

Product Guide Specification

Specifier Notes: This product guide specification is written according to the Construction Specifications Institute (CSI) 3-Part Format as described in *The Project Resource Manual-CSI Manual of Practice*. The section must be carefully reviewed and edited by the Architect or Engineer to meet the requirements of the project and local building code. Coordinate this section with other specification sections and the Drawings. Delete all "Specifier Notes" when editing this section.

Section numbers and titles are from *MasterFormat* 2004 Edition, with numbers from *MasterFormat* 1995 in parentheses. Delete version not required.

SECTION 21 20 00 (13900)**FIXED AEROSOL FIRE-EXTINGUISHING SYSTEM****PART 1 - GENERAL****1. SUMMARY**

Section includes fire-extinguishing systems comprised of fixed condensed aerosol agent generators interconnected with agent release instrumentation and control for fire-suppression systems.

2. RELATED SECTIONS

Section 26 05 00 – Common Work Results for Electrical applies to electrical work specified in this section.

3. REQUIRED WORK THAT IS TO PROVIDED BY OTHERS

- A. 110 VAC dedicated power circuit to the fire suppression control panel-Elec. contractor
- B. Interface wiring from the fire suppression system to the buildings fire alarm systems-Elec. contractor
- C. Fire dampers, operators, and interface wiring to the fire suppression system (if req.)-Mech. contractor
- D. Interface wiring from the fire suppression system to the HVAC equipment serving the protected space for power shutdown- Elec. contractor
- E. Interface wiring from the fire suppression system to process or computer equipment for power shutdown Elec. contractor
- F. Providing and installing a means to ventilate the aerosol agent after a discharge if required- Mech. and Elec. contractors

4. REFERENCES

A. National Fire Protection Association (NFPA)

1. NFPA 70 National Electrical Code (NEC).
2. NFPA 72 National Fire Alarm and Signaling Code.
3. NFPA 101 Life Safety Code.
4. NFPA 2010 The Standard for Fixed Aerosol Fire-Extinguishing Systems

B. Underwriters Laboratories (UL)

1. UL 268 Smoke Detectors for Fire Alarm Systems
2. UL 464 Audible Signal Appliances
3. UL 864 Control Units and Accessories for Fire Alarm Systems
4. UL 1481 Power Supplies for Fire Protective Signaling Systems
5. UL 1638 Visual Signaling Appliances
6. UL 2775 Fixed Condensed Aerosol Extinguishing System Units

C. National Institute for Certification of Engineering Technologies (NICET)

1. NICET 1016-2 Program Detail Manual, Special Hazards Suppression Systems

D. United States Environmental Protection Agency (EPA)

1. EPA 59FR13044 Halon Substitutes Under Significant New Alternative Policy (SNAP)

E. All separate requirements of the Authority Having Jurisdiction (AHJ).

5. DEFINITIONS

A. *Condensed Aerosol Agent.* An extinguishing medium consisting of finely divided solid particles, generally less than 10 microns in diameter, and gaseous matter, generated by the exothermic oxidation of a solid aerosol-forming component.

B. *Electrical Initiators (E-match).* Encapsulated bridge-wire device fitted at top of aerosol generator which, when electrically energized, initiates the exothermic oxidation of the solid aerosol-forming component, producing the condensed aerosol agent fire suppressant.

C. *Fixed Aerosol Fire-Extinguishing System.* A special hazard fire protection system employing one or more condensed aerosol generators interconnected with and actuated by an agent release fire alarm system for the purpose of total flooding a protected space with potassium-based aerosol fire suppression agent.

D. *Aerosol Generator.* In condensed aerosol systems, a device for creating a fire extinguishing medium by means of exothermic oxidation.

E. *Agent Release Fire Alarm System.* A protected premises fire alarm system that is part of a fire suppression system and/or which provides control inputs to a fire suppression system related to the fire suppression system's actuation and sequence of operations and outputs for other signaling and notification.

F. *Transient Protector for Releasing Device (PN 3005014).* Device placed in releasing circuit before each e-match to protect against high voltage transient signals, such as lightning, that may cause the e-match to energize and accidentally initiate aerosol generator operation.

G. *AHJ.* Authority having jurisdiction.

6. SYSTEM DESCRIPTION

- A. Design, furnish, install, connect, and test an agent release fire alarm and fixed aerosol fire-extinguishing system ready for operation. This shall include, but is not limited to:
1. condensed aerosol agent generators and hardware
 2. agent release electrical initiators and wiring
 3. agent release control panel and batteries
 4. detection and alarm initiating devices
 5. alarm notification appliances
 6. lock-out and abort switches
 7. mounting hardware and wiring
 8. auxiliary power supply, control devices and annunciators (as needed)
 9. system user signage and documentation
- B. The fire-extinguishing system shall comply with requirements of NFPA 2010 and NFPA 72 except as modified and supplemented by this specification. System field wiring shall be supervised either electrically or by software-directed polling of field devices. Electrical installations shall comply with NFPA 70 and local code requirements.
- C. The fire-extinguishing system shall be manufactured by an ISO 9001 certified company and system and components shall be Underwriters Laboratories, Inc. listed under the appropriate UL standard given in Part 1.3 of this specification.
- D. The contractor designing and furnishing the fixed aerosol fire-extinguishing system and components shall be an authorized engineered system distributor of the supplying manufacturer. A NICET certified technician (minimum Level II) shall be employed on site to guide the final check-out and to ensure system integrity regardless of the contractor performing installation, connection, or testing for commissioning.
- E. Cross-zone operation. When a fire alarm condition is detected and reported by two system initiating devices which are cross-zoned these functions shall immediately occur:
1. A programmed delay timer (typically 30 seconds) shall be started.
 2. Warning audible circuits shall sound.
 3. Electronic equipment in the hazard area requiring emergency power off (EPO) per NFPA 75 shall de-energize circuitry fans, area ventilation shall be shutdown, and dampers closed as required.
 4. If abort is activated, the timer shall stop (or extend delay). Manual release shall override abort.
 5. At completion of the delay timeout, the aerosol generator electrical initiators shall be activated.
 6. Aerosol agent shall flood the protected area at design concentration with a minimum holding time of 10 minutes.
- F. Basic circuitry performance.
1. Initiation Device Circuits (IDC) shall be wired Class B (NFPA Style B).
 2. Notification Appliance Circuits (NAC) shall be wired Class A (NFPA Style Z).
 3. Releasing circuits shall be wired to supervise the aerosol generator electrical initiators
 4. A single ground or open on any initiating device circuit or notification appliance circuit shall not cause system malfunction, loss of operating power or the ability to report an alarm.

7. SUBMITTALS

A. Comply with Section 01 33 00 – Submittal Procedures.

B. Pre-construction Submittals:

1. All references to manufacturer's model numbers and other pertinent information herein is intended to establish minimum standards of performance, function and quality. Equivalent compatible UL-listed equipment from other manufacturers may be substituted for the specified equipment as long as the minimum standards are met. For equipment other than that specified, the contractor shall supply proof that such substitute equipment equals or exceeds the features, functions, performance, and quality of the specified equipment. Control/releasing panel manufacturers design or operation documents shall reference compatibility with the condensed aerosol system devices.
2. Include sufficient information, clearly presented, to determine compliance with the Specifications and Drawings in accordance with NFPA 2010, section 7.1.
3. Product data sheets shall be provided with printed logo or trademark shall of:
 - a. only one manufacturer for all the condensed aerosol fire suppression equipment
 - b. only one manufacturer for all the agent release fire alarm system
4. Compatibility documentation shall be provided showing the agent release fire alarm system is UL-listed and compatible with the fixed aerosol fire-extinguishing equipment
5. LEED Credit EA-4: Fire suppression agent shall be listed as a substitute for ozone-depleting chemicals under the EPA Significant New Alternatives Policy (SNAP) program. The condensed fire suppressant shall be Powdered Aerosol D as described in the EPA SNAP list.

C. Equipment Submittals:

1. Cover page shall give project name and address, Engineered Systems Distributor name and contact information, installing contractor's name and contact information (if different), equipment submittal date and revision level.
2. Scope of Work narrative including the sequence of operation for the fixed aerosol fire-extinguishing system shall describe:
 - a. Automatic or manual actuation
 - b. Control panel
 - c. Generator actuation
 - d. Notification appliance
 - e. Coordination with other building components and systems
3. Bill of material for the system shall include the part number, item description, and total quantity required for each system component or supplied material.
4. System design data shall provide battery and supplemental NAC circuit calculations as well as agent design concentration calculations for the protected special hazard volume.

D. Shop Drawings: NFPA2010

1. Cover page shall give project name and address, Engineered Systems Distributor name and contact information, installing contractor's name and contact information (if different), shop drawing package date and revision level.
2. Shop drawings shall have title blocks with project name and address, drawing name, scale and sheet number, drawing date and revision.
3. Information on all drawings shall be clearly presented, and include manufacturer's part numbers, power requirements and ratings, equipment layout, device arrangement, complete wiring point-to-point diagrams, and conduit layouts. Auxiliary control devices and annunciators and floor plans shall be included as needed. Hardcopy of calculation results from the condensed aerosol manufacturer's software system design program shall be included.

- E. Certifications. The fire suppression system contractor shall obtain any required local or state contractors licenses for this project as well as any required licenses for their installation technicians as required by state the project is located in and or the AHJ. The fire suppression system contractor shall also provide evidence of, technician NICET Level II certification and shall be an authorized distributor of the fire suppression system equipment manufacturer at time of equipment submittals.
- F. Permits- The fire suppression system contractor shall provide the necessary permits that are required for the installation of the fire suppression system.
- G. Operation and Maintenance Manuals. A complete as-built instruction and maintenance manual as well as the manufacturer's owner's manual shall be provided within 14 days after acceptance. Operation and maintenance manual shall be similar to information in Equipment Submittals, but revised to reflect changes made for final acceptance.
- H. Close-out Submittals. Project record drawings and final system program files shall be provided within 14 days after acceptance. Project record drawings shall be similar to Shop Drawings, but revised to reflect changes made for final acceptance.

8. QUALITY ASSURANCE

- A. Codes and Standards. System installation shall comply with the following NFPA codes and standards:
1. NFPA 70
 2. NFPA 72
 3. NFPA 101
 4. NFPA 2010
 5. UL 2775
 6. EPA 59FR13044
 7. MIL-STD-810G
- B. Equipment, Programming, and Installation Supervision.
1. Services of an Authorized Peripheral Manufacturing Distributor shall be provided for furnishing all equipment, hazard volume agent design concentration, system programming, and installation supervision.
 2. The Engineered Systems Distributor shall provide proof of factory training within 14 calendar days of award of the contract.

9. DELIVERY, STORAGE AND HANDLING

- A. Delivery. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer. Ensure transportation of materials, packaging signage, and documentation complies with domestic and international regulatory requirements.
- B. Storage. Store materials in clean, dry area indoors in accordance with manufacturer's instructions and Material Safety Data Sheet (MSDS) or Safety Data Sheet according to Regulation (SDSR). For any opened packaging for materials being placed back into storage, verify the permanent date code marking on the aerosol generator to ensure that the shelf life has not expired.
- C. Handling. Protect materials from damage, avoid dropping generators or subjecting to shock, electric currents, static discharge, excessive heat and extended periods of storage at temperatures greater than 149° F (65° C) or as specified in the MSDS/SDSR applicable to the material.

10. COORDINATION

Coordinate the work in this section with the work of other sections, including sprinkler systems as specified in Section 21 10 00, electronic detection and alarms as specified in Section 28 30 00, and HVAC systems as specified in Section 23 00 00.

11. WARRANTY

Warranty for aerosol fire suppression equipment is 12-month from date of installation. Warranty for agent release fire suppression system control panel and devices are also 12-month from installation.

PART 2 - PRODUCTS**1. GENERAL EQUIPMENT AND MATERIALS**

- A. All equipment and components shall be new, and the manufacturer's current model. System equipment and devices shall be tested and listed by Underwriters Laboratories for use as part of a fire-extinguishing system and meeting the National Fire Alarm and Signaling Code (NFPA 72).
- B. All equipment and components shall be installed in strict adherence with manufacturers' Design, Installation, Operation and Maintenance manual instructions, agent design concentration calculation programs, and published technical bulletins.
- C. All equipment shall be attached to wall, ceiling and floor structures and shall be located as required by the manufacturer's instructions and held firmly in place using fasteners and supports adequate to support the required load.
- D. All equipment must be available through the manufacturer's authorized Engineered System Distributors and can be installed independent of the manufacturer.

2. FIXED AEROSOL FIRE-EXTINGUISHING SYSTEM

- A. Manufacturer
 - 1. The fixed aerosol fire-extinguishing system shall consist of Aero-K[®] brand models by Peripheral Manufacturing, Inc., 2171 S. Trenton Way # 207, Denver, Colorado 80231. Phone (800) 468-6888 Fax (303) 371-8643 Website: www.fire-suppression-systems.com
 - 2. References to manufacturer's model numbers and other information are intended to establish minimum standards for performance, function, and quality. Equivalent equipment from Peripheral Manufacturing Inc. may be substituted for the specified equipment, as long as minimum standards are met. No other manufacturers other than Peripheral Manufacturing Inc. will be considered for supplying the fixed aerosol fire-extinguishing system on this project.
- B. Condensed aerosol agent generators shall be Aero-K[®] "E" (Electrical) Series. The units shall be listed to UL category FWSA and ULC category FWSAC.
 - 1. Agent container.
 - a. Generator housing shall consist of exterior and interior stainless steel cylindrical shells separated by insulating materials.
 - b. Exterior finish shall be brushed stainless steel, salt-spray resistant, and certified to MIL-STD-810G for extreme environments.

- c. Top of housing shall be stainless steel and incorporate a $\frac{3}{4}$ " NPT fitting for direct connection to releasing circuit conduit.
- d. Bottom of housing shall be stainless steel, sealed with a non-permeable hermetic sealed membrane, and shall incorporate a mechanical means to insure membrane rupture upon activation.
2. Condensed aerosol agent.
 - a. Aerosol agent generated shall be potassium based with 97% of particle sizes less than 5 microns.
 - b. Agent shall have zero ozone depletion potential (ODP), no atmospheric life (ALT) and negligible global warming potential (GWP) under EPA 59FR13044 (SNAP program).
3. Electrical initiators.
 - a. The Initiator element shall be of the encapsulated electric match type, integrated into the generator and incorporate a two-wire conductor for connection to the agent release control panel output circuit.
 - b. Device operating voltage is 12-24 VDC and supervisory current shall be ≤ 5 mA. Activation current shall be at least 1A for initiators connected in series or 0.5A for each parallel connected initiator.
 - c. Transient protection device shall be wired with each initiator, and shall be UL listed to Category SZWT2 and UOXX2.
4. Mounting hardware. Generators shall be mounted by means of stainless steel brackets and fasteners that allow for vertical and horizontal adjustment, or of the fixed L-bracket type.

C. Wiring of multiple generators. Generators may be wired individually to the control panel's agent release circuit or connected in series on a loop.

3. FIRE SUPPRESSION SYSTEM CONTROL PANEL

A. Manufacturer.

1. The agent release control panel and peripherals shall be manufactured by Potter.
2. References to manufacturer's model numbers and other information are intended to establish minimum standards for performance, function, and quality. Equivalent agent release from other fire suppression system control panel manufacturers may be substituted for the specified equipment, as long as minimum standards are met, and are verified to be UL-cross listed for automatic release of Aero-K[®] aerosol generators. No other manufacturers other than Peripheral Manufacturing, Inc. will be considered for supplying the fixed aerosol fire-extinguishing system on this project.

B. Fire Suppression Control Panel. The control panel shall be a Potter PFC-4410RC model that is UL listed and FM approved. Basic functions to be performed shall include:

1. Supervise and monitor all initiating device circuits, alarm notification circuits, and agent release circuit for trouble and alarm conditions.
2. Detect the operation of any initiating device circuit and the location of the alarm condition.
3. Operate all notification appliances and release devices as designed.
4. Visually and audibly announce any trouble, supervisory or alarm condition on the panel display.
5. System Capacity. The control panel shall include four initiating device circuits (IDC), two supervisory circuits, two NAC circuits, two release circuits, and trouble, alarm, and supervisory relays for interface to the buildings fire alarm or monitoring system.
 - a. IDCs can be configured as conventional two-wire smoke detector circuits, as well as any dry contact input device including abort switches, manual release stations, heat detectors, and smoke detectors
 - b. The control panel shall have two supervised notification appliance circuits (NACs).
 - c. The control panel shall have two dedicated release circuits that are supervised.
 - d. The panel shall include alarm, trouble, and supervisory dry contact relays for interface to the buildings fire alarm or monitoring system.

- e. On-board power supply shall be capable of delivering 2.5 amps of max power to the output circuits.
6. Control Panel Safeguards.
 - a. Battery/Earth fault supervision shall be provided.
 - b. Adjustable pre discharge timer shall be available, 00 to 60 seconds.
7. Programming and System Commissioning. The FSCP shall have a configuration option which allows the user to program the FSCP with one of four factory preprogrammed templates or one custom template which can be programmed by the user.
8. Batteries.
 - a. Shall be 12 volt, Gell-Cell type (2 required).
 - b. Battery shall have sufficient capacity to power the fire alarm system for not less than 24 hours plus 5 minutes of alarm upon a normal AC power failure.
 - c. The batteries are to be completely maintenance free. No liquids are required. Fluid level checks refilling, spills and leakage shall not be required.

C. Detection and alarm initiating devices

The contractor shall design the fire detection system and select appropriate and prescribed fire detection devices in accordance with regulatory requirements and the applicable NFPA standards for the application, and for the fire hazards associated with the application.

1. Conventional Photoelectric Area Smoke Detectors.
 - a. Smoke detectors shall be listed to Underwriters Laboratories UL 268 for Fire Protection Signaling Systems.
 - b. The detector shall be a photoelectric type
2. Automatic Conventional Heat Detectors.
 - a. Mechanical heat detectors shall be listed to Underwriters Laboratories UL 521 for Heat Detectors for Fire Protective Signaling Systems.
 - b. The detector shall be either a single-circuit or a dual-circuit type, normally open. The detector shall be rated for activation at either 135°F or 200°F, and shall activate by means of a fixed temperature thermal sensor, or a combination fixed temperature/rate-of-rise thermal sensor.
 - c. The rate-of-rise element shall be activated by a rapid rise in temperature, approximately 15°F (8.3°C) per minute.
3. Linear Heat Detection Cable.
 - a. Linear heat detection cable shall consist of a fixed temperature sensing element comprised of two electrical current carrying wires separated by a heat sensitive insulation material.
 - b. The detection cable shall detect the specified temperature anywhere along the detector length.
 - c. The detection cable shall be constructed by spiral wrapping the two conductors with a protective Mylar tape wrapped in protective outer coverings of cotton braid, PVC, or weather resistant Nylon.
 - d. The initiating circuits shall be capable of intrinsically safe service.
4. Air Sampling Smoke Detector.
 - a. Detector shall be aspirated laser-based mass light scattering type capable of detecting a wide range of smoke particle types and size.
 - b. Detector shall allow programming of smoke threshold alarm levels, time delays, faults, including airflow, detector, power, filter and network.
 - c. Monitoring contamination of the detector filter shall be employed to automatically notify when maintenance is needed.
 - d. Detector(s) shall contain programmable relays for alarm and fault conditions.

- e. Air sampling smoke detectors shall be capable of communicating to various manufacturers' fire alarm or suppression control panel by relay connectivity or through a UL listed high level interface.
 - f. Sampling pipe and fittings shall be orange $\frac{3}{4}$ " chlorinated polyvinyl chloride (CPVC) pipe.
 - g. Pipe shall be UL listed as an accessory for plenum use as per UL1887 standard. Mechanical pipe fasteners and hangers shall be approved for use with the CPVC pipe material.
5. Manual Release Stations.
- a. Manual release stations shall be UL listed with the fire suppression system control panel
 - b. Manual release stations shall be non-coded and an operated station shall automatically condition itself so as to be visually detected as activated. Station cannot be restored to normal after activation except by use of a key or hex.
6. Abort Stations
- a. Abort Stations shall include a momentary ("dead-man") switch that may be manually held in to cause abort of the release process.

D. Alarm notification appliances,

1. Horns, Strobes, and Horn/Strobes.
 - a. Horn/strobes and strobes shall be listed to UL 1971 and shall be approved for fire protective service.
 - b. Outdoor horns, strobes and horn/strobes shall be listed for outdoor use by UL.

4. WIRING AND ELECTRICAL HARDWARE

A. Wire and wiring

1. All wire and cable shall be listed and/or approved by a recognized testing agency for use with a protective signaling system. Wiring installations shall comply with NFPA 70 and 72, regulatory, and customer specific installation policies.
2. Number and size of conductors shall be as recommended by the fire suppression system control panel manufacturer, but not less than 18 AWG (1.02 mm) for Initiating device circuits and 14 AWG (1.63 mm) for notification appliance circuits.
3. The fire alarm cable shall have a fire resistance rating suitable for the installation as indicated in NEC 760 (e.g., FPLR).
4. All fire suppression system wiring shall be new and shall be in accordance with local, state and national codes (e.g., NEC Article 760) and as recommended by the manufacturer of the fire suppression system control panel.
5. All field wiring shall be electrically supervised for open circuits and ground faults.
6. All circuits shall be provided with transient suppression devices and the system shall be designed to permit simultaneous operation of all circuits without interference or signal loss.
7. The fire suppression system control panel shall be connected to a separate dedicated branch circuit, maximum 20 amperes. This circuit shall be labeled at the main power distribution panel as FIRE SUPPRESSION SYSTEM. Fire suppression control panel primary power wiring shall be 12 AWG.
8. The control panel cabinet shall be grounded securely to a cold water pipe or grounding rod.

B. Conduit, boxes and cabinets

1. Conduit shall be in accordance with the National Electrical Code (NEC), and state and local requirements.
2. All initiating and releasing device wiring shall be installed in a minimum of raceway as required by NFPA 2010. The wiring for this system may need to be installed in EMT based on the project requirements. When conduit is required, wiring for 24 volt DC control, alarm notification, emergency communication and similar power-limited auxiliary functions may be

run in the same conduit as initiating and signaling line circuits if approved by the fire suppression control panel manufacturer.

3. When required, conduit shall be 3/4 inch (19.1 mm) minimum and shall not enter the fire alarm control panel, or any remote equipment back boxes, except where entry is specified by manufacturer.
4. All cabinets, terminal and junction boxes shall be UL listed for their purpose.

5. SYSTEM USER SIGNAGE

A. All manual operating devices shall be identified as to the hazard area they protect and system abort switch shall be clearly recognizable for the purpose intended.

B. Warning and instructions signs shall be provided at the entrance to and inside the protected area.

PART 3 - EXECUTION

1. INSTALLATION:

A. Fixed aerosol fire-extinguishing system

1. Aerosol generators shall be of the type listed for intended purposes and shall be placed within the protected area in compliance with listed limitations with regard to spacing, floor coverage, thermal clearances, and alignment.
2. The type of aerosol generators selected, their number, and their placement shall be such that the application design concentration will be established in all parts of the protected space.
3. Agent shall not directly impinge on any loose objects, shelves, cabinet tops, or other surfaces, or on areas where personnel could be found in the protected space.
4. Calculations shall be performed with the Peripheral Manufacturing Aero-K[®] Designer Program and in accordance with the UL listed Design, Installation, Operation, and Maintenance manual. All examined unclosable openings in the protected enclosure shall be included in the design calculations and identified in the plan drawings.

B. Agent release fire alarm system

1. Installation shall be in accordance with the NEC, NFPA 72, NFPA 2010, local and state codes, as shown on the drawings, and as recommended by the major equipment manufacturer.
2. Fire detectors shall not be installed prior to the system programming and test period. If construction is ongoing during this period, measures shall be taken to protect smoke detectors from contamination and physical damage.
3. A transient protection for releasing device of the type listed shall be connected to each aerosol generator to protect against high voltage transient signals and unwanted system discharge.
4. Per NFPA 2010, occupiable spaces shall include a "lock-out" device. A supervised disconnect switch shall be installed interrupting the releasing circuits to the aerosol system to prevent unwanted system discharge during maintenance. Abort switches are optional and shall be considered in applications where the end user or AHJ require this safety feature in addition to the releasing system pre-discharge delay and notification appliance alarms.

C. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.

2. TESTS

- A. Provide the service of a competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment to technically supervise and participate during all of the adjustments and tests for the system.
- B. Preliminary functional tests.
1. If system is connected to an alarm-receiving office, notify the office that a test is to be conducted and that fire service response is not desired.
 2. Notify all concerned personnel at facility that a test is to be conducted and instruct them as to sequence of operation.
 3. Comply with manufacturer's procedures as described in the manual. Note all warnings and safety requirements highlighted in the manufacturer's owner's manual, applicable building regulations, and end user's policies.
 4. Prior to installing each aerosol generator to the releasing circuit, using a multi-meter, verify that each (unconnected) aerosol generator initiator resistance is between 1.4 Ω to 2.0 Ω . Replace the generator if the initiator resistance is outside this range.
 5. Conduct a visual inspection of all installed aerosol equipment and verify compliance with the plans with regards to location, orientation, clearance and agent discharge path design requirements, and any room general arrangement installation changes that can affect the fire extinguishing system performance.
 6. Confirm each aerosol and all associated equipment is securely fastened to prevent vertical or lateral movement during system discharge. Use non-permanent thread locking products on the bracket fasteners for installations subject to vibration.
 7. Disable each aerosol generator so that activation of the release circuit will not release agent during fire detection system tests, and then reconnect the release circuit with a functional test device in lieu of each generator. The test device can be a quick response fuse and fuse holder, an indicating lamp, or an electrical test match to simulate the aerosol generator initiator element or releasing circuit loop. There is no NFPA 2010 requirement for actual discharge tests for commissioning of the fire extinguishing system.
 8. Confirm each detector for response, check for end of line resistors and polarity of all polarized devices, and check all supervised circuits for trouble response.
 9. Following the reset and reestablishing normal operating condition of the fire detection system, ensure that the releasing circuit is safely in stand-by mode, before reconnecting the aerosol generators to the releasing circuit. Check at the FACP that the releasing circuit is clear of any trouble or fault condition.
- C. Complete system functional tests.
1. Each of the alarm, trouble, and fault conditions that the system is required to detect should be introduced on the system. Verify the proper receipt and that the releasing circuits will activate.
 2. Operate detection initiating circuit(s) and verify all alarm and notification appliance functions occur according to design specification.
 3. Check installation and supervision of the fire detection devices to ascertain that they will function as specified.
 4. Operate manual release and verify all manual release functions occur according to design specification.
 5. Operate abort switch circuit (if supplied) and verify abort functions occur according to design functions.
 6. Check audibility of tone and visibility of strobe light at all alarm notification devices.
 7. Confirm that visual and audible supervisory signals are received and annunciated at the control panel and, if supplied, each remote annunciator.
 8. Conduct tests to verify trouble indications for common mode failures, such as alternating current power failure.
 9. Conduct tests to verify remote monitoring operations if applicable.

10. Confirm that all auxiliary functions such as door and vent closers, alarm-displaying devices, air-handling shutdown, and power shutdown operate in accordance with design specifications.
11. Verify integration with other building systems interlocked with the fire protection systems as required in the plans and specifications.

3. FINAL INSPECTION:

- A. At the final inspection a factory trained technician shall demonstrate that the systems function properly in every respect.
- B. At successful conclusion of all functional testing, return system to its fully operational condition.

4. INSTRUCTION:

- A. Provide instruction as required to the building personnel. "Hands-on" demonstrations of the operation of all system components and the entire system shall be provided.
- B. An as-built instruction manual that includes a full sequence of operation, a set of drawings and calculations should be maintained on site.
- C. The building personnel should also retain a copy of the aerosol fire extinguishing system owner's manual. Instruct building personnel on safety and operational procedures as described in the owner's manual. Review with building personnel the post-extinguishing system discharge and recovery procedures.

END OF SECTION