

## SECTION 28 30 00

### FIRE 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.

##### 1.2 SUMMARY

- A. Section Includes:
  - 1. This specification describes additions to an existing addressable fire detection and alarm signaling system.
  - 2. The system shall be in full compliance with National and Local Codes.
  - 3. The system shall include all required hardware, raceways, interconnecting wiring and software to accomplish the requirements of this specification and the contract drawings, whether or not specifically itemized herein.
  - 4. All equipment furnished shall be new and the latest state of the art products of a single manufacturer, engaged in the manufacturing and sale of analog fire detection devices for over ten years.
  - 5. The system as specified shall be supplied, installed, tested and approved by the local Authority Having Jurisdiction, and turned over to the owner in an operational condition.
  - 6. The installing contractor shall contract with a single supplier for fire alarm equipment, engineering, programming, inspection and tests, and shall be capable of providing a "UL Listing Certificate" for the complete system.

##### 1.3 DEFINITIONS

- A. ASME: American Society of Mechanical Engineers.
- B. FACP: Fire Alarm Control Panel.
- C. FM: FM Global (Factory Mutual).
- D. Furnish: To supply the stated equipment or materials.
- E. Install: To set in position and connect or adjust for use.
- F. LED: Light-emitting diode.
- G. NCC: Network Command Center.

- H. NFPA: National Fire Protection Association: Definitions in NFPA 72 apply to fire alarm terms used in this Section.
- I. NICET: National Institute for Certification in Engineering Technologies.
- J. Provide: To furnish and install the stated equipment or materials.
- K. UL: Underwriters Laboratories.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
  - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
  - 3. Complete manufacturer's catalog data including supervisory power usage, alarm power usage, physical dimensions, and finish and mounting requirements.
- B. Power calculations. Battery capacity calculations. Battery size shall be a minimum of 125% of the calculated requirement. Provide the following supporting information:
  - 1. Supervisory power requirements for all equipment.
  - 2. Alarm power requirements for all equipment.
  - 3. Power supply rating justification showing power requirements for each of the system power supplies. Power supplies shall be sized to furnish the total connected load in a worst-case condition plus 25% spare capacity.
  - 4. Voltage drop calculations for wiring runs demonstrating worst-case condition.
  - 5. NAC circuit design shall incorporate a 15% spare capacity for future expansion.
- C. General Submittal Requirements:
  - 1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Engineer.
  - 2. Shop Drawings shall be prepared by persons with the following qualifications:
    - a. Trained and certified by manufacturer in fire-alarm system design.
    - b. NICET-certified, fire-alarm technician; Level III minimum.
    - c. Licensed or certified by authorities having jurisdiction.
- D. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
  - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 2. Wiring Diagrams: For power, signal, and control wiring.
  - 3. Complete drawings covering the following:
    - a. Floor plans in a CAD compatible format at a scale of 1/8"=1'-0" showing all equipment and raceways, marked for size, conductor count with type and size, showing the percentage of allowable National Electric Code fill used.
    - b. Provide a fire alarm system function matrix as referenced by NFPA 72, Figure A-7-5.2.2 (9). Matrix shall illustrate alarm input/out events in association with initiation devices. Matrix summary shall include system

- supervisory and trouble output functions. Include any and all departures, exceptions, variances or substitutions from these specifications and/or drawings at time of bid.
  - 4. Installation drawings shop drawings, and as-built drawings shall be prepared by an individual experienced with the work specified herein.
- E. Qualification Data: For Installer.
- F. Source quality-control reports.
- G. Field quality-control reports.
- H. Operation and Maintenance Data: For all fire alarm equipment, to include in operation and maintenance manuals.
- I. Software and Firmware Operational Documentation:
  - 1. Software operating and upgrade manuals.
  - 2. Program Software Backup: On magnetic media or compact disk, complete with data files.
  - 3. Device address list.
  - 4. Printout of software application and graphic screens.

## 1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: The publications listed below form a part of this publication to the extent referenced. The publications are referenced in the text by the basic designation only. The latest version of each listed publication shall be used as a guide unless the authority having jurisdiction has adopted an earlier version.
  - 1. FM Global (Factory Mutual (FM)): FM Approval Guide.
  - 2. National Fire Protection Association (NFPA).
    - a. NFPA 70 National Electrical Code.
    - b. NFPA 72 National Fire Alarm Code.
    - c. NFPA 90A Standard for the Installation of Air Conditioning and Ventilating Systems.
    - d. NFPA 101 Life Safety Code.
  - 3. Underwriters' Laboratories, Inc. (UL) equipment standards, Latest Edition.
    - a. UL Fire Protection Equipment Directory.
    - b. UL Electrical Construction Materials Directory.
    - c. UL 38 – Manually Actuated Signaling Boxes for Use With Fire Protection Signaling Systems.
    - d. UL 228 – Door Holding Devices.
    - e. UL 268 - Smoke Detectors for Fire Protective Signaling Systems.
    - f. UL 268A - Smoke Detectors for Duct Application.
    - g. UL 464 - Audible Signal Appliances.
    - h. UL 497A – Secondary Protectors for Communications Circuits.
    - i. UL 521 - Heat Detectors for Fire Protective Signaling Systems.
    - j. UL 864 - Control Units for Fire Protective Signaling Systems.
    - k. UL 1283 – Electromagnetic Interference Filters.
    - l. UL 1449 - Transient Voltage Surge Suppressors.
    - m. UL 1971 - Signaling Devices for the Hearing Impaired.

4. Underwriters Laboratories Canada (ULC).
  5. International Code Council.
    - a. International Building Code.
    - b. International Fire Code.
  6. State and Local Building Codes as adopted and/or amended by The Authority Having Jurisdiction, ADA, and/or State and local equivalency standards as adopted by The Authority Having Jurisdiction.
  7. ISO 9002.
- B. Manufacturer's Representative Contact Information:
1. The local representative for the fire alarm system is Berkshire Systems Group, Inc., contact Kyle Slenker at 1-800-344-4012.
- C. Testing Agency Qualifications: Qualified for testing indicated.
- D. Source Limitations for fire alarm equipment: Obtain fire alarm equipment from single source.
- E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to project site in original, unopened packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, and shelf life if applicable.
- B. Store materials inside, under cover, above ground, and kept dry and protected from physical damage until ready for use. Remove from site and discard wet or damaged materials.

#### 1.7 PROJECT CONDITIONS

- A. Installed products or materials shall be free from any damage including, but not limited to, physical insult, dirt and debris, moisture, and mold damage.
- B. Environmental Limitations: Do not deliver or install products or materials until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

#### 1.8 WARRANTY

- A. Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire alarm equipment that fail(s) in materials or workmanship within specified warranty period.
  1. Warranty Period: One (1) year from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturer is proprietary as approved by the University Contracting Officer: Siemens Building Technologies, Inc., fire alarm equipment and devices. Berkshire Systems Group, Inc., 50 South Museum Road, Reading, PA 19607, Phone No. 610-775-1220, Attention Mr. Kyle Slenker.
- B. Manufacturers: Subject to compliance with requirements all equipment shall be Siemens.

### 2.2 SYSTEM DESCRIPTION

- A. The existing fire alarm system control panel is a Siemens Cerberus PRO Modular. All new and existing devices as part of this renovation are to be connected to this fire alarm control panel.

### 2.3 INITIATING DEVICES

- A. Intelligent Initiation Devices – General:
  - 1. All initiation devices shall be insensitive to initiating loop polarity. Specifically, the devices shall be insensitive to plus/minus voltage connections on either Style 4 or Style 6 circuits.
- B. Duct Smoke Detectors – Addressable:
  - 1. For duct detector applications, the smoke detector shall be an intelligent digital photoelectric detector with a programmable heat detector. Detectors shall be listed for use as open area protective coverage, in duct installation and sampling assembly installation and shall be insensitive to air velocity changes.
  - 2. The detector communications shall allow the detector to provide alarm input to the system and alarm output from the system within four (4) seconds. The detector shall be mounted in a duct detector housing listed for that purpose. The duct detector shall support the use of a remote test switch, relay or LED remote indicator. The duct detector shall be supplied with the appropriate sampling tubes to fit the installation.
  - 3. Where duct detectors are exposed to the weather, a weatherproof enclosure shall be available. The duct housing cover shall include a test port for functional testing of the detector without cover removal. The duct housing shall include a cover removal switch capable of indicating cover removal status to the fire alarm control panel.
  - 4. The intelligent duct detector shall be Model No. FDBZ Series. Where required there shall be available a duct housing with an on-board relay. Also where required, there shall be a standalone housing available with its own power supply and test/reset switch that does not require connection to a fire alarm control panel. It shall be Model No. FDBZ492-HR.
- C. Addressable Interface Devices:

1. Addressable Interface Devices shall be provided to monitor contacts for such items as water-flow, tamper, and PIV switches connected to the fire alarm system. These interface devices shall be able to monitor a single or dual contacts. An address will be provided for each contact. Where remote supervised relay is required the interface shall be equipped with a SPDT relay rated for 4 amps resistive and 3.5 amps inductive. The addressable interface modules shall be model number XTRI Series.
- D. Device Programming Unit: The programming tool shall program the intelligent devices with addresses. The unit shall test the device to respond to its address. Dipswitches and rotary switches shall not be acceptable. The programmer shall be model DPU with carrying case.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 INSTALLATION

- A. Perform work in accordance with the requirements of NFPA 70, NFPA 72 and NECA 1-2006, Standard of Good Workmanship in Electrical Contracting.
- B. Fasten equipment to structural members of building or metal supports attached to structure, or to concrete surfaces.
- C. In the event that limited energy cable installation is allowed, all cable runs shall be run at right angles to building walls, supported from structure at intervals not exceeding 3 feet and where installed in environmental air plenums, be rated for such use and tied/supported by components listed for environmental air plenums installation.
- D. Wiring Method: Install cables in raceways. Conceal raceway and cables except in unfinished spaces.
- E. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

#### 3.3 BOXES, ENCLOSURES AND WIRING DEVICES

- A. Boxes shall be installed plumb and firmly in position.
- B. Extension rings with blank covers shall be installed on junction boxes where required.

- C. Junction boxes served by concealed conduit shall be flush mounted.
- D. Upon initial installation, all wiring outlets, junction, pull and outlet boxes shall have dust covers installed. Dust covers shall not be removed until wiring installation when permanent dust covers or devices are installed.
- E. "Fire alarm system" decal or silk-screened label shall be applied to all junction box covers.

### 3.4 CONDUCTORS

- A. Each conductor shall be identified as shown on the drawings at each with wire markers at terminal points. Attach permanent wire markers within 2 inches of the wire termination. Marker legends shall be visible.
- B. All wiring shall be supplied and installed in compliance with the requirements of the National Electric Code, NFPA 70, Article 760, and that of the manufacturer.
- C. Wiring for strobe and audible circuits shall be a minimum 14 AWG, signal line circuits; 18 AWG twisted shielded, speaker circuits; 18 AWG twisted, telephone circuit; 18 AWG twisted shielded.
- D. All splices shall be made using solderless connectors. All connectors shall be installed in conformance with the manufacturer recommendations.
- E. Crimp-on type spade lugs shall be used for terminations of stranded conductors to binder screw or stud type terminals. Spade lugs shall have upset legs and insulation sleeves sized for the conductors.
- F. The installation contractor shall submit for approval prior to installation of wire, a proposed color code for system conductors to allow rapid identification of circuit types.
- G. Wiring within sub panels shall be arranged and routed to allow accessibility to equipment for adjustment and maintenance.

### 3.5 DEVICES

- A. Relays and other devices to be mounted in auxiliary panels are to be securely fastened to avoid false indications and failures due to shock or vibration.
- B. Wiring within panels shall be arranged and routed to allow accessibility to equipment for adjustment and maintenance.
- C. All devices and appliances shall be mounted to or in an approved electrical box.

### 3.6 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."
- B. Permanently label or mark each conductor at both ends with permanent alphanumeric wire markers.
- C. A consistent color code for fire alarm system conductors throughout the installation.

### 3.7 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Testing General:
  - 1. All Alarm Initiating Devices shall be observed and logged for correct zone and sensitivity. These devices and their bases shall be tagged with adhesive tags located in an area not visible when installed, showing the initials of the installing technician and date.
  - 2. Wiring runs shall be tested for continuity, short circuits and grounds before system is energized. Resistance, current and voltage readings shall be made as work progresses.
  - 3. The acceptance inspector shall be notified before the start of the required tests. All items found at variance with the drawings or this specification during testing or inspection by the acceptance inspector shall be corrected.
  - 4. Test reports shall be delivered to the acceptance inspector as completed.
  - 5. All test equipment, instruments, tools and labor required to conduct the system tests shall be made available by the installing contractor. The following equipment shall be a minimum for conducting the tests:
    - a. Ladders and scaffolds as required to access all installed equipment.
    - b. Multi-meter for reading voltage, current and resistance.
    - c. Two way radios, and flashlights.
    - d. A manufacturer recommended device for measuring air flow through air duct smoke detector sampling assemblies.
    - e. Decibel meter.
    - f. In addition to the testing specified to be performed by the installing contractor, the installation shall be subject to test by the acceptance inspector.

### 3.8 ACCEPTANCE TESTING

- A. A written acceptance test procedure (ATP) for testing the fire alarm system components and installation will be prepared by the engineer in accordance with NFPA 72 and this specification. The contractor shall be responsible for the performance of the ATP, demonstrating the function of the system and verifying the correct operation of all system components, circuits, and programming.

- B. A program matrix shall be prepared by the installing contractor referencing each alarm input to every output function affected as a result of an alarm condition on that input.
- C. The installing contractor prior to the ATP shall prepare a complete listing of all device labels for alphanumeric annunciator displays.
- D. Loop Resistance Tests: Measure and record the resistance of each circuit with each pair of conductors in the circuit short-circuited at the farthest point from the circuit origin. The tests shall be witnessed by the owner and test results recorded for use at the final acceptance test.
- E. Preliminary Testing: Conduct preliminary tests to ensure that all devices and circuits are functioning properly. After preliminary testing is complete, provide a letter certifying that the installation is complete and fully operable. The letter shall state that each initiating and indicating device was tested in place and functioned properly. The letter shall also state that all panel functions were tested and operated properly. The Contractor and an authorized representative from each supplier of equipment shall be in attendance at the preliminary testing to make necessary adjustments.
- F. Final Acceptance Test: Notify the owner in writing when the system is ready for final acceptance testing. Submit request for test at least 14 calendar days prior to the test date. A final acceptance test will not be scheduled until meggar test results, the loop resistance test results, and the submittals required in Part 1 are provided to the owner. Test the system in accordance with the procedures outlined in NFPA 72.
  - 1. Verify that the control unit is in the normal condition as detailed in the manufacturer's operating and maintenance manual.
  - 2. Test each initiating and indicating device and circuit for proper operation and response. Disconnect the confirmation feature for smoke detectors during tests to minimize the amount of smoke or test gas needed to activate the detector.
  - 3. Test the system for all specified functions in accordance with the contract drawings and specifications and the manufacturer's operating and maintenance manual.
  - 4. Visually inspect all wiring.
  - 5. Verify that all software control and data files have been entered or programmed into the FACP.
  - 6. Verify that Shop Drawings reflecting as-built conditions are accurate.
  - 7. Measure the current in circuits to assure that there is the calculated spare capacity for the circuits.
  - 8. Measure voltage readings for circuits to assure that voltage drop is not excessive.
  - 9. Measure the voltage drop at the most remote appliance on each notification appliance circuit.
- G. The acceptance inspector shall use the system record drawings in combination with the documents specified in this specification during the testing procedure to verify operation as programmed. In conducting the ATP, the acceptance inspector shall request demonstration of any or all input and output functions. The items tested shall include but not be limited to the following:
  - 1. System wiring shall be tested to demonstrate correct system response and correct subsequent system operation in the event of:

- a. Open, shorted and grounded signal line circuits.
  - b. Open, shorted and grounded notification, releasing circuits.
  - c. Primary power or battery disconnected.
- 2. System notification appliances shall be demonstrated as follows:
  - a. All alarm notification appliances actuate as programmed.
  - b. Audibility and visibility at required levels.
- 3. System indications shall be demonstrated as follows:
  - a. Correct message display for each alarm input at the control display.
  - b. Correct annunciator light for each alarm input at each annunciator and graphic display as shown on the drawings.
  - c. Correct history logging for all system activity.
- 4. System off-site reporting functions shall be demonstrated as follows:
  - a. Correct zone transmitted for each alarm input.
  - b. Trouble signals received for disconnect.
- 5. Secondary power capabilities shall be demonstrated as follows:
  - a. System primary power shall be disconnected for a period of time as specified herein. At the end of that period, an alarm condition shall be created and the system shall perform as specified for a period as specified.
  - b. System primary power shall be restored for forty-eight hours and system-charging current shall be normal trickle charge for a fully charged battery bank.
  - c. System battery voltages and charging currents shall be checked at the fire alarm control panel.

### 3.9 PROTECTION

- A. Remove and replace devices and panel components that are wet, moisture damaged, or mold damaged.

### 3.10 DEMONSTRATION

- A. Required Instruction Time: Provide 4 hours of instruction after final acceptance of the system. The instruction shall be given during regular working hours on such dates and times as are selected by the owner. The instruction may be divided into two or more periods at the discretion of the owner. One training session shall be videotaped by the contractor. Videotapes shall be delivered to the owner.
- B. Provide a typeset printed or typewritten instruction card mounted behind a Lexan plastic or glass cover in a stainless steel or aluminum frame. Install the frame in a conspicuous location observable from the FACP. The card shall show those steps to be taken by an operator when a signal is received as well as the functional operation of the system under all conditions, normal, alarm, supervisory and trouble. The instructions shall be approved by the owner.
- C. All training sessions shall be conducted by an authorized fire alarm system distributor representative, who has received specific training from the manufacturer for the training of other persons regarding the inspection, testing, and maintenance of the system provided.

END OF SECTION 283111