

SECTION 28 46 00 - FIRE DETECTION AND ALARM

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fire alarm system design and installation, including all components, wiring, and conduit.
- B. Transmitters for communication with supervising station.

1.02 RELATED REQUIREMENTS

- A. Section 07 84 00 - Firestopping: Materials and methods for work to be performed by this installer.
- B. Designed using manufacturer's product-specific design software or based on manufacturer's pre-engineered design suitable for the application.
- C. Section 08 71 00 - Door Hardware: Electrically operated locks and door holder devices to be monitored and released by fire alarm system.
- D. Section 14 21 00 - Electric Traction Elevators: Elevator systems monitored and controlled by fire alarm system.
- E. Section 21 13 00 - Fire-Suppression Sprinkler Systems: Supervisory and alarm devices installed in sprinkler system.
- F. Section 23 33 00 - Air Duct Accessories: Smoke dampers controlled by fire alarm system.
- G. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- H. Section 26 05 33.13 - Conduit for Electrical Systems.
- I. Section 26 05 33.16 - Boxes for Electrical Systems.
- J. Section 26 05 53 - Identification for Electrical Systems.

1.03 REFERENCE STANDARDS

- A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines.
- B. ADA Standards - 2010 ADA Standards for Accessible Design.
- C. IEEE C62.41.2 - IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits.
- D. NFPA 70 - National Electrical Code.
- E. NFPA 72 - National Fire Alarm and Signaling Code.

1.04 PERFORMANCE REQUIREMENTS

- A. Manufacturer and contractor shall be responsible for the final system design per state and local AHJ, codes and ordinances. Contractor to confirm with local Fire Marshal that cellular monitoring of the fire alarm system is acceptable. Final system design subject to approval by AHJ. Bid and Contract documents are intended to show only general intent and coordination.
- B. Fire alarm signal initiation shall be by one or more of the following devices:

Sauk County Courthouse HVAC and Lighting Upgrades
Project No. 2025012

1. Manual stations.
 2. Heat detectors.
 3. Smoke detectors.
 4. Verified automatic alarm operation of smoke detectors.
 5. Automatic sprinkler system water flow.
 6. Fire extinguishing system operation.
 7. Fire standpipe system.
 8. Duct Smoke detectors shall NOT initiate alarm signal.
- C. Fire alarm signal shall initiate the following actions:
1. Alarm notification appliances shall operate continuously.
 2. Identify alarm at the FACP and remote annunciators.
 3. De-energize electromagnetic door holders.
 4. Transmit an alarm signal to the remote alarm receiving station.
 5. Unlock electric door locks in designated egress paths.
 6. Release fire and smoke doors held open by magnetic door holders.
 7. Activate voice/alarm communication system.
 8. Close smoke dampers in air ducts of system serving zone where alarm was initiated.
 9. Recall elevator. Send signal to turn off elevator power after cab has been recalled.
 10. Record events in the system memory.
- D. Supervisory signal initiation shall be by one or more of the following devices or actions:
1. Operation of a fire-protection system valve tamper.
 2. Activation of AHU shutdown by duct smoke detector. Send signal to shut down respective AHU.
- E. System trouble signal initiation shall be by one or more of the following devices or actions:
1. Open circuits, shorts and grounds of wiring for initiating device, signaling line, and notification-appliance circuits.
 2. Opening, tampering, or removal of alarm-initiating and supervisory signal-initiating devices.
 3. Loss of primary power at the FACP.
 4. Ground or a single break in FACP internal circuits.
 5. Abnormal ac voltage at the FACP.
 6. A break in standby battery circuitry.
 7. Failure of battery charging.
 8. Abnormal position of any switch at the FACP or annunciator.
- F. System Trouble and Supervisory Signal Actions: Ring trouble bell and annunciate at the FACP and remote annunciators.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Proposal Documents: Submit the following with cost/time proposal:
 - 1. NFPA 72 "Record of Completion", filled out to the extent known at the time.
 - 2. Manufacturer's detailed data sheet for each control unit, initiating device, and notification appliance.
 - 3. Certification by Contractor that the system design will comply with Contract Documents.
- C. Evidence of designer qualifications.
- D. Shop Drawings: Submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, riser diagrams, and description of operation:
 - 1. Copy (if any) of list of data required by authority having jurisdiction.
 - 2. NFPA 72 "Record of Completion", filled out to the extent known at the time.
 - 3. Clear and concise description of operation, with input/output matrix similar to that shown in NFPA 72 Appendix A-7-5-2.2(9), and complete listing of software required.
 - 4. System zone boundaries and interfaces to fire safety systems.
 - 5. Location of all components, circuits, and raceways; mark components with identifiers used in control unit programming.
 - 6. Circuit layouts; number, size, and type of raceways and conductors; conduit fill calculations; spare capacity calculations; notification appliance circuit voltage drop calculations.
 - 7. List of all devices on each signaling line circuit, with spare capacity indicated.
 - 8. Manufacturer's detailed data sheet for each component, including wiring diagrams, installation instructions, and circuit length limitations.
 - 9. Description of power supplies; battery calculations demonstrating adequate battery power.
 - 10. Detailed drawing of graphic annunciator(s).
 - 11. Certification by either the manufacturer of the control unit or by the manufacturer of each other component that the components are compatible with the control unit.
 - 12. Certification by the manufacturer of the control unit that the system design complies with Contract Documents.
 - 13. Certification by Contractor that the system design complies with Contract Documents.
 - 14. Submit Shop Drawings to AHJ for review and approval. Submittal to AHJ to be done in a timely fashion. Do not start fire alarm system construction until approval is received from AHJ.
- E. Evidence of installer qualifications.
- F. Evidence of instructor qualifications; training lesson plan outline.
- G. Inspection and Test Reports:

1. Submit inspection and test plan prior to closeout demonstration.
 2. Submit documentation of satisfactory inspections and tests.
 3. Submit NFPA 72 "Inspection and Test Form," filled out.
- H. Operating and Maintenance Data: See Section 01 78 00 for additional requirements; revise and resubmit until acceptable; have one set available during closeout demonstration:
1. Complete set of shop drawings, as approved by authority having jurisdiction.
 2. Additional printed set of project record documents and closeout documents, bound or filed in same manuals.
 3. Contact information for firm that will be providing warranty service.
 4. List of recommended spare parts, tools, and instruments for testing.
 5. Replacement parts list with current prices, and source of supply.
 6. Detailed troubleshooting guide and large scale input/output matrix.
 7. Preventive maintenance, inspection, and testing schedule complying with NFPA 72; provide printed copy and computer format acceptable to Owner.
 8. Detailed but easy to read explanation of procedures to be taken by non-technical administrative personnel in the event of system trouble, when routine testing is being conducted, for fire drills, and when entering into contracts for remodeling.
- I. Project Record Documents: See Section 01 78 00 for additional requirements; have one set available during closeout demonstration:
1. Complete set of floor plans showing actual installed locations of components, conduit, and zones.
 2. "As installed" wiring and schematic diagrams, with final terminal identifications.
 3. "As programmed" operating sequences, including control events by device, updated input/output chart, and voice messages by event.
- J. Closeout Documents:
1. Certification by manufacturer that the system has been installed in compliance with manufacturer's installation requirements, is complete, and is in satisfactory operating condition.
 2. NFPA 72 "Record of Completion", filled out completely and signed by installer and authorized representative of authority having jurisdiction.
- K. Maintenance Materials, Tools, and Software: Furnish the following for Owner's use in maintenance of project.
1. See Section 01 60 00 - Product Requirements, for additional provisions.
 2. Furnish spare parts of same manufacturer and model as those installed; deliver in original packaging, labeled in same manner as in operating and maintenance data and place in spare parts cabinet.
 3. In addition to the items in quantities indicated in PART 2, furnish the following:

- a. All tools, software, and documentation necessary to modify the fire alarm system using Owner's personnel; minimum modification capability to include addition and deletion of devices, circuits, and zones, and changes to system description, operation, and evacuation and instructional messages.
- b. One copy, on CD-ROM, of all software not resident in read-only-memory.

1.06 QUALITY ASSURANCE

- A. Copies of Design Criteria Documents: Maintain at the project site for the duration of the project, bound together, an original copy of NFPA 72, the relevant portions of applicable codes, and instructions and guidelines of authorities having jurisdiction; deliver to Owner upon completion.
- B. Designer Qualifications: NICET Level III or IV (3 or 4) certified fire alarm technician or registered fire protection engineer, employed by fire alarm control panel manufacturer, Contractor, or installer, with experience designing fire alarm systems in the jurisdictional area of the authorities having jurisdiction.
- C. Installer Qualifications: Firm with minimum 3 years documented experience installing fire alarm systems of the specified type and providing contract maintenance service as a regular part of their business.
 1. Authorized representative of control unit manufacturer; submit manufacturer's certification that installer is authorized; include name and title of manufacturer's representative making certification.
 2. Installer Personnel: At least 2 years of experience installing fire alarm systems.
 3. Supervisor: NICET level III or IV (3 or 4) certified fire alarm technician; furnish name and address.
 4. Warranty maintenance office located within 50 miles of project site.
 5. Certified in the State in which the Project is located as fire alarm installer.
- D. Instructor Qualifications: Experienced in technical instruction, understanding fire alarm theory, and able to provide the required training; trained by fire alarm control unit manufacturer.
- E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Provide control panel manufacturer's warranty that system components other than wire and conduit are free from defects and will remain so for 1 year after date of Substantial Completion.
- C. At the end of the project, the Contractor shall post the warranty period along with the company's name and telephone number inside the fire alarm panel.

- D. Any occupied facility shall not be without a UL and an NFPA approved and fully operational fire alarm system for a period longer than two (2) hours. Emergency response shall be provided within two (2) hours of the notification, to the contractor, of the failure of the system to perform operationally per UL and NFPA standards. Non-emergency service calls shall be responded to within twenty-four (24) hours of the notification to the contractor.
- E. Emergency situations may include, but not limited to:
 - 1. System can't be acknowledged or reset
 - 2. System is non-responsive to commands
 - 3. System in non-responsive to actuated alarm devices
 - 4. Malfunction of notification/initiating circuit(s)
 - 5. System going into alarm/trouble without indicating the source
 - 6. System is dead (no power), etc.
- F. Repairs and/or replacement arising from emergency situations shall be completed within twenty-four (24) hours of the time of notification. Other than emergency, actual repairs and /or replacement shall be provided within seventy-two (72) hours of the time of notification during normal working hours, Monday through Friday, excluding holidays. If the repairs involve parts that are not shelf items and require lead time, the contractor shall inform the Owner within twenty-four (24) hours from the time of notification of the exact time when the repairs will be completed.
- G. If repair and/or replacement cannot be made within the prescribed time, then other means and methods of protection shall be provided to ensure the safety of the building's occupants during which time the system is not in compliance with the standards. This may involve up to and include hiring Owner approved qualified personnel to stand a fire watch, all at the contractor's expense.
- H. Warranty service for the equipment shall be provided by the system supplier's factory trained representative. Further, Warranty shall include all parts, labor and necessary travel.

1.08 EXTRA MATERIALS

- A. Provide the extra materials to the Owner at the completion of the project:
 - 1. Two (2) fire alarm cabinet keys.
 - 2. Two (2) manual pull station reset keys.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Fire Alarm Control Units and Accessories:
 - 1. Honeywell Security & Fire Solutions/Fire-Lite: www.firelite.com/#sle.
 - 2. Simplex, a brand of Johnson Controls: www.simplex-fire.com/#sle.
- B. Initiating Devices and Notification Appliances:

1. Honeywell Security & Fire Solutions/Fire-Lite; _____: www.firelite.com/#sle.
2. Same manufacturer as control units.

2.02 FIRE ALARM SYSTEM

- A. Fire Alarm System: Provide a new addressable / intelligent voice fire detection and alarm system:
 1. Provide all components necessary for a complete and functioning system.
 2. Protected Premises: Entire building shown on drawings.
 3. Comply with the following; where requirements conflict, order of precedence of requirements is as listed:
 - a. ADA Standards.
 - b. The requirements of the State Fire Marshal.
 - c. The requirements of the local authority having jurisdiction .
 - d. Applicable local codes.
 - e. Contract Documents (drawings and specifications).
 - f. NFPA 72; where the word "should" is used consider that provision mandatory; where conflicts between requirements require deviation from NFPA 72, identify deviations clearly on design documents.
 4. Evacuation Alarm: general audible (voice) and visual notification of entire premises.
 5. Fire Alarm Control Panel: New, located as shown on the Drawings.
 6. Do not combine fire alarm system with other non-fire systems.
- B. Supervising Stations and Fire Department Connections:
 1. Public Fire Department Notification: By on-premises supervising station.
- C. Circuits:
 1. Initiating Device Circuits (IDC): Class B, Style A.
 2. Signaling Line Circuits (SLC) Within Single Building: Class B, Style 0.5.
 3. Notification Appliance Circuits (NAC): Class B, Style W.
- D. Spare Capacity:
 1. Initiating Device Circuits: Minimum 25 percent spare capacity.
 2. Notification Appliance Circuits: Minimum 25 percent spare capacity.
 3. Speaker Amplifiers: Minimum 25 percent spare capacity.
 4. Fire Alarm Control Units: Capable of handling all circuits utilized to capacity without requiring additional components other than plug-in control modules.
- E. Power Sources:
 1. Primary: Dedicated branch circuits of the facility power distribution system.
 2. Secondary: Storage batteries.
 3. Capacity: Sufficient to operate entire system for period specified by NFPA 72.

2.03 FIRE SAFETY SYSTEMS INTERFACES

- A. Supervision: Provide supervisory signals in accordance with NFPA 72 for the following:
 - 1. Sprinkler water control valves.
 - 2. Dry-pipe sprinkler system pressure.
 - 3. Dry-pipe sprinkler valve room low temperature.
 - 4. Elevator shut-down control circuits.
- B. Alarm: Provide alarm initiation in accordance with NFPA 72 for the following:
 - 1. Sprinkler water flow.
 - 2. Elevator lobby, elevator hoistway, and elevator machine room smoke detectors.
- C. Elevators:
 - 1. Elevator lobby, hoistway, and elevator control room smoke detectors: Elevator recall for fire fighters' service.
 - 2. Elevator Control Room Heat Detector: Shut down elevator power prior to hoistway sprinkler activation.
 - 3. Elevator Hoistway Heat Detector(s): Shut down elevator power prior to hoistway sprinkler activation.
 - 4. Sprinkler pressure or waterflow: Shut down elevator power prior to hoistway sprinkler activation.
- D. HVAC:
 - 1. Duct Smoke Detectors: Close dampers indicated; shut down air handlers indicated.
- E. Doors:
 - 1. Smoke Barrier Door Magnetic Holders: Release upon activation of smoke detectors in smoke zone on either side of door, upon alarm from manual pull station on same floor, and upon sprinkler activation on same floor. Refer to Section 08 71 00.
 - 2. Electromagnetic Door Locks on Egress Doors: Unlock upon activation of any alarm initiating device or suppression system in smoke zone that doors serve as egress from. Refer to Section 08 71 00.

2.04 COMPONENTS

- A. General:
 - 1. Provide flush mounted units where installed in finish areas; in unfinished areas, surface mounted units are acceptable.
 - 2. Provide legible, permanent labels for each control device, using identification used in operation and maintenance data.
- B. Main Fire Alarm Control Panel:
 - 1. General Description:
 - a. Modular, power-limited design with electronic modules, UL 864 listed.

- b. Addressable initiation devices that communicate device identity and status.
 - 1) Smoke sensors shall additionally communicate sensitivity setting and allow for adjustment of sensitivity at the FACP.
 - 2) Temperature sensors shall additionally test for and communicate the sensitivity range of the device.
 - c. Addressable control circuits for operation of mechanical equipment.
 - d. Actuation of alarm notification appliances, emergency voice communications, annunciation, smoke control, and elevator recall shall occur within 10 seconds after the activation of an initiating device.
2. Alphanumeric Display and System Controls: Arranged for interface between human operator at the FACP and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.
- a. Annunciator and Display: Liquid-crystal type,
 - b. 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.
3. Circuits:
- a. Signaling Line Circuits: Style and Class as required by the AHJ and codes for the building occupancy and construction type.
 - b. Notification Appliance Circuits: Style and Class as required by the AHJ and codes for the building occupancy and construction type.
 - c. Electrical monitoring for the integrity of wiring external to the FACP for mechanical equipment shutdown and magnetic door-holding circuits is not required, provided a break in the circuit will cause doors to close and mechanical equipment to shut down.
4. Smoke-Alarm Verification:
- a. Initiate audible and visible indication of an "alarm verification" signal at the FACP.
 - b. Activate a listed and approved "alarm verification" sequence at the FACP and the detector.
 - c. Sound general alarm if the alarm is verified.
 - d. Cancel FACP indication and system reset if the alarm is not verified.
5. Transmission to Remote Alarm Receiving Station:
- a. Automatically transmit alarm, trouble, and supervisory signals to a remote alarm station through a cellular digital alarm communicator transmitter.
6. Notification-Appliance Circuit: Operation shall sound in a temporal pattern, complying with ANSI S3.41.
7. Walk Test:

- a. A test mode to allow one person to test alarm and supervisory features of initiating devices.
 - b. Enabling of this mode shall require the entry of a password.
 - c. The FACP and annunciators shall display a test indication while the test is underway.
 - d. If testing ceases while in walk-test mode, after a preset delay, the system shall automatically return to normal.
- 8. Remote Smoke-Detector Sensitivity Adjustment:
 - a. Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and control of changes in those settings.
 - b. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups.
 - c. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory.
- 9. Transmission to Remote Alarm Receiving Station:
 - a. Automatically transmit alarm, trouble, and supervisory signals to a remote alarm station through a digital alarm communicator transmitter and telephone lines.
- 10. Voice/Alarm Signaling Service:
 - a. A central emergency communication system with redundant microphones, preamplifiers, amplifiers, and tone generators provided as a special module that is part of the FACP.
 - 1) 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.
 - 2) Programmable tone and message sequence selection.
 - 3) Standard digitally recorded messages for "Evacuation" and "All Clear."
 - 4) Generate tones to be sequenced with audio messages of the type recommended by NFPA 72 and that are compatible with tone patterns of the notification-appliance circuits of the FACP.
- 11. Status Annunciator:
 - a. Indicate the status of voice/alarm speaker and the status of one-way all call communication system.
- 12. Primary Power:
 - a. 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signal, supervisory and digital alarm communicator transmitter shall be powered by the 24-V dc source.

- b. The alarm current draw of the entire fire alarm system shall not exceed 80 percent of the power-supply module rating.
 - c. Power supply shall have a dedicated fused safety switch for this connection at the service entrance equipment. Paint the switch box red and identify it with "FIRE ALARM SYSTEM POWER."
- 13. Secondary Power: 24-V dc supply system with batteries and automatic battery charger and an automatic transfer switch.
 - a. Batteries: Sealed lead calcium.
 - b. Battery and Charger Capacity: Comply with NFPA 72.
- 14. Surge Protection:
 - a. Install surge protection on normal ac power for the FACP and its accessories.
 - b. Install surge protectors recommended by FACP manufacturer.
- 15. Instructions:
 - a. Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame.
 - b. Include interpretation and describe appropriate response for displays and signals.
 - c. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.
- C. Remote Annunciator(s):
 - 1. Description:
 - a. Duplicate annunciator monitoring and control functions of the FACP for alarm, supervisory, and trouble indications. Also duplicate manual switching functions of the FACP, including acknowledging, silencing, resetting, and testing.
 - b. Voice paging handset.
 - c. Mounting: Flush cabinet, NEMA 250, Class 1.
 - 2. Display Type and Functional Performance:
 - a. Alphanumeric display same as the FACP. Controls with associated LEDs permit acknowledging, silencing, resetting, and testing functions for alarm, supervisory, and trouble signals identical to those in the FACP.
- D. Addressable Modules:
 - 1. Provide addressable modules suitable for connection to fire alarm control unit signaling line circuits.
 - 2. Unless otherwise indicated, use addressable modules only in clean, dry, indoor, nonhazardous locations.
 - 3. Monitor Modules: Unless devices are explicitly permitted to be connected together as zone, provide separate addressable monitor module for each conventional dry-contact input device in order to be individually identifiable by addressable fire alarm control unit.

4. Control Modules: Provide as indicated or as required for selective control of notification appliances.
 5. Relay Modules: Provide as indicated or as required to perform necessary functions via dry-contact interface. Where load exceeds module contact rating, provide accessory power isolation relays suitable for load as required.
 6. Signaling Line Circuit (SLC) Isolating Modules: Provide as indicated or as required to automatically isolate short circuits on connected sections of SLC loops and allow other sections to continue to function normally. Provide automatic reset upon correction of short circuit.
- E. Initiating Devices:
1. Manual Fire Alarm Boxes
 - a. Description: UL 38 listed; finished in red with molded, raised-letter operating instructions in contrasting color. Station shall show visible indication of operation. 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-lever type. With integral addressable module, arranged to communicate manual-station status (normal, alarm, or trouble) to the FACP.
 - 2) Station Reset: Key- or wrench-operated switch.
 2. Fire Alarm System Detectors:
 - a. General Description:
 - 1) UL 268 listed, operating at 24-V dc, nominal.
 - 2) Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.
 - 3) Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.
 - 4) Plug-in Arrangement: Detector and associated electronic components shall be mounted in a plug-in module that connects to a fixed base. Provide terminals in the fixed base for connection of 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 the FACP for calibration, sensitivity, and alarm condition, and individually adjustable for sensitivity from the FACP.

- a) Rate-of-rise temperature characteristic shall be selectable at the FACP for 15 or 20 deg per minute.
 - b) Fixed-temperature sensing shall be independent of rate-of-rise sensing and shall be settable at the FACP to operate at 135 or 155 deg F.
 - c) Provide multiple levels of detection sensitivity for each sensor.
 - b. Photoelectric Smoke Detectors:
 - 1) Sensor: LED or infrared light source with matching silicon-cell receiver.
 - 2) Detector Sensitivity: Between 2.5 and 3.5 percent/foot smoke obscuration when tested according to UL 268A.
 - c. Duct Smoke Detectors:
 - 1) Photoelectric Smoke Detectors:
 - a) Sensor: LED or infrared light source with matching silicon-cell receiver.
 - b) Detector Sensitivity: Between 2.5 and 3.5 percent/foot smoke obscuration when tested according to UL 268A.
 - 2) UL 268A listed, operating at 24-V dc, nominal.
 - 3) Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.
 - 4) Plug-in Arrangement: Detector and associated electronic components shall be mounted in a plug-in module that connects to a fixed base. The fixed base shall be designed for mounting directly to the air duct. Provide terminals in the fixed base for connection to building wiring.
 - 5) Self-Restoring: Detectors shall 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. Provide remote status and alarm indicator and test station.
 - 7) Remote Control: Unless otherwise indicated, detectors shall be analog-addressable type, individually monitored at the FACP for calibration, sensitivity, and alarm condition, and individually adjustable for sensitivity from the FACP.
 - 8) Each sensor shall have multiple levels of detection sensitivity.
 - 9) Sampling Tubes: Design and dimensions as recommended by manufacturer for the specific duct size, air velocity, and installation conditions where applied.
 - 10) Remote test/indicator station:
 - a) Keyed test switch with LED indicators.
- 3. Heat Detectors:

- a. Elevator hoistway, elevator control room; fixed temperature sensor. Lower temperature actuation than adjacent fire protection sprinkler head temperature.
 - b. Rate-of-rise temperature sensor. Lower temperature actuation than adjacent fire protection sprinkler head temperature.
- F. Notification Appliances:
- 1. Description: Equipped for mounting as indicated and with screw terminals for system connections.
 - a. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly.
 - 2. Voice/Tone Speakers:
 - a. UL 1480 listed.
 - b. Mounting: Flush, semi-recessed, or surface mounted; bidirectional as indicated.
 - c. Matching Transformers: Tap range matched to the acoustical environment of the speaker location.
 - d. Finish: as selected by the Architect.
 - e. Fire alarm speakers shall be labeled "FIRE".
 - f. Vandal resistant metal or Lexan housing or grills.
 - g. Sealed backs to protect the phenolic impregnated cone.
 - h. Field adjustable output taps ranging from 1/4 watt to 2 watts.
 - i. Speakers selected for this project shall produce a Sound Pressure Level, at the 1 watt tap of at least 82 dBA at 10 feet – as tested per UL Standard 1480.
 - 3. Strobes:
 - a. ALL strobes, and the strobe portion of audible/strobe combination units, shall be of the Xenon type.
 - b. Rated Light Output: as noted on the drawings unless a higher rating is .
 - c. Fire alarm strobes shall have clear lenses and labeled "FIRE".
 - d. Designed for synchronized flash operation at one flash per second (1 Hz) minimum over the device's listed input voltage range. Strobes shall be synchronized such that all strobe units within the building shall flash simultaneously (As a minimum, all devices on each floor shall flash simultaneously, with flash timing within the limits established by current UL standards.).
 - e. Synchronized such that all strobe units within the building shall flash simultaneously
 - 1) As a minimum, all devices on each floor shall flash simultaneously, with flash timing within the limits established by current UL standards.
 - 4. Exterior horn/strobe:
 - a. Weatherproof
 - b. Locate above the sprinkler system Siamese connection.

- c. Strobe per requirements above.
 - d. Horn
 - 1) Configured for either temporal three output or steady output.
 - 2) Produce a sound-pressure level of 90 dBA measured 10 feet from the horn with a multiple-frequency tone.
 - 3) Selectable high or low dB output with a reduction of approximately 6 dBA.
 - 4) Fire alarm horns shall be labeled "FIRE".
 - e. Coordinate required color with Architect.
- G. Cellular Digital Alarm Communicator Transmitter
- 1. Listed and labeled according to UL 632.
 - 2. Secondary Power: Integral rechargeable battery and automatic charger. Battery capacity is adequate to comply with NFPA 72 requirements.
 - 3. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.
 - 4. Contractor to confirm that the proposed cellular digital transmitter is compatible with the monitoring company selected by the Owner.
- H. Power/Audio Booster panels
- 1. Where they are used, "NAC Power Booster Panels" shall be individually supervised. Interconnecting NAC Booster Panels in a manner, which prevents identification of individual panel TROUBLE conditions, shall not be approved.
 - 2. Secondary Power: Integral rechargeable battery and automatic charger. Battery capacity is adequate to comply with NFPA 72 requirements.
- I. Digital Alarm Communicator Transmitter
- 1. Listed and labeled according to UL 632.
 - 2. Functional Performance
 - a. Unit receives an alarm, supervisory, or trouble signal from the FACP, and automatically captures one or two telephone lines and dials a preset number for a remote central station. When contact is made with the central station(s), the signal is transmitted. The unit supervises up to two telephone lines. Where supervising 2 lines, if service on either line is interrupted for longer than 45 seconds, the unit initiates a local trouble signal and transmits a signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. When telephone service is restored, unit automatically reports that event to the central station. If service is lost on both telephone lines, the local trouble signal is initiated.
 - 3. Secondary Power: Integral rechargeable battery and automatic charger. Battery capacity is adequate to comply with NFPA 72 requirements.

- 4. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.
- J. Circuit Conductors: Copper or optical fiber; provide 200 feet extra; color code and label.
- K. Surge Protection: In accordance with IEEE C62.41.2 category B combination waveform and NFPA 70; except for optical fiber conductors.
 - 1. Equipment Connected to Alternating Current Circuits: Maximum let through voltage of 350 V(ac), line-to-neutral, and 350 V(ac), line-to-line; do not use fuses.
 - 2. Initiating Device Circuits, Notification Appliance Circuits, and Communications Circuits: Provide surge protection at each point where circuit exits or enters a building; rated to protect applicable equipment; for 24 V(dc) maximum dc clamping voltage of 36 V(dc), line-to-ground, and 72 V(dc), line-to-line.
 - 3. Signaling Line Circuits: Provide surge protection at each point where circuit exits or enters a building, rated to protect applicable equipment.
- L. Locks and Keys: Deliver keys to Owner.
 - 1. Provide the same standard lock and key for each key operated switch and lockable panel and cabinet; provide 5 keys of each type
- M. Storage Cabinet for System Record Documents: Steel with baked enamel finish, size appropriate for record documents.
 - 1. Desk type door held open at 90 degrees for use as a working surface. Stainless steel piano hinge.
 - 2. Two key ring hooks to hold system keys, accommodations for 8 1/2" x 11" manuals and document records, and area for business cards for key contact personnel.
 - 3. Access door shall be locked with a 3/4" barrel lock.
 - 4. RED Finish with 1" high lettering "SYSTEM RECORD DOCUMENTS" with white indelible ink.
 - 5. Locate as directed by Owner.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with applicable codes, NFPA 72, NFPA 70, and the approved shop drawings.
- B. Install all wiring in conduit.
- C. Connect the FACP and NAC Booster Panels to dedicated Emergency Power Branch Circuits where available.
- D. Conceal all wiring, conduit, boxes, and supports where installed in finished areas.
- E. Install instruction cards and labels.
- F. Duct detectors:

1. Duct smoke detector installation to be by this contractor and should be installed in the locations shown on the mechanical and electrical plans. Ensure that the duct smoke detectors are in serviceable locations. Consult with the mechanical designer for alternate locations if these are shown in non-serviceable locations. When locations on mechanical plans are not available, install in locations called for that provide accessibility for service. For duct smoke detectors that are associated with shaft smoke dampers, ensure the sampling tubes protruding into the duct are located within five feet of the smoke damper and there are no air inlets or outlets between the sampling tubes and the damper. Do not install within four feet of a fan discharge.
 2. Install Remote Test/Indicator Stations as shown on drawings. Where location not shown on drawings, locate in accessible location near the respective duct detector.
- G. Addressable Modules:
1. Install fire alarm addressable modules within 3 feet of the device controlled or monitored.
- H. Initiating Device Protection:
1. Install dust protection covers on all initiating devices until project area is free from construction dust.
 2. Ensure that all dust protection covers are removed at project completion.
- I. Indicating appliances:
1. Where ceiling mounted type indicating appliances are installed in areas without a ceiling, pendant mount the bottom of the indicating appliance at the same level as the bottom of the adjacent light fixtures.
 2. Exterior horn/light: coordinate with the fire protection contractor that a separate exterior bell is not installed over the Siamese connection as the fire alarm system horn/strobe will be installed in that location.
- J. Power/audio Booster Panels
1. If NAC Booster Panels are needed at locations other than those identified on the construction drawings, the Electrical Contractor shall obtain approval for their proposed installation locations. At such locations, the EC shall provide any required circuit breakers, associated power wiring, and local smoke detection at the approved location. Power shall be obtained from the nearest available emergency panel. The cost of such equipment and installation shall be included within the base Electrical Bid.
 2. Provide smoke detection at all proposed NAC booster panels and fire alarm audio amplifiers.
- K. Elevators:
1. Install heat detectors within 2 feet of sprinkler heads in elevator hoistways and elevator control rooms.
 2. Install smoke detectors at elevator landings, top of hoistway and in elevator control room.

3.02 INSPECTION AND TESTING FOR COMPLETION

- A. Notify Owner 7 days prior to beginning completion inspections and tests.
- B. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.
- C. Provide the services of the installer's supervisor or person with equivalent qualifications to supervise inspection and testing, correction, and adjustments.
- D. Prepare for testing by ensuring that all work is complete and correct; perform preliminary tests as required.
- E. Provide all tools, software, and supplies required to accomplish inspection and testing.
- F. Perform inspection and testing in accordance with NFPA 72 and requirements of local authorities; document each inspection and test.
- G. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

3.03 OWNER PERSONNEL INSTRUCTION

- A. Provide the following instruction to designated Owner personnel:
 - 1. Hands-On Instruction: On-site, using operational system.
- B. Basic Operation: One 2-hour session for attendant personnel, security officers, and engineering staff; combination of classroom and hands-on:
 - 1. Initial Training: 1 session pre-closeout.
- C. Detailed Operation: One 2-hour session for Owner facility personnel.
 - 1. Initial Training: 1 session pre-closeout.
 - 2. Set day/time of training in writing with Owner at least 2 weeks in advance of the training session.
- D. Furnish the services of instructors and teaching aids; have copies of operation and maintenance data available during instruction.

3.04 CLOSEOUT

- A. Closeout Demonstration: Demonstrate proper operation of all functions to Owner.
 - 1. Be prepared to conduct any of the required tests.
 - 2. Have at least one copy of operation and maintenance data, preliminary copy of project record drawings, input/output matrix, and operator instruction chart(s) available during demonstration.
 - 3. Have authorized technical representative of control unit manufacturer present during demonstration.
 - 4. Demonstration may be combined with inspection and testing required by authority having jurisdiction; notify authority having jurisdiction in time to schedule demonstration.

5. Repeat demonstration until successful.

END OF SECTION

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