare capacity for 25% additional addressable points.
2. Addressable Initiation Device Circuits: The FACP shall indicate which communication zones have been silenced and shall provide selective silencing of alarm notification appliance by building communication zone.
 3. Addressable Control Circuits for Operation of Notification Appliances and Mechanical Equipment: The FACP shall be listed for releasing service.
- B. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.
1. Annunciator and Display: LCD type, [80] <Insert number> characters, minimum.
 2. Keypad: Arranged to permit entry and execution of programming, display, and control commands.
- C. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.
1. Annunciator and Display: LCD type, [two] [three] line(s) of [40] [80] <Insert number> characters, minimum.
 2. Keypad: Arranged to permit entry and execution of programming, display, and control commands **[and to indicate control commands to be entered into the system for control of smoke-detector sensitivity and other parameters]**.
- D. Initiating-Device, Notification-Appliance, and Signaling-Line Circuits:
1. Pathway Class Designations: NFPA 72, [Class B]
 2. Pathway Survivability: [Level 0] [Level 1] [Level 2] [Level 3].
 3. Install no more than [50] [100] [256] <Insert number> addressable devices on each signaling-line circuit.
 4. Initiating circuits and notification circuits to be designed with 25 percent spare capacity.
 5. Serial Interfaces:
 - a. One dedicated RS 485 port for [central-station] [remote station] operation using point ID DACT.
 - b. One RS 485 port for remote annunciators, Ethernet module, or multi-interface module (printer port).
 - c. One [USB] [RS 232] port for PC configuration.
 - d. One RS 232 port for voice evacuation interface.
- E. Stairwell **[and Elevator Shaft]** Pressurization: Provide an output signal using an addressable relay to start the stairwell **[and elevator shaft]** pressurization system. Signal shall remain on until alarm conditions are cleared, and fire-alarm system is reset. Signal shall not stop in response to alarm acknowledge or signal silence commands.
1. Pressurization starts when any alarm is received at fire-alarm control unit.
 2. Alarm signals from smoke detectors at pressurization air supplies have a higher priority than other alarm signals that start the system.

- F. Smoke-Alarm Verification (*Where approved by the AHJ*):
1. Initiate audible and visible indication of an "alarm-verification" signal at fire-alarm control unit.
 2. Activate an approved "alarm-verification" sequence at fire-alarm control unit and detector.
 3. Record events by the system printer.
 4. Sound general alarm if the alarm is verified.
 5. Cancel fire-alarm control unit indication and system reset if the alarm is not verified.
- G. Notification-Appliance Circuit:
1. Audible appliances shall sound in a three-pulse temporal pattern, as defined in NFPA 72.
 2. Where notification appliances provide signals to sleeping areas, the alarm signal shall be a 520-Hz square wave with an intensity 15 dB above the average ambient sound level or 5-dB above the maximum sound level, or at least 75-dBA measured at the pillow, whichever is greater.
 3. Visual alarm appliances shall flash in synchronization where multiple appliances are in the same field of view, as defined in NFPA 72.
 4. Carbon Monoxide detection shall sound in a four-pulse temporal pattern, as defined in NFPA 72.
- H. Elevator Recall:
1. Elevator recall shall be initiated only by one of the following alarm-initiating devices:
 - a. Elevator lobby detectors except the lobby detector on the designated floor.
 - b. Smoke detector in elevator machine room.
 - c. Smoke detectors in elevator hoistway.
 2. Elevator controller shall be programmed to move the cars to the alternate recall floor if lobby detectors located on the designated recall floors are activated.
 3. Water-flow alarm connected to sprinkler in an elevator shaft and elevator machine room shall shut down elevators associated with the location without time delay.
 - a. Water-flow switch associated with the sprinkler in the elevator pit may have a delay to allow elevators to move to the designated floor.
- I. Door Controls: Door hold-open devices that are controlled by smoke detectors at doors in smoke barriers and fire-rated barriers shall be connected to fire-alarm system.
- J. Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory and print out the final adjusted values on system printer.
- K. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.
- L. Voice/Alarm Signaling Service: Central emergency communication system with redundant microphones, preamplifiers, amplifiers, and tone generators provided [**in a separate cabinet located in the fire command center**] [**as a special module that is part of fire-alarm control unit**].

1. Indicate number of alarm channels for automatic, simultaneous transmission of different announcements to different zones or for manual transmission of announcements by use of the central-control microphone. Amplifiers shall comply with UL 1711.
 - a. Allow the application of, and evacuation signal to, indicated number of zones and, at the same time, allow voice paging to the other zones selectively or in any combination.
 - b. Programmable tone and message sequence selection.
 - c. Standard digitally recorded messages shall be University's standard messages and must be reviewed and approved by the University before recording. Finished voice messages shall be installed and tested prior to building occupancy and final acceptance testing of the system.
 - d. Generate tones to be sequenced with audio messages of type recommended by NFPA 72 and that are compatible with tone patterns of notification-appliance circuits of fire-alarm control unit.
 2. Status Annunciator: Indicate the status of various voice/alarm speaker zones and the status of firefighters' two-way telephone communication zones.
 3. Preamplifiers, amplifiers, and tone generators shall automatically transfer to backup units, on primary equipment failure.
- M. Printout of Events: On receipt of signal, print alarm, supervisory, and trouble events. Identify zone, device, and function. Include type of signal (alarm, supervisory, or trouble) and date and time of occurrence. Differentiate alarm signals from all other printed indications. Also print system reset event, including same information for device, location, date, and time. Commands initiate the printing of a list of existing alarm, supervisory, and trouble conditions in the system and a historical log of events.
- N. Power Requirements: The system shall support 100% of addressable devices in alarm or operated at the same time, under both primary (AC) and secondary (battery) power conditions.
- O. Primary Power: 24-V dc obtained from a dedicated 120-V ac essential power system service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, **[supervisory signals] [supervisory and digital alarm communicator transmitters] [and] [digital alarm radio transmitters]** shall be powered by 24-V dc source.
1. Size the control panel power supplies for 25 percent spare capacity of the calculated load.
 2. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.
- P. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.
1. Batteries: Rechargeable, low maintenance, sealed lead acid; Lead Calcium grid structure with immobilized electrolyte in an absorbent separator. UL 924 recognized pressure relief valves.
 2. Rated for four (4) hours operation in normal supervisory mode and then 15 minutes of alarm operation.
 3. Provide 25% spare capacity for future growth, which must be provided in addition to NFPA 72 requirements for battery decay.
- Q. Supplemental Notification and Remote User Access (Fire Panel Internet Interface).

1. Fire Alarm Control Panel (FACP) shall have the capability to provide supplemental notification and remote user access to the FACP using Ethernet and TCP/IP communications protocol compatible with IEEE Standard 802.3.
2. A standard RJ-45 Ethernet connection shall connect to the owners Ethernet network. Provisions for that connection must be provided at each fire alarm control unit as part of the contract.
3. The means of providing supplemental email and SMS text messaging notification shall be agency listed for specific interfaces and for the purpose described in this section. The use of non-listed external third-party products and interfaces is not acceptable.
4. The fire panel internet interface shall be capable of sending automated notification of discrete system events via email and SMS text messaging to up to 50 individual user accounts and via email to up to 5 distribution list.

2.6 PRE-ACTION SYSTEM

- A. Initiate Pre-signal Alarm: This function shall cause an audible and visual alarm and indication to be provided at the FACP. Activation of an initiating device connected as part of a pre-action system shall be annunciated at the FACP only, without activation of the general evacuation alarm.

2.7 MANUAL FIRE-ALARM BOXES

- A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.
 1. Double-action mechanism requiring two actions to initiate an alarm - pull up then down (breaking-glass or plastic-rod not permitted) type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
 2. Station Reset: Key- or wrench-operated switch.
 3. **[Indoor Protective Shield: Factory-fabricated, clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm. Lifting the cover actuates an integral battery-powered audible horn intended to discourage false-alarm operation.]**
 4. **[Weatherproof Protective Shield: Factory-fabricated, clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm.]**

2.8 SYSTEM SMOKE DETECTORS

- A. General Requirements for System Smoke Detectors:
 1. Comply with UL 268; operating at 24-V dc, nominal.
 2. Detectors shall be **[four] [two]**-wire type.
 3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
 4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
 5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.

6. Integral Visual-Indicating Light: LED type, indicating detector has operated and power-on status.
 7. Remote Control: Unless otherwise indicated, detectors shall be digital-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit.
 - a. Rate-of-rise temperature characteristic of combination smoke- and heat-detection units shall be selectable at fire-alarm control unit for 15 or 20 deg F (8 or 11 deg C) per minute.
 - b. Fixed-temperature sensing characteristic of combination smoke- and heat-detection units shall be independent of rate-of-rise sensing and shall be settable at fire-alarm control unit to operate at 135 or 155 deg F (57 or 68 deg C).
 - c. Multiple levels of detection sensitivity for each sensor.
 - d. Sensitivity levels based on time of day.
- B. Photoelectric Smoke Detectors:
1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
 2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - a. Primary status.
 - b. Device type.
 - c. Present average value.
 - d. Present sensitivity selected.
 - e. Sensor range (normal, dirty, etc.).
- C. Ionization Smoke Detector:
1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
 2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - a. Primary status.
 - b. Device type.
 - c. Present average value.
 - d. Present sensitivity selected.
 - e. Sensor range (normal, dirty, etc.).
- D. Duct Smoke Detectors: Photoelectric type complying with UL 268A.
1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
 2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - a. Primary status.
 - b. Device type.
 - c. Present average value.
 - d. Present sensitivity selected.
 - e. Sensor range (normal, dirty, etc.).

3. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector for smoke detection in HVAC system ducts.
4. Each sensor shall have multiple levels of detection sensitivity.
5. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
6. Relay Fan Shutdown: Fully programmable relay rated to interrupt fan motor-control circuit.
7. All concealed duct mounted smoke detectors shall be provided with a remote indicator device and test switch.

2.9 PROJECTED BEAM SMOKE DETECTORS

- A. Projected Beam Light Source and Receiver: Designed to accommodate small angular movements and continue to operate and not cause nuisance alarms.
- B. Detector Address: Accessible from fire-alarm control unit and able to identify the detector's location within the system and its sensitivity setting.
- C. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 1. Primary status.
 2. Device type.
 3. Present average value.
 4. Present sensitivity selected.
 5. Sensor range (normal, dirty, etc.).

2.10 CARBON MONOXIDE DETECTORS

- A. General: Carbon monoxide detector listed for connection to fire-alarm system.
 1. Mounting: Adapter plate for outlet box mounting.
 2. Testable by introducing test carbon monoxide into the sensing cell.
 3. Detector shall provide alarm contacts and trouble contacts.
 4. Detector shall send trouble alarm when nearing end-of-life, power supply problems, or internal faults.
 5. Comply with UL 2075.
 6. Locate, mount, and wire according to manufacturer's written instructions.
 7. Provide means for addressable connection to fire-alarm system.
 8. Test button simulates an alarm condition.

2.11 HEAT DETECTORS

- A. General Requirements for Heat Detectors: Comply with UL 521.
 1. Temperature sensors shall test for and communicate the sensitivity range of the device.
- B. Heat Detector, Combination Type: Actuated by either a fixed temperature of [**135 deg F (57 deg C)**] or a rate of rise that exceeds [**15 deg F (8 deg C)**] per minute unless otherwise indicated.

1. Mounting: **[Adapter plate for outlet box mounting] [Twist-lock base interchangeable with smoke-detector bases]**.
 2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
- C. Heat Detector, Fixed-Temperature Type: Actuated by temperature that exceeds a fixed temperature of **[190 deg F (88 deg C)/ other]**.
1. Mounting: **[Adapter plate for outlet box mounting] [Twist-lock base interchangeable with smoke-detector bases]**.
 2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

2.12 NOTIFICATION APPLIANCES

- A. General Requirements for Notification Appliances: Individually addressed, connected to a signaling-line circuit, equipped for mounting as indicated, and with screw terminals for system connections.
1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated, and with screw terminals for system connections.
 2. Finishes: Fire Alarm Systems: RED, Mass Notification Systems: WHITE.
- B. Chimes, Low-Level Output: Vibrating type, 75-dBA minimum rated output.
- C. Chimes, High-Level Output: Vibrating type, 81-dBA minimum rated output.
- D. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet (3 m) from the horn, using the coded signal prescribed in UL 464 test protocol.
- E. Visual Notification Appliances: Xenon strobe lights complying with UL 1971, with clear polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- (25-mm-) high letters on the lens.
1. Rated Light Output: (**select a or b**)
 - a. **[15] [30] [75] [110] [177]** cd.
 - b. 15/30/75/110 cd, selectable in the field.
 2. Mounting: **[Ceiling] [Wall]** mounted as indicated.
 3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
 4. Flashing shall be in a temporal pattern, synchronized with other units.
 5. Strobe Leads: Factory connected to screw terminals.
 6. Mounting Faceplate: Factory finished **red**.
- F. Voice/Tone Notification Appliances:
1. Comply with UL 1480.

2. Speakers for Voice Notification: Locate speakers for voice notification to provide the intelligibility requirements of the "Notification Appliances" and "Emergency Communications Systems" chapters in NFPA 72.
3. High-Range Units: Rated 2 to 15 W.
4. Low-Range Units: Rated 1 to 2 W.
5. Mounting: **[Flush] [semi recessed] [ceiling] [wall mounted]**.
6. Matching Transformers: Tap range matched to acoustical environment of speaker location.
7. Mounting Faceplate: Factory finished **red**.

G. Outdoor Notification Devices:

1. Shall be rated for wet locations.

H. Exit Marking Audible Notification Appliance:

1. Exit marking audible notification appliances shall meet the audibility requirements in NFPA 72.
2. Provide exit marking audible notification appliances at the entrance to all building exits.
3. Provide exit marking audible notification appliances at the entrance to areas of refuge with audible signals distinct from those used for building exit marking.

2.13 FIREFIGHTERS' TWO-WAY TELEPHONE COMMUNICATION SERVICE

A. Dedicated, two-way, supervised, telephone voice communication links between fire-alarm control panel, **[the fire command center,]** and remote firefighters' telephone stations. Supervised telephone lines shall be connected to talk circuits by controls in a control module. Provide the following:

1. Common-talk type for firefighter use only.
2. Selective-talk type for use by firefighters and fire wardens.
3. Controls to disconnect phones from talk circuits if too many phones are in use simultaneously. An indicator lamp shall flash if a phone is disconnected from the talk circuits.
4. Addressable firefighters' phone modules to monitor and control a loop of firefighter phones. Module shall be capable of differentiating between normal, off-hook, and trouble conditions.
5. Audible Pulse and Tone Generator, and High-Intensity Lamp: When a remote telephone is taken off the hook, it causes an audible signal to sound and a high-intensity lamp to flash at the **[fire-alarm control panel] [fire command center]**.
6. Selector panel controls to provide for simultaneous operation of up to six telephones in selected zones. Indicate ground faults and open or shorted telephone lines on the panel front by individual LEDs.
7. Display: digital to indicate location of caller.
8. Remote Telephone Cabinet: Flush- or surface-mounted cabinet as indicated, factory-standard red finish, with handset.
 - a. Install one-piece handset to cabinet with vandal-resistant armored cord. Silk-screened or engraved label on cabinet door, designating **["Fire Warden Phone" or] "Fire Emergency Phone."**
 - b. With "break-glass" type door access lock.

9. Remote Telephone Jack Stations: Single-gang, stainless-steel-plate mounted plug, engraved [**"Fire Warden Phone" or**] "Fire Emergency Phone."
10. Handsets: <Insert number> [**push-to-talk-type**] sets [**with noise-canceling microphone**] stored in a cabinet [**adjacent to fire-alarm control unit**] [**in the fire command center**].

2.14 FIREFIGHTERS' SMOKE-CONTROL SYSTEM

A. Initiate Smoke-Management Sequence of Operation:

1. Comply with sequence of operation as described in Division 23 Section "Sequence of Operations for HVAC DDC."
2. Fire-alarm system shall provide all interfaces and control points required to properly activate smoke-management systems.
3. The first automatic fire-alarm system initiating device serving the smoke control system which goes into alarm condition shall activate the smoke-control functions.
4. Subsequent devices going into alarm condition shall have no effect on the smoke-control mode.

B. Addressable Relay Modules:

1. Provide address-setting means on the module. Store an internal identifying code for control panel use to identify the module type.
2. Allow the control panel to switch the relay contacts on command.
3. Have a minimum of two normally open and two normally closed contacts available for field wiring.
4. Listed for controlling HVAC fan motor controllers.

2.15 MAGNETIC DOOR HOLDERS

A. Description: Units are equipped for wall or floor mounting as indicated and are complete with matching doorplate.

1. Electromagnets: Require no more than 3 W to develop 25-lbf (111-N) holding force.
2. Wall-Mounted Units: Flush mounted unless otherwise indicated.
3. Material and Finish: Match door hardware.
4. Unit shall operate from a **24Vdc** source.
5. Combination door closer/holder devices are not permitted.

2.16 WATER FLOW SWITCHES

A. Water flow switches shall be UL Listed for intended purpose; furnished mounted and adjusted under Division 23 and connected under Division 28.

2.17 SPRINKLER VALVE TAMPER SWITCHES

A. Valve tamper switches shall be UL Listed for intended purpose; furnished mounted and adjusted under Division 23 and connected by Division 26. Valve tamper switches shall be connected to the fire alarm system (**for Chicago report to Valve Supervisory Control Panel**) by way of address reporting interface device.

2.18 CAMPUS WIDE EMERGENCY COMMUNICATION SYSTEM (ECS)

- A. The local Fire Alarm System shall interface with audio input from the ECS by means of one of the following: Line level audio input (1 Volt Peak to Peak), 25v speaker circuit, and 70v speaker circuit.
- B. Local fire alarm system shall be capable of receiving multiple contact closures or network communications, at a minimum, for the following:
 - 1. Initiating multiple digital voice messages as designated per Northwestern University standards.
 - 2. Transmitting a "LIVE" voice message or a digital pre-recorded message from the Campus Wide ECS as directed by the event.
- C. In the event that the Local Building FA System has a fire event in progress and an ECS event is received from the Campus Wide System, the ECS may take precedence over the Fire Alarm event, if determined by the results of a risk assessment to be necessary and will respond by either transmitting a "live" voice or a digital pre-recorded message from the Campus Wide ECS as directed by the event.
- D. **(Where an in-building mass notification system is provided)**, 'Alert' notification appliances will illuminate during Fire/ECS events. Campus Wide System Interface to local FACP panel shall be accomplished by FCP/VCP Fire Alarm Network panels capable of one-way voice communications from the ECS to remote Campus Buildings utilizing the University LAN/WAN network infrastructure.
- E. Minimum system requirements: FCP/VCP, Fiber modem(s) – Single Mode, Internal relays (8), Amplifier. (Non-Compliant Fire Alarm panel requirements: Audio input module.)

2.19 GRAPHIC ANNUNCIATOR WORKSTATION (*optional*)

- A. **[Graphic Annunciator Workstation: PC-based, with fire-alarm annunciator software with historical logging, report generation, and a graphic interface showing all alarm points in the system. PC with operating system software, two (2) minimum 500 GB hard drives, minimum 23" digital display monitor, with wireless keyboard and mouse.]**
- B. **[Power supply: dedicated 120 V ac circuit with UPS for standby power supply. The UPS system shall be comprised of a static inverter, a battery float charger, and sealed maintenance free batteries. UPS system shall be sized to operate the central processor, CRT, printer, and all other directly connected equipment for 10 minutes upon a normal AC power failure.]**

2.20 REMOTE ANNUNCIATOR

- A. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.
 - 1. Mounting: **[Flush] [Surface]** cabinet, NEMA 250, Type 1.
- B. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

2.21 ADDRESSABLE INTERFACE DEVICE

- A. General:
1. Include address-setting means on the module.
 2. Store an internal identifying code for control panel use to identify the module type.
 3. Listed for controlling HVAC fan motor controllers.
- B. Monitor Module: Microelectronic module providing a system address for alarm-initiating devices for wired applications with normally open contacts.
- C. Integral Relay: Capable of providing a direct signal **[to elevator controller to initiate elevator recall] [to circuit-breaker shunt trip for power shutdown] <Insert functions>**.
1. Allow the control panel to switch the relay contacts on command.
 2. Have a minimum of two normally open and two normally closed contacts available for field wiring.
- D. Control Module:
1. Operate notification devices.
 2. Operate solenoids for use in sprinkler service.
 3. **<Insert other functions>**.

2.22 DIGITAL ALARM COMMUNICATOR TRANSMITTER

- A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632.
- B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically capture **[one] [two]** telephone line(s) and dial a preset number for a remote central station. When contact is made with central station(s), signals shall be transmitted. If service on either line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.
- C. Local functions and display at the digital alarm communicator transmitter shall include the following:
1. Verification that both telephone lines are available.
 2. Programming device.
 3. LED display.
 4. Manual test report function and manual transmission clear indication.
 5. Communications failure with the central station or fire-alarm control unit.
 6. **<Insert local function>**.
- D. Digital data transmission shall include the following:
1. Address of the alarm-initiating device.
 2. Address of the supervisory signal.
 3. Address of the trouble-initiating device.

4. Loss of ac supply.
5. Loss of power.
6. Low battery.
7. Abnormal test signal.
8. Communication bus failure.
9. <Insert signal to be transmitted>.

- E. Secondary Power: Integral rechargeable battery and automatic charger.
- F. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

2.23 [RADIO ALARM TRANSMITTER] (optional)

- A. [Transmitter shall comply with NFPA 1225 and 47 CFR 90.
- B. Description: Manufacturer's standard commercial product; factory assembled, wired, and tested; ready for installation and operation.
1. Packaging: A single, modular, NEMA 250, Type 1 metal enclosure with a tamper-resistant flush tumbler lock.
 2. Signal Transmission Mode and Frequency: VHF or UHF 2-W power output, coordinated with operating characteristics of the established remote alarm receiving station designated by Owner.
 3. Normal Power Input: 120-V ac.
 4. Secondary Power: Integral-sealed, rechargeable, 12-V battery and charger. Comply with NFPA 72 requirements for battery capacity; submit calculations.
 5. Antenna: Omni-directional, coaxial half-wave, dipole type with driving point impedance matched to transmitter and antenna cable output impedance. Wind-load strength of antenna and mounting hardware and supports shall withstand <Insert value mph> with a gust factor of 1.3 without failure.
 6. Antenna Cable: Coaxial cable with impedance matched to the transmitter output impedance.
 7. Antenna-Cable Connectors: Weatherproof.
 8. Alarm Interface Devices: Circuit boards, modules, and other auxiliary devices, integral to the transmitter, matching fire-alarm and other system outputs to message-generating inputs of the transmitter that produce required message transmissions.
- C. Functional Performance: Unit shall receive alarm, supervisory, or trouble signal from fire-alarm control unit or from its own internal sensors or controls and shall automatically transmit signal along with a unique code that identifies the transmitting station to the remote alarm receiving station. Transmitted messages shall correspond to standard designations for fire-reporting system to which the signal is being transmitted and shall include separately designated messages in response to the following events or conditions:
1. Transmitter Low-Battery Condition: Sent when battery voltage is below 85 percent of rated value.
 2. System Test Message: Initiated manually by a test switch within the transmitter cabinet, or automatically at an optionally preselected time, once every 24 hours, with transmission time controlled by a programmed timing device integral to transmitter controls.

3. **Transmitter Trouble Message:** Actuated by failure, in excess of one-minute duration of the transmitter normal power source, derangement of the wiring of the transmitter, or any alarm input interface circuit or device connected to it.
4. **Local Fire-Alarm-System Trouble Message:** Initiated by events or conditions that cause a trouble signal to be indicated on the building system.
5. **Local Fire-Alarm-System Alarm Message:** Actuated when the building system goes into an alarm state. Identifies device that initiated the alarm.
6. **Local Fire-Alarm-System, Supervisory-Alarm Message:** [Actuated when the building alarm system indicates a supervisory alarm] <Insert condition>.]

2.24 NETWORK COMMUNICATIONS

- A. Provide network communications for fire-alarm system according to fire-alarm manufacturer's written requirements.
- B. Provide network communications per manufacturer's written requirements and requirements in NFPA 72 and NFPA 70.
- C. Provide integration gateway using [**BACnet**] [**Modbus**] for connection to building automation system.

2.25 CITY CONNECTION (Chicago)

- A. City key disconnect switch: to disconnect the fire alarm panel from reporting any alarm or trouble condition to the city in order to test and maintain the fire alarm system.
- B. City tie trouble module: to silence and test city tie disconnect troubles.
- C. Fire Alarm trouble module: Fire Alarm Trouble Bell module used to silence and test the fire alarm trouble bell.
- D. (*Future use*).

2.26 SYSTEM PRINTER

- A. Printer shall be listed and labeled to UL 864 as an integral part of fire-alarm system.
- B. Serial RS-232, USB, or parallel communications interface.
- C. Transient protection for AC input and RS-232.

2.27 DEVICE GUARDS

- A. Description: Welded wire mesh of size and shape for the manual station, smoke detector, gong, or other device requiring protection.
 1. Factory fabricated and furnished by device manufacturer.
 2. Finish: Painted by manufacturer of color to match the protected device.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions for compliance with requirements for ventilation, temperature, humidity, and other conditions affecting performance of the Work.
 - 1. Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment and wiring are installed, before installation begins.
- B. Examine roughing-in for electrical connections to verify actual locations of connections before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 EQUIPMENT INSTALLATION

- A. Comply with NFPA 72, NFPA 101, and requirements of authorities having jurisdiction for installation and testing of fire-alarm equipment. Install all electrical wiring to comply with requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems."
 - 1. Devices placed in service before all other trades have completed cleanup shall be replaced.
 - 2. Devices installed but not yet placed in service shall be protected from construction dust, debris, dirt, moisture, and damage according to manufacturer's written storage instructions.
 - 3. Fire alarm devices shall be installed in a manner that provides accessibility for periodic maintenance or replacement of the device.
 - 4. Devices installed in square ceiling tiles must be installed in the center of the tile. For ceiling tiles of other shapes, confirm installation location with the architect and Owner.
 - 5. Addressable devices shall be provided with a label stating their unique device address and panel identifier. Labels shall be visible from floor level.

(Edit the Following to Suite Project Requirements)

- B. **[Demolition of existing equipment should begin by the fire alarm contractor disconnecting the existing circuits at the control panels, terminal cans or junction boxes as appropriate and rerouting any active circuits around the construction area utilizing the previously installed temporary wiring.]**
- C. **[Existing devices that are to be reused shall be properly mounted and installed. Mounting surfaces shall be cut and patched in accordance with Architectural Sections and be repainted in accordance with Painting Sections as necessary to match existing.]**
- D. **[Connecting to Existing Equipment: Verify that existing fire-alarm system is operational before making changes or connections.**
 - 1. **Connect new equipment to existing control panel in existing part of the building.**
 - 2. **Connect new equipment to existing monitoring equipment at the supervising station.**

3. **Expand, modify, and supplement existing control and monitoring equipment as necessary to extend existing control and monitoring functions to the new points. New components shall be capable of merging with existing configuration without degrading the performance of either system.**
 4. **If an existing fire alarm system is to be out of service for more than [4 hours (Chicago)] [8 hours (Evanston)] hours a University approved fire watch shall be provided (for impaired systems outside of a construction area complying with NFPA 241).**
 5. **In occupied buildings where an outage lasts longer than 8 hours, the fire department must be notified no later than 3 PM if a fire watch is required.]**
- E. Equipment Mounting: Install fire-alarm control unit on concrete base if required. Comply with requirements for concrete base specified in Division 3 Sections.
1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (460-mm) centers around the full perimeter of concrete base.
 2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 4. Install anchor bolts to elevations required for proper attachment to supported equipment.
- F. Install wall-mounted equipment with tops of cabinets not more than 78 inches (1980 mm) above the finished floor. Mount cabinets plumb and rigid without distortion of box. Do not attach directly to masonry walls. Attach fire-alarm control unit to the vertical surface behind the equipment on steel channels such as "Unistrut".
- G. Mount recessed equipment with fronts uniformly flush with wall finish and mating with back-box.
- H. Manual Fire-Alarm Boxes:
1. Install manual fire-alarm box in the normal path of egress within 60 inches (1520 mm) of the exit doorway.
 2. Mount manual fire-alarm box on a background of a contrasting color.
 3. The operable part of manual fire-alarm box shall be between 42 inches (1060 mm) and 48 inches (1220 mm) above floor level. All devices shall be mounted at the same height unless otherwise indicated.
- I. Smoke or Heat-Detector Spacing:
1. Comply with the "Smoke-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for smoke-detector spacing.
 2. Comply with the "Heat-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for heat-detector spacing.
 3. Smooth ceiling spacing shall not exceed [30 feet (9 m)] or manufacturer's listed spacing, whichever is greater.
 4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Annex A [or Annex B] in NFPA 72.
 5. HVAC: Locate detectors not closer than [36 inches (910 mm)] [60 inches (1520 mm)] from air-supply diffuser or return-air opening.
 6. Lighting Fixtures: Locate detectors not closer than 12 inches (300 mm) from any part of a lighting fixture and not directly above pendant mounted or indirect lighting.

- J. Install a factory supplied cover on each smoke detector that is not placed in service during construction. Cover shall remain in place except during system testing. Remove cover prior to system turnover.
- K. Duct Smoke Detectors: Detectors shall be furnished and installed as shown on mechanical drawings. Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct. Tubes more than 36 inches (9100 mm) long shall be supported at both ends.
 - 1. Do not install smoke detector in duct smoke-detector housing during construction. Install detector only during system testing and prior to system turnover.
 - 2. Provide a remote test station with test switch and indicating LED lights for each duct detector. Locate key test stations in plain view on walls or ceilings so that they can be observed and operated from a normal standing position.
- L. Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location. Do not install smoke detectors in sprinklered elevator shafts. Any fire alarm device located in the hoistway must be serviceable from outside of the hoistway (**City of Evanston requires AHJ approval to omit smoke detectors from the top of the elevator shaft**)
- M. Remote Status and Alarm Indicators: Install in a visible location near each smoke detector, sprinkler water-flow switch, and valve-tamper switch that is not readily visible from normal viewing position.
- N. Audible Alarm-Indicating Devices: Install at 96" above the finished floor or not less than 6 inches (150 mm) below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille. Install all devices at the same height unless otherwise indicated.
- O. Visual Alarm-Indicating Devices: Install at 96" above the finished floor or adjacent to each alarm bell or alarm horn and at least 6 inches (150 mm) below the ceiling. Install all devices at the same height unless otherwise indicated.
- P. Audible/Visual Alarm-Indicating Devices: Install at 96" above the finished floor or not less than 6 inches (150 mm) below the ceiling. Install devices on flush-mounted back boxes with the device-operating mechanism concealed behind a grille. Install all devices at the same height unless otherwise indicated.
- Q. Device Location-Indicating Lights: Locate in public space near the device they monitor.
- R. **[Antenna for Radio Alarm Transmitter: Mount to building structure where indicated. Use mounting arrangement and substrate connection that resists [100-mph (160-km/h)] <Insert value> wind load with a gust factor of 1.3 without damage.]**
- S. Provide wire guards on all devices in areas subject to potential abuse or incidental damage.
- T. Provide a device lock on the circuit breaker(s) serving the fire alarm system to prevent inadvertent shut-off but does not interfere with the tripping function.
- U. Attach a permanent label to the inside of the fire alarm control panel and equipment cabinets identifying the location of the panel's 120-volt electrical source. This label is in addition to any labeling required under the "Electrical Identification" Section.
- V. The date of installation shall be permanently marked on all batteries installed in the FACP or power extender panels.

- W. All keying and locks for cabinets shall comply with University Standards.
- X. A parts cabinet with a minimum of 10 percent attic stock is required to be kept on-site in the FACP room (where one is included) or as directed by the University Electric Shop.

3.3 INSTRUCTIONS

- A. Provide computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.
- B. Install framed instructions in a location visible from the FACP.

3.4 PATHWAYS

- A. All wiring shall be enclosed by EMT without exception.
- B. EMT, junction boxes, and covers shall be factory-painted red enamel.
- C. Total wiring size including insulation shall be considered when sizing conduit runs and calculating the 40 percent fill.
- D. Adequate J-boxes shall be installed to allow for wire removal or replacement.

3.5 WIRING

- A. System Wiring: Wire and cable shall be a type listed for its intended use by an approval agency acceptable to the Authority Having Jurisdiction.
- B. Fire alarm cable shall be designed to survive for two hours in burning infrastructure while being fully operational in order for safe evacuation of building occupants and support critical systems such as emergency voice-alarm communication, smoke/fire alarm systems, fireman's telephone, area-of-refuge communication systems, and visible notification appliances.
- C. Wiring shall be NEC type FPL, solid copper, fully annealed. Minimum 16 AWG. Color coded polypropylene insulation. Digital communication loops shall use twisted and shielded (100% aluminum/polyester foil, 25% overlap), low capacitance cable with stranded copper drain wire.
 - 1. Manufacturers: Allied Wire & Cable or as approved by fire alarm system vendor.
- D. "T-tapping" of intelligent (addressable) fire alarm initiating circuits is not permitted in the City of Chicago.
- E. Wiring shall be color coded as to function per University Design Standards.
- F. Wire nuts are not acceptable for joining wires. Wire terminal strips shall be used to join wires. Wire terminal strips shall be permanently mounted inside junction boxes with wires neatly bundled and arranged, wires shall be labeled with the system circuit number and area served. Junction box cover is to be labeled "splice".
- G. Comply with UL 2196.

- H. Fire alarm riser raceway shall be routed in a 2-hour rated shaft.

3.6 CONNECTIONS

- A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in "Door Hardware" Section. Connect hardware and devices to fire-alarm system.
1. Verify that hardware and devices are listed for use with installed fire-alarm system before making connections.
- B. The fire alarm control panel shall be connected to the University Campus wide central supervisory system. Requirements for this connection can be obtained from Facilities Management Operations (FMO).
- C. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 36 inches (910 mm) from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled. **(Edit for project requirements)**
1. Alarm-initiating connection to smoke-control system (smoke management) at firefighters' smoke-control system panel.
 2. Alarm-initiating connection to stairwell and elevator-shaft pressurization systems.
 3. Smoke dampers in air ducts of designated HVAC duct systems.
 4. Magnetically held-open doors.
 5. Electronically locked doors and access gates.
 6. Alarm-initiating connection to elevator recall system and components.
 7. Alarm-initiating connection to activate emergency lighting control.
 8. Alarm-initiating connection to activate emergency shutoffs for gas and fuel supplies.
 9. Supervisory connections at valve supervisory switches.
 10. Supervisory connections at low-air-pressure switch of each dry-pipe sprinkler system.
 11. Supervisory connections at elevator shunt-trip breaker.
 12. Data communication circuits for connection to building management system.
 13. Data communication circuits for connection to mass notification system.
 14. Supervisory connections at fire-extinguisher locations.
 15. Supervisory connections at fire-pump power failure including a dead-phase or phase-reversal condition.
 16. Supervisory connections at fire-pump engine control panel.
 17. Supervisory connections at engine-generator control panel.
 18. **<Insert connections>**.

3.7 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 0553 "Identification for Electrical Systems."
- B. A barcode is to be placed on the main fire alarm panel that complies with the University's standards.
- C. Labeling must be attached to the inside of the fire control panel and equipment cabinet identifying the location of that panels 120-volt electrical source.

3.8 GROUNDING

- A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.
- B. Ground shielded cables at the control panel location only. Insulate shield at device location.

3.9 SURGE PROTECTION

- A. Provide a UL listed surge protection device on all low voltage communications wiring entering or leaving the building to or from the FACP and other components.

3.10 FIELD QUALITY CONTROL

- A. Field tests shall be witnessed by **[Architect] [Engineer] [Authorities Having Jurisdiction] [Representatives of the University]**.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- C. Perform tests and inspections.
- D. Perform the following tests and inspections **[with the assistance of a factory-authorized service representative]**:
 - 1. Visual Inspection: Conduct visual inspection prior to testing.
 - a. Inspection shall be based on completed record Drawings and system documentation that is required by the "Completion Documents, Preparation" table in the "Documentation" chapter of NFPA 72.
 - b. Comply with the "Visual Inspection Frequencies" table in the "Inspection" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
 - 2. System Testing: Comply with the test method indicated in the "Testing" Table of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
 - 3. Test audible appliances e according to manufacturer's written instructions.
 - 4. Perform audible tests using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
 - 5. Test visual appliances according to manufacturer's written instructions.
 - 6. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" chapter of NFPA 72 and the "Inspection and Testing Form" in the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
- E. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances and not less than 10 percent of the initiating devices, notification appliances and controlled devices on every initiating device circuit, notification appliance circuit, and signaling line circuit, as required by NFPA 72.
- F. Fire-alarm system will be considered defective if it does not pass tests and inspections.
- G. Prepare test and inspection reports.

- H. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.
- I. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

3.11 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include **12** months' full maintenance by skilled employees of manufacturer's designated service organization. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
 - 1. Include visual inspections according to the "Visual Inspection Frequencies" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
 - 2. Perform tests in accordance with the methods and at the frequencies noted in "Testing" table of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
 - 3. Comply with Evanston Fire Department mandates for test and inspections. (Weekly, Monthly, Quarterly, Semi-annual, and Annual)
 - 4. A MS 'Excel' report shall be provided and shall include system type, location, deficiency notes & barcode information.

3.12 SOFTWARE SERVICE AGREEMENT

- A. Comply with UL 864.
- B. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two years.
- C. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.
 - 1. Upgrade Notice: At least 30 days to allow the University to schedule access to system and to upgrade computer equipment if necessary.

3.13 DEMONSTRATION AND TRAINING

- A. Engage a factory-authorized service representative to train University's maintenance personnel to adjust, operate, and maintain fire-alarm system. Provide a minimum of 8 hours training.
- B. The Contractor shall submit a proposed training agenda for the Project Manager's review within 30 days of authorization to proceed. The final, approved training agenda shall be submitted 14 days prior to the final system acceptance test.
- C. Training by the Contractor shall include all system operational functions needed by building personnel and personnel of the AHJ. This shall include, but will not be limited to:
 - 1. Alarm acknowledgment.

NORTHWESTERN UNIVERSITY
PROJECT NAME _____
JOB # _____

FOR: _____
ISSUED: 2022.2

2. Interpretation of the scheme used to provide identifiers.
 3. System reset.
 4. Basic troubleshooting.
- D. **[Tuition for two attendees from the University for Manufacturer sponsored and taught service school shall be included in the contract.]**

END OF SECTION 28 3113