

## SECTION 21 13 19 PREACTION SPRINKLER SYSTEM

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This section outlines the requirements for automatic preaction fire sprinkler systems. The work described in this section includes all engineering, labor, materials, equipment, and service required to design, supply, install, test, and commission the automatic preaction sprinkler system.
- B. Section includes:
  - 1. Preaction system assembly in enclosure.
  - 2. Fire detectors.
  - 3. Alarm notification devices.
  - 5. Pipe pressurization equipment
  - 6. Raceways and wiring.

#### 1.2 RELATED SECTIONS

- A. 01 43 00 Quality Control.
- B. 21 05 00 Common Work Results for Fire Suppression.
- C. 21 06 00 Schedules for Fire Suppression.
- D. 21 11 19 Fire Department Connections.
- E. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 01 Specification Sections.

#### 1.3 REFERENCES

- A. All applicable State Building Codes.
- B. All applicable State Fire Codes.
- C. All requirements of local fire department.
- D. Underwriters Laboratories (UL):
  - 1. UL 260 – *Dry Pipe and Deluge Valves for Fire Protection Service.*
  - 2. UL 268 – *Smoke Detectors for Fire Alarm Systems.*
  - 3. UL 864, 9th Edition – *Control Units and Accessories for Fire Alarm Systems.*
  - 4. UL 2125 – *Motor-Operated Air Compressors for Use in Sprinkler Systems* (also see UL 1450).
- E. Factory Mutual (FM):
  - 1. Class Numbers 1011 / 1012 / 1013 – *Deluge and Preaction Systems.*
  - 2. Class Number 1020 – *Automatic Water Control Valves.*
  - 3. Class Number 3010 – *Fire Alarm Signaling Systems.*
  - 4. Class Number 3230 – *Smoke Actuated Detectors for Automatic Fire Alarm Signaling.*
  - 5. Property Loss Prevention Data Sheet 2-0 – *Automatic Sprinkler Systems.*
  - 6. Property Loss Prevention Data Sheet 5-40 – *Fire Alarm Systems.*

- F. National Fire Protection Association (NFPA):
  - 1. NFPA 13 – *Installation of Sprinkler Systems*.
  - 2. NFPA 70 – *National Electrical Code*.
  - 3. NFPA 72 – *National Fire Alarm and Signaling Code*.

### 1.3 SYSTEM DESCRIPTION

- A. Furnish and install water-based pre-action fire suppression system using self-contained **[Choose one] [single interlock] [double interlock]** preaction assembly that contains all mechanical and electrical components required. The assembly shall be PREACTION-PAC™, manufactured by UNITED Fire Systems (908-688-0300, x222), and shall consist of:
  - 1. Two steel enclosures factory assembled together one above the other.
  - 2. Lower enclosure containing:
    - a. Preaction valve factory-assembled to inlet tee.
    - b. Air maintenance device factory-assembled in enclosure.
    - c. Compressor to provide supervisory air pressure, factory assembled to rubber mounts, pre-wired to shutoff switch in upper enclosure, and factory connected to preaction valve.
    - d. (3) pressure gages factory assembled and visible through cutouts in lower enclosure without opening lower enclosure door.
      - i. System Air Pressure.
      - ii. Water Supply Pressure.
      - iii. Valve Line Pressure.
    - e. Manual release handle behind separate non-lockable door.
  - 3. Upper enclosure containing an integral addressable control panel factory-assembled and wired, FenwalNET 6000 or approved equal.
- B. The assembly shall be pre-assembled, pre-wired, and fully factory tested as a system by UNITED Fire Systems, Kenilworth, NJ USA. Assemblies using non-addressable control panels shall not be accepted.

**[Choose either C OR D below]**

- C. **Furnish and install very early warning air-sampling smoke detection. The system shall be VESDA VLP, manufactured by Xtralis, 175 Bodwell Street, Avon, MA 02322 USA.**
- D. **Furnish and install intelligent, spot smoke detectors. The detectors shall be SmartOne photoelectric, Model PSD-7252, manufactured by Kidde-Fenwal, Inc., 400 Main Street, Ashland, MA 01721, USA, phone (508) 881-2000, www.kidde-fenwal.com.**

### 1.4 PERFORMANCE REQUIREMENTS

- A. General.
  - 1. Design and performance of systems, components, and methods specified herein shall comply with all applicable referenced codes and standards.
  - 2. Contract drawings indicate the general arrangement of the system and are a guide for intent only. Contractor is responsible for providing and installing all equipment necessary to complete the installation in compliance with all applicable requirements.
  - 3. Contractor shall design, furnish, and install the preaction sprinkler system(s) per this specification, and shall provide Professional Engineering services needed to assume Engineering responsibility.

4. Contractor is responsible for system layout in the fire zones indicated as "Pre-Action" on the contract drawings, including spacing and location of sprinkler heads, pipe size and pipe routing, location and number of preaction enclosures, and all other details required by applicable standards.
  5. All equipment and materials shall be new and unused.
- B. Fire Detection Design.
1. Standards.
    - a. FM Property Loss Prevention Sheet 5-40 – *Fire Alarm Systems*.
    - b. FM Number 3010 – *Fire Alarm Signaling Systems*.
    - c. NFPA 70 – *National Electrical Code*.
    - d. NFPA 72 – *National Fire Alarm Code*.
  2. Requirements.
    - a. Power.
      - i. Primary. Primary power shall be from a 110VAC dedicated branch circuit. A primary power calculation that details the power requirements for the FenwalNET 6000 Control Unit and all field devices such as smoke detectors, notification appliances and releasing solenoids shall be performed.
      - ii. Standby. Standby power shall be provided by rechargeable gel-cell batteries installed in the PREACTION-PAC™ upper enclosure. A secondary power calculation that shows the quiescent and alarm power requirements for the FenwalNET 6000 Control Unit and all field devices shall be performed.
        1. Quiescent power requirement = 24 hours.
        2. Alarm power requirement = 5 minutes.
    - b. Wire Sizes. Voltage drop calculations shall be performed justifying the wire sizes of all 24 VDC circuits.

**[Choose either C OR D below]**

**C. System Operation - Single Interlock**

1. The activation of both a single electric fire detector AND the activation by heat of an automatic sprinkler head are necessary to cause water to discharge.
2. The activation of an electric fire detector BEFORE activation by heat of an automatic sprinkler head shall:
  - a. Put PREACTION-PAC™ integral control panel into alarm condition.
  - b. Activate solenoid on trim of preaction valve in Preaction-Pac lower enclosure.
  - c. Allow water to enter the sprinkler piping.
3. The activation by heat of an automatic sprinkler head OR a break or air leak in the sprinkler piping BEFORE activation of an electric fire detector shall:
  - a. Put PREACTION-PAC™ integral control panel into SUPERVISORY condition.
  - b. NOT permit water to enter the sprinkler piping.
4. The activation of an electric fire detector AND activation by heat of an automatic sprinkler head shall:
  - a. Put PREACTION-PAC™ integral control panel into alarm condition.
  - b. Activate solenoid on trim of preaction valve in PREACTION-PAC™ lower enclosure.
  - c. Allow water to enter the sprinkler piping.
  - d. Discharge water from activated sprinkler head(s).
5. Operation of the emergency manual release valve integral with the PREACTION-PAC™ shall open the preaction valve and allow water to enter the sprinkler piping.

**D. System Operation - Double Interlock**

1. The activation of both a single electric fire detector AND the activation by heat of an automatic sprinkler head are necessary to cause water to discharge.
2. The activation of an electric fire detector BEFORE activation by heat of an automatic sprinkler head shall:
  - a. Put PREACTION-PAC™ integral control panel into alarm condition.
  - b. Activate solenoid on trim of preaction valve in Preaction-Pac lower enclosure.
  - c. NOT allow water to enter the sprinkler piping.
3. The activation by heat of an automatic sprinkler head AFTER activation of an electric fire detector shall:
  - a. Allow water to enter the sprinkler piping.
  - b. Discharge water from activated sprinkler heads.
4. The activation by heat of an automatic sprinkler head OR a break or air leak in the sprinkler piping BEFORE activation of an electric fire detector shall:
  - a. Put PREACTION-PAC™ integral control panel into SUPERVISORY condition.
  - b. NOT permit water to enter the sprinkler piping.
5. Operation of the emergency manual release valve integral with the PREACTION-PAC™ shall open the preaction valve and allow water to enter the sprinkler piping.

**1.5 QUALITY ASSURANCE**

- A. Perform a level of Quality Control in accordance with Section 01 43 00.
- B. Furnish a Quality Work Plan per Section 01 43 00 for this work.
- C. Shop drawings and design calculations shall include a seal and signature by a qualified Licensed Professional Engineer, registered in the State where jobsite is located.

**1.6 SUBMITTALS**

- A. General Requirements. The Engineer shall review all submittals for conformance to the contract drawings and specifications. The contractor shall be required to resubmit any materials, with appropriate modifications, that are found to be in non-conformance with the requirements of the contract drawings and these specifications after review by the Engineer. Approval of the submittals by the Engineer shall not relieve the Contractor of their responsibility to meet the requirements of the drawings and specifications.
- B. Action Submittals.
  1. Product Data. For each type of product indicated, include, as applicable, product rated capacities, operational characteristics, electrical characteristics, materials of construction, standards of construction, and approvals.
    - a. PREACTION-PAC™ assembly.
    - b. Fire detectors.
    - c. Manual release stations.
    - d. Audible / visual devices.
    - e. Raceways.
    - f. Wire.

2. Shop Drawings. Include all pertinent information such as structural members, ceiling construction, partitions, lighting fixtures, air diffusers and registers, speakers, sprinklers, and piping runs.
    - a. Plan views of all areas protected by preaction sprinkler systems, including room designations and node numbers for hydraulic calculations.
    - b. Plan views of all rooms where PREACTION-PAC assemblies are located.
    - c. Plan views indicating installation location of all electrical devices. Conduit routings shall be shown, with number of conductors, type of wire, and wire sizes indicated for each conduit segment.
    - d. An electrical riser diagram, specific to this design, showing interconnection of all electrical devices.
    - e. All details necessary for proper evaluation and installation of design, including:
      - i. Provisions for commissioning, inspecting, and testing.
      - ii. Wiring diagrams for all electrical devices and power, signal, and control wiring.
  3. Power Calculations.
    - a. Primary.
    - b. Backup.
  4. Wire Size Voltage Drop Calculations.
- C. Delegated-Design Submittals. Include performance requirements and design criteria analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- D. Information Submittals.
1. Coordination Drawings. All preaction sprinkler system components, drawn to scale, coordinated with:
    - a. Domestic water piping.
    - b. HVAC ductwork and inlets / outlets.
    - c. Electrical items including lighting fixtures and wall-mounted devices.
    - d. Reflected ceiling plan.
  2. Qualification Data.
    - a. Installing Contractor.
    - b. Professional Engineer.
- E. Commissioning Submittal: Field Test Plan.
- F. Closeout Submittals. Provide six (6) sets of:
1. As-Built Drawings.
  2. Field Test Data and Results.
- G. Operation and Maintenance Submittals. Provide six (6) sets of:
1. Operation and Maintenance Instructions – PREACTION-PAC Assembly, including:
    - a. Preacton valve.
    - b. Control panel.
    - c. Compressor.
    - d. Fire detectors.
  2. System Sequence of Operation.

## PART 2 - PRODUCTS

2.1 PREACTION SYSTEM ASSEMBLY. Furnish and install factory-wired and factory-tested self-contained single interlock preaction assembly(ies) containing all mechanical and electrical components required. The assembly shall be PREACTION-PAC™, manufactured by UNITED Fire Systems, Kenilworth, NJ USA (908-688-0300 x222), and shall contain all components factory-assembled and tested to make up a complete, ready-to-install device. The assembly shall consist of:

A. Standard: FM Class Numbers 1011 / 1012 / 1013 – *Deluge and Preaction Systems*.

B. Enclosure.

1. Two steel enclosures factory assembled together: one above the other.
2. Lower enclosure – 14 gage steel with continuous welded seams.
3. Upper enclosure – 12 gage steel with continuous welded seams.
4. Both enclosures finished in powder-coat red paint.
5. Both enclosures equipped with lockable access doors.
6. Key locks for upper and lower enclosure doors to be equipped with different keys.
7. Access door for manual release handle separate from enclosure doors. No key lock shall be installed on manual release handle door.
8. All doors equipped with full piano hinge and oil-resistant gaskets.

C. Fire Protection Valve.

1. General Requirements.

- a. The fire protection valve shall be Model FireLock NXT Series 769, manufactured by Victaulic. The valve shall be a low-differential, latched clapper valve that uses the supply water pressure from upstream of the main control valve to hold the clapper shut. When the water pressure in the diaphragm chamber is released, the latch is retracted and the valve actuates.
- b. Valve shall be self-resetting and no disassembly or cover removal shall be required for reset.
- c. Valve shall be rated for no less than 300 PSIG water working pressure, and factory hydrostatically tested to a minimum of 600 PSIG.
- d. Minimum required supervisory gas pressure shall be 13 PSIG.
- e. No separate check valve shall be required.
- f. Valve shall be factory-assembled to an inlet tee secured to the bottom of the lower enclosure.
- g. The full trim for the preaction valve shall be factory-assembled. No field modifications of the valve trim shall be permitted.

2. Standards.

- a. UL 260 – *Dry Pipe and Deluge Valves for Fire Protection Service*.
- b. Factory Mutual (FM) Class Number 1020 – *Automatic Water Control Valves*.

**Operation. [Choose from 3 OR 4 below.]**

**3. Operation. The valve shall operate as a single-interlock preaction valve with electric release. When the electric solenoid is operated by the PREACTION-PAC™ control panel, the water in the diaphragm chamber shall be released and the valve shall open.**

4. **Operation. The valve shall operate as a double-interlock preaction valve with electric release. When the electric solenoid is operated by the PREACTION-PAC™ control panel AND the supervisory gas is exhausted by the operation of an automatic sprinkler head, the water in the diaphragm chamber shall be released and the valve shall open.**
- D. Compressor.
1. General Requirements.
    - a. Factory assembled into lower enclosure, wired and attached to preaction valve.
    - b. Compressor shall be sized to restore normal air pressure in the pre-action system piping in 30 minutes or less.
    - c. Compressor shall be of the oil-less piston type, equipped with a pressure switch and a bubble-tight check valve.
    - d. Power: 110 VAC 60 Hz, 1 phase.
  2. Standard: UL 2125 – *Motor-Operated Air Compressors for Use in Sprinkler Systems* (also see UL 1450).
- E. Control Panel, integrated, and factory wired, and integral with preaction sprinkler cabinet, FenwalNET 6000 or equal.
1. General Requirements.
    - a. Factory-assembled into upper enclosure.
    - b. Factory-wired to release solenoid in lower enclosure.
    - c. Visible through polycarbonate window in upper enclosure door.
    - d. Listed and approved for pre-action release service.
  2. Standards.
    - a. UL 864, 9<sup>th</sup> Edition – *Control Units and Accessories for Fire Alarm Systems*.
    - b. Factory Mutual (FM) Class Number 3010 – *Fire Alarm Signaling Systems*.
  3. Specific Product Requirements.
    - a. Control panel shall be a FenwalNET Model 6000 addressable control panel, and shall consist of:
    - b. A printed circuit board (PCB), with:
      - i. Main system microprocessor.
      - ii. Real-time clock.
      - iii. History buffer.
      - iv. An integral display / control assembly.
      - v. Watchdog timer.
      - vi. One (1) USB device port.
      - vii. Two (2) RS-232 serial ports.
      - viii. Terminations for field circuits.
    - c. Field circuits shall include:
      - i. One (1) signaling line circuit (SLC). The SLC shall serve as the hardware and software interface between the intelligent initiating and control devices and the control panel. The SLC shall be capable of communicating with up to 255 fire detectors, monitor modules, and control devices, in any combination, without restrictions on the number of each type of device.
      - ii. Two (2) notification appliance circuits (NACs), independently programmable and configurable for either Class A or B operation. It shall not be necessary to use external synchronization modules to synchronize the audible and visual notification signals created by any NAC.
      - iii. Two (2) releasing circuits.
      - iv. Two (2) combination NAC / releasing circuits (Combos).
      - v. Three (3) programmable volt-free relay contacts.

- vi. One (1) volt-free trouble relay contact.
- vii. One (1) RS-485 communications circuit.
- viii. One (1) circuit for connection of secondary battery, providing for changeover to secondary power upon loss of primary power, and charging of battery when primary power is present.
- d. A primary power supply / charger assembly, consisting of an AC to DC switching power unit. The power-supply / charger assembly shall be factory configured to accept 120 VAC input voltage, and shall provide 5.4 A at 24 VDC of filtered and regulated power to operate the system and charge the system's standby batteries. Two user-configurable auxiliary-power circuits shall be provided on the PCB to power peripheral devices. The auxiliary-power circuits shall be software programmable for either continuous or interruptible power output, and shall be rated for 1.0 A at 24 VDC. It shall not be necessary to set jumpers or dip switches on the PCB to make these outputs continuous or interruptible.
- e. Operator Switches and Interface.
  - i. Switch - Event Acknowledgment.
  - ii. Switch - Alarm Silence.
  - iii. Switch - Scroll.
  - iv. Switch - System Reset.
  - v. Six (6) Status LEDs – Power On, Alarm, Pre-Alarm, Trouble, Supervisory, Silence.
  - vi. 12-key numeric keypad with BACKSPACE and ENTER keys.
  - vii. 80-character backlit liquid crystal display (LCD).
- f. Programming.
  - i. Control panel shall be programmable and configurable in the field without programming of PROM chips or replacement of memory chips.
  - ii. Programming shall allow any input to activate any output or group of outputs. Systems with limited programming capability or complex hardware programming (such as a diode matrix) are not considered suitable.
- g. Communication.
  - i. The control panel shall communicate with all initiating devices via a digital data protocol, transmitted over a two-wire signaling line circuit (SLC).
  - ii. Each point on the SLC shall have a unique address, permitting point identification of fire location and detector faults.
  - iii. The communication protocol used by the control panel over the SLC shall provide complete supervision of wiring and detector status.
- h. Contacts. Dry contacts shall be provided for signaling the building fire alarm system.
  - i. Alarm. Contact operates on any fire alarm signal processed by the PREACTION-PAC™ control panel.
  - ii. Trouble. Contact operates on any fault reported by the PREACTION-PAC™ control panel.
  - iii. Supervisory. Contact operates on any supervisory signal processed by the PREACTION-PAC™ control panel.

F. Addressable Monitor Modules.

1. General Requirements.

- a. Factory-assembled into PREACTION-PAC™ upper enclosure.
- b. Factory-wired to connection points in lower enclosure.
  - i. Low air sensor switch.
  - ii. Tamper switch.
  - iii. Waterflow sensor switch.



G. Addressable Output Module

1. General Requirements

- a. Factory assembled into PREACTION-PAC™ upper enclosure.
- b. Factory-wired to valve releasing solenoid in PREACTION-PAC™ lower enclosure.

H. Other

1. (3) pressure gages factory assembled and visible through cutouts in lower enclosure without opening lower enclosure door.
  - a. System Air Pressure
  - b. Water Supply Pressure
  - c. Valve Line Pressure
2. Manual release handle behind separate non-lockable door in lower enclosure.
3. Printed instructions visible with door closed through polycarbonate window in upper enclosure door.
4. Knockouts provided in upper enclosure for attachment of external electrical conduits.
5. Space for required spare sprinkler heads and sprinkler wrench in upper enclosure. No separate spare sprinkler head enclosure shall be permitted.
6. All wiring in lower enclosure for complete system installed at factory. No field wiring in lower enclosure permitted.
7. Inlet for water supply on top of lower enclosure, with optional inlets on left and right side of lower enclosure.
8. Outlet for water to sprinklers on top of lower enclosure.
9. 120VAC, 60 Hz, single phase connection point in upper enclosure to serve both control panel and compressor. If necessary, jumpers may be removed to permit separate 120VAC connections for control panel and compressor.
10. Assembly to be FM Approved and marked with FM Approval mark on inside of upper enclosure.

**FIRE DETECTORS [Choose 2.2 OR 2.3 below]**

**2.2 FIRE DETECTORS - SPOT SMOKE DETECTION**

**A. General Requirements. The control panel's distributed intelligence shall extend to the SmartOne automatic initiating devices on the signaling line circuit. Each automatic initiating device shall have a microprocessor capable of independently determining whether or not a fire signature at its monitored location is of sufficient magnitude to warrant the issuance of an alarm signal to the control unit.**

**B. Standards.**

1. **UL 268 – *Smoke Detectors for Fire Alarm Systems.***
2. **FM Class Number 3230 – *Smoke Actuated Detectors for Automatic Fire Alarm Signaling.***

**C. Photoelectric Smoke Detector.**

1. **The SmartOne Photoelectric Smoke Detector, Model PSD-7252, shall be a microprocessor-based smoke detector. The detector shall be a light scattering type, low profile, intelligent detector that senses a broad range of smoldering and flaming-type fires. The sensing chamber shall permit a full 360° smoke entry.**

2. Each photoelectric smoke detector shall be electronically addressable and fully field-programmable. It shall be possible to set an alert threshold anywhere from 0.2 to 3.4% per foot obscuration in 0.1%-per-foot increments, and to set an alarm threshold anywhere from 0.5 to 3.5% per foot obscuration in 0.1%-per-foot increments. Alarm thresholds shall be dynamically adjustable as a result of another alarm event anywhere in the system. Where permitted, each detector shall be programmable for alarm verification in periods of up to 180 seconds in 1-second increments. Each detector shall provide a real-time value of current, local obscuration level in percent-per-foot readout when requested by an operator at the control unit.
3. It shall be possible to configure each photoelectric detector for non-latching operation to prevent inadvertent or spurious fire signatures from accidentally discharging a waterless extinguishing system. The control unit shall latch the alarm report, but the discharge sequence shall be interrupted if the fire signature at the detector drops below the detector's programmable alarm threshold.
4. Detector calibration, address, alert and alarm thresholds, and drift-compensation algorithm shall be stored in each detector's non-volatile memory. Systems that store all detector parameters in the control unit (i.e., non-distributed-intelligence-to-the-device-level architecture) shall not be considered as equivalent.

### 2.3 FIRE DETECTORS - AIR SAMPLING SMOKE DETECTION

#### A. General Requirements.

1. The Very Early Warning Air Sampling Smoke Detection System shall provide early warning smoke detection in the incipient stage of fire. The Air Sampling Smoke Detection System shall be VESDA VLP by Xtralis or approved equal.
2. The system shall consist of a distributed air sampling pipe network connected to the inlet manifold of a central detection unit housing a highly sensitive laser-based smoke detector, aspirator, and filter.

#### B. Standards.

1. UL 268 – *Smoke Detectors for Fire Alarm Systems*.
2. FM Class Number 3230 – *Smoke Actuated Detectors for Automatic Fire Alarm Signaling*.

#### C. Specific Product Requirements.

1. Detector Assembly. The detector assembly shall be housed in a mounting box capable of being surface-mounted to a wall or recessed in a wall cavity. The assembly shall be capable of being mounted upright or inverted in either surface-mount or recessed configuration.
  - a. Sampling Inlets. The assembly shall be equipped with four (4) air sampling inlets. A flow sensor shall be provided for each inlet to sense high and low airflow faults.
  - b. Aspirator. The aspirator shall be a purpose-designed rotary vane air pump, capable of allowing for multiple sampling pipe runs up to 650 feet in total length.
  - c. Filter. The filter shall be a two-stage disposable filter cartridge. The first stage shall filter particles 20 microns and larger from the sampled air. The second stage shall remove at least 99% of particles of 0.3 microns or larger to provide a clean air barrier across critical detector optics. A particle counting method shall be used for the purpose of monitoring contamination of the filter to automatically provide notification of the need for filter maintenance.

- d. **Laser Detector.** The detector shall be laser-based light-scattering type, and shall be capable of detecting a wide range of smoke particle types and sizes. A particle counting method shall be used for the purpose of preventing large particles from affecting the true smoke reading. The particle counting circuitry shall not be used for the purpose of smoke density measurement. The detector shall not use adaptive algorithms to automatically adjust the sensitivity from that set during commissioning.
  - e. **Relays.** The assembly shall be equipped with software-programmable relays for alarm and fault signaling. Relay contacts shall be rated 2 amps at 30 VDC.
  - f. **Display.** Each detector shall be equipped with an integral display, with a 20-segment bar graph of smoke level, four alarm indicators, two fault indicators, and four control buttons for mode/test, silence, reset, and isolate.
  - g. **Event Logging.** The assembly shall be equipped with built-in event logging. The log shall store smoke levels, alarm conditions, operator actions, and faults, along with the date and time of each event. The capacity of the log shall not be less than 18,000 events.
  - h. **Area Coverage.** Each detector shall be capable of up to 20,000 square feet (2000 m<sup>2</sup>) of area coverage.
  - i. **Output Levels and Sensitivity.** Each detector shall provide four (4) programmable output levels capable of being individually set from a maximum sensitivity of 0.0015% obscuration per foot (0.005% obscuration per meter) to a minimum sensitivity of 6% obscuration per foot (20% obscuration per meter). The four output levels shall be identified as:
    - i. Alarm Level 1 – Alert – default 0.025% obs/ft.
    - ii. Alarm Level 2 – Action – default 0.448 obs/ft.
    - iii. Alarm Level 3 – Fire 1 – default 0.0625% obs/ft – 100% on bar graph scale.
    - iv. Alarm Level 4 – Fire 2 – default 0.625% obs/ft.
  - j. **Fault Reporting.** Configurable relay outputs shall be available for reporting the following faults:
    - k. Airflow.
    - l. Detector.
    - m. Power.
    - n. Filter.
2. **Power Supply.** The detector shall receive 24 VDC power from a Listed power supply. Supervised, charged battery backup shall provide a minimum of 24 hours standby power followed by minimum 24 hours alarm power.
3. **Design.**
- a. The maximum transport time (the time for smoke to travel from sampling port to detector) shall not exceed 60 seconds for the least favorable sampling port. If capillary sampling ports are used, the maximum transport time may be 90 seconds.
  - b. The volume of air drawn through the least favorable sampling port shall be no less than 70% of the average volume of air drawn through all other sampling ports on the same network.
  - c. The air sampling pipe network shall be designed using calculations from a computer-based design modeling tool. Calculation results shall indicate all sampling port sizes and transport time from the least favorable sampling port.
  - d. Power calculations shall be performed to verify power supply and backup battery capacity.

4. **Programming.** The system shall permit programming of smoke alarm thresholds and relay outputs.
5. **Communication.** Each detector shall be equipped with a digital communication port complying with the EIA RS485 protocol. The network shall be capable of supporting a minimum of 100 detectors, and shall be capable of configuration as a fault-tolerant loop.
6. **Sampling Pipe Network.**
  - a. The sampling pipe network shall be installed using UL 1887 plenum rated CPVC pipe. The nominal OD shall be 1.05", and the nominal ID shall be 0.75".
  - b. The pipe shall be identified as air sampling / aspirating smoke detector pipe with wording printed along the pipe's entire length. All joints in the sampling pipe shall be made air tight by using solvent cement. The joint at the entry to the detector shall not use solvent cement. Sampling pipes shall be supported at not less than 5 ft. centers.
  - c. The far end of each network or branch shall be an end cap made airtight with solvent cement. If required by air sampling design calculation, the end cap shall be provided with the proper size orifice.
  - d. Sampling ports shall be provided separated by no more than the distance required as if the detection system used spot smoke detectors. Each sampling port shall be clearly labeled. Port size shall be as specified by calculation.
  - e. Where false ceilings are installed, the sampling pipe network shall be above the false ceiling, with capillary sampling points on the lower surface of the ceiling. 3/8 inch capillary tubing, with a maximum length of eight (8) feet each, shall connect the sampling pipe network to each capillary sampling point. Each capillary sampling port shall be clearly labeled.

**D. Commissioning.**

1. A commissioning plan shall be part of the submittal.
2. All necessary equipment, materials, instrumentation, and labor shall be supplied by the Contractor.
3. Commissioning tests shall take place in the presence of the Engineer.
4. The Contractor shall provide a written record of all commissioning and test results.
5. The following are the minimum checks and tests to be performed at commissioning:
  - a. Verify that all installed equipment complies with this specification.
  - b. Visually examine entire installation for conformance with approved as-built plans.
  - c. Verify programming of:
    - i. Alarm threshold levels,
    - ii. Airflow fault thresholds,
    - iii. Clock time and date,
    - iv. Units set to US / SI.
  - d. Introduce smoke into each least favorable sampling port. Verify transport times do not exceed maximum per this specification.
  - e. Verify proper receipt of alarms.
  - f. Verify proper operation of all control buttons.

## 2.4 ALARM NOTIFICATION DEVICES.

### A. General Requirements.

1. Provide audible and visual alarm notification devices as indicated on the Contract Drawings.
2. A sign shall be mounted next to or underneath each alarm notification device to identify the system condition(s) represented by operation of the device. Each sign shall be red with white lettering, and a minimum size of seven by ten inches.

### B. Standards:

1. UL 464 – *Audible Signal Appliances*.
2. UL 1971 – *Signaling Devices for the Hearing Impaired*.
3. FM Class Number 3150 – *Audible Notification Appliances for Fire Alarm Signaling*.

### C. Bells.

1. Manufacturers: Provide products by one or more of the following manufacturers, subject to compliance with requirements:
  - a. Wheelock.
  - b. Potter.
  - c. Edwards.
  - d. Gentex.
  - e. Or approved equal.
2. Types:
  - a. Motor.
  - b. Vibrating.
3. Sizes:
  - a. 6 inch diameter.
  - b. 10 inch diameter.
4. Voltage: 24 VDC.
5. Compatibility: Compatible with control panel installed in PREACTION-PAC™ assembly.
6. Other Requirements: Polarized to allow supervision by control panel NAC circuit. Red enamel factory finish.

### D. Horns and Horn / Strobes.

1. Manufacturers: Provide products by one or more of the following manufacturers, subject to compliance with requirements:
  - a. Wheelock.
  - b. System Sensor.
  - c. Gentex.
  - d. Or approved equal.
2. Voltage: 24 VDC.
3. Compatibility: Compatible with control panel installed in PREACTION-PAC assembly.
4. Other Requirements: Devices shall meet the requirements of FCC Part 15 Class B. Strobe flash rate shall be one (1) flash per second. Strobes shall be capable of synchronization.

## PART 3 - EXECUTION

### 3.1 STORAGE AND HANDLING

- A. Deliver all material properly identified by type, size, manufacturer's name and specification section. All material to be undamaged.
- B. Do not store exposed to weather. Store indoors or cover to protect from damage.
- C. Store all equipment and hardware to the satisfaction of the Resident Engineer.

### 3.2 ELECTRICAL INSTALLATION

- A. Location and Arrangement. Contract drawings, plans, schematics, and diagrams indicate general location and arrangement of electrical devices. Working drawings shall indicate actual device installation layout. Install devices per working drawings.
- B. Deviations. Installation deviations from approved working drawings require written approval from the Engineer. During installation, do not deviate from approved working drawings without written approval from the Engineer.
- C. Standard. Comply with requirements of NFPA 72 – 2010, *National Fire Alarm and Signaling Code*.
- D. Wiring.
  - 1. All wiring shall be of the proper size to conduct the circuit current, but shall not be smaller than #18 AWG unless permitted by the local electrical code.
  - 2. Wiring for the signaling line circuit shall be in accordance with the FenwalNET 6000 Installation, Operation, and Maintenance Manual.
  - 3. Wire that has scrapes, nicks, gouges, or crushed insulation shall not be used.
  - 4. The manufacturer's minimum wire-bending radii shall be observed in all enclosures, raceways, and conduits.
  - 5. Aluminum wire shall not be used.
  - 6. Splicing of circuits shall be kept to a minimum, and is only permitted in an electrical box suitable for the purpose. Appropriate hardware shall be used to make the wire splices. Wires that are spliced together shall have the same color insulation.
  - 7. Wire with white insulation shall be used exclusively for the identification of the neutral conductor of AC circuits. Wire with green insulation shall be used exclusively for the identification of the earth -ground conductor of AC or DC circuits. Appropriate color-coding shall be utilized for all other field wiring.
  - 8. All electrical circuits shall be numerically tagged with suitable markings at each terminal point. All circuits shall correspond with the installation drawings.
- E. Raceways.
  - 1. Wiring to be installed in a minimum ¾ inch EMT using steel compression fittings.
  - 2. All electrical enclosures, raceways, and conduits shall be provided and installed in accordance with applicable codes and intended use, and shall contain only those electrical circuits associated with the fire detection and control system. No circuit or circuits that are unrelated to the fire detection system shall be routed through the enclosures, raceways, and conduits dedicated to the fire detection system.

### 3.2 ELECTRICAL CHECKOUT AND TESTING

- A. Electrical checkout and testing shall be performed by the Contractor. Contractor personnel shall be competent fire alarm technicians with a current training certificate from UNITED Fire Systems or approved equal.
- B. Test Plan.
  - 1. The Contractor shall submit a test plan that describes how the system shall be tested. This shall include a step-by-step description of all tests and shall indicate type and location of test apparatus to be used. At a minimum, the tests to be conducted shall be per the relevant referenced codes and any additional supplemental tests required by the authority having jurisdiction.
  - 2. Tests shall not be scheduled or conducted until the Engineer approves the test plan.
- C. Execution. All tests shall be performed in the presence of the Engineer and the authority having jurisdiction. The Contractor shall record all equipment, tests and system configurations in a format approved by the Engineer and the authority having jurisdiction. A copy of the commissioning tests and results shall be provided to the Engineer, the authority having jurisdiction, and the end user.

### 3.3 WARRANTY

- A. All equipment and installation to be warranted against defects for 12 months starting upon the date of system acceptance by all authorities having jurisdiction.