

SECTION 212200 - CLEAN-AGENT FIRE-EXTINGUISHING SYSTEMS

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 APPLICABLE STANDARDS AND PUBLICATIONS

- A. The design, installation, testing and maintenance of the Clean Agent Extinguishing System shall be in accordance with the applicable requirements set forth in the latest edition of the following codes, standards, and third party approval agencies:
 - 1. NFPA 2001: Standard on Clean Agent Fire Extinguishing Systems
 - 2. NFPA 70: National Electrical Code
 - 3. NFPA 72: National Fire Alarm and Signaling Code
 - 4. Factory Mutual (FM)
 - 5. Underwriters Laboratories (UL)
 - 6. Requirements of the local Authority Having Jurisdiction (AHJ)

1.3 SUMMARY

- A. Section Includes:

- 1. Piping and piping specialties.
- 2. Extinguishing-agent containers.
- 3. Extinguishing agent.
- 4. Detection and alarm devices.
- 5. Releasing control panel.
- 6. Accessories.
- 7. Connection devices for and wiring between system components.
- 8. Connection devices for power and integration into building's fire-alarm system.

- B. Section Excludes:

- 1. Power supply (120/240 VAC) to system control panel.
- 2. Interface (conduit and wiring) to HVAC units, dampers, electric power supplies, relays, or shunt-trip breakers.
- 3. Interface (conduit and wiring) to local/remote fire alarm system
- 4. Connection to listed central station fire alarm system.
- 5. Room sealing, other than penetrations made by the suppression system contractor during system installation. Suppression system contractor shall coordinate room sealing requirements with project's General contractor and all sub-contractors.
- 6. **<Insert item>**.

1.4 DEFINITIONS

- A. AHJ: Authority Having Jurisdiction.
- B. ATS: Acceptance Testing Specifications.
- C. EPO: Emergency Power Off.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED Submittals:
 - 1. Product Data for Credit EA 4: Documentation indicating that clean agents comply.
- C. Shop Drawings:
 - 1. Prepared by persons with the following qualifications:
 - a. Trained and certified by the manufacturer of the Clean Agent Suppression system.
 - b. NICET certified Fire-Alarm Technician, Level III minimum.
 - 2. Comply with recommendations in the “Working Plans” Section of the “System Design” Chapter in NFPA 2001.
 - 3. Comply with the recommendations in the “Documentation” Section of the “Fundamentals of Fire Alarm Systems” Chapter in NFPA 72.
 - 4. Include plans, elevations, sections, details, and attachments to other work.
 - 5. Include design calculations: Enclosure volume, agent quantity, backup battery, voltage drop, detector spacing, etc.
 - 6. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 7. Include plans to indicate mounting location of field devices, including size and routing of cable and conduits.
 - 8. Submittals shall be signed and sealed by a qualified professional engineer prior to submitting them to the Authority Having Jurisdiction.
 - 9. Submittals shall be approved by the Authority Having Jurisdiction prior to submitting them to Architect.
- D. Delegated-Design Submittal: For clean-agent fire-extinguishing system signed and sealed by the qualified professional engineer.
 - 1. Indicate compliance with performance requirements and design criteria, including analysis data.
 - 2. Include design calculations for selecting the spacing and sensitivity of detection devices, complying with NFPA 72.
 - 3. Include design calculations for weight, volume, and concentration of extinguishing agent required for each hazard area.
 - 4. Include design calculations for enclosure pressure relief/venting as required to avoid structural damage to the hazard enclosure, equipment, or building.
 - 5. Indicate the Following on Reflected Ceiling Plans:

- a. Ceiling penetrations and ceiling-mounted items.
 - b. Extinguishing-agent containers if mounted above floor, piping and discharge nozzles, detectors, and accessories.
 - c. Method of attaching hangers to building structure.
 - d. Other ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, and access panels.
6. Indicate the Following on Occupied Work Area Plans:
- a. Controls and alarms.
 - b. Extinguishing-agent containers, piping and discharge nozzles if mounted in space, detectors, and accessories.
 - c. Equipment and furnishings.
7. Indicate the Following on Access Floor Space Plans:
- a. Extinguishing-agent containers, piping and discharge nozzles, detectors, and accessories.
 - b. Method of supporting piping.
8. Indicate the Following on Ceiling Plans:
- a. Extinguishing-agent containers, piping and discharge nozzles, detectors, and accessories.
 - b. Method of supporting piping.
 - c. Other equipment located in the ceiling space that is being protected including sprinkler piping, HVAC equipment, raceways, or conduit.

1.6 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Sprinkler systems, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:
1. Domestic water piping.
 2. Items Penetrating Finished Ceiling Include the Following:
 - a. Lighting fixtures.
 - b. Air outlets and inlets.
 - c. <Insert item>.
 3. <Insert item>.
- B. Permit Approved Drawings: Working plans, prepared according to NFPA 2001, that have been approved by authorities having jurisdiction. Include design calculations.
- C. Seismic Qualification Certificates: For extinguishing-agent containers and control panels from manufacturer.
1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

- D. Field quality-control reports.
- E. Installer Qualifications:
 - 1. Authorized distributor of the system manufacturer. Shall maintain an inventory of replacement parts.
 - 2. Trained by the system manufacturer to design, install, test, and maintain the clean agent extinguishing system.
 - 3. Provide proof of emergency service available on a twenty-four hour, seven-days-a-week basis.
 - 4. Maintain or have access to a recharging station capable of recharging the largest suppression system within <72> hours after a discharge.
 - 5. Minimum five (5) years' experience in the design, installation, and testing of clean-agent fire extinguishing systems. A list of systems of similar nature and scope shall be provided upon request.
 - 6. Shall employ a NICET [Level II] [Level III] [Level IV] certified special hazard designer, who will be responsible for this project.

1.7 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For special agent system to include in emergency, operation, and maintenance manuals.
- B. Deliver copies to Authorities Having Jurisdiction and include the following:
 - 1. Comply with the "Records" Section of the "Inspections, Testing and Maintenance" Chapter of NFPA 72.
 - 2. Provide "Record of Completion Documents" according to NFPA 72 article "Permanent Records" in the "Records" section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
 - 3. Record copy of site-specific software.
 - 4. Provide "Maintenance, Inspection and Testing Records" according to NFPA 72 article of the same name and include the following:
 - a. Frequency of testing of installed components.
 - b. Frequency of inspection of installed components.
 - c. Requirements and recommendations related to results of maintenance.
 - d. Manufacturer's user training manuals.
 - 5. Manufacturer's required maintenance related to system warranty requirements.
 - 6. Abbreviated operating instructions for mounting at the control panel.
 - 7. Copy of NFPA 25.
- C. As-built Drawings: Indicate actual installation configuration at time of project completion including all equipment locations, pipe routing, conduit routing, room configurations, etc.

1.8 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Deliver extra materials to Owner.

1. Detection Devices: Not less than 20 percent of amount of each type installed.
2. Container Valves: Not less than 10 percent of amount of each size and type installed.
3. Nozzles: Not less than 20 percent of amount of each type installed.
4. Extinguishing Agent: Not less than 100 percent of amount installed in largest hazard area. Include pressure-rated containers with valves.

1.9 QUALITY ASSURANCE

- A. 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.
- B. FM Global Compliance: Provide components that are FM Approved and that are listed in FM Global's "Approval Guide."
- C. UL Compliance: Provide equipment listed in UL's "Fire Protection Equipment Directory."
- D. All devices, components, and equipment shall be new, standard products of the manufacturer's latest design and suitable to perform the functions intended. The name of the manufacturer, part number, and serial number shall appear on all major components.
- E. Locks for all cabinets shall be keyed alike.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide a [**Fike; ECARO-25®**] [**Fike; HFC-227ea**] [**Fike; ProInert® <200><300> bar**] or comparable product by one of the following manufacturers:
 1. Chemetron Fire Systems; a UTC Fire & Security company.
 2. Ansul.
 3. Pem All Fire Extinguisher Corporation; a division of Pem Systems Inc.
 4. Siemens Building Technologies, Inc.; Fire Safety Division.
 5. **<Insert manufacturer's name>**.
- B. Description: Clean-agent fire-extinguishing system shall be an engineered system for total flooding of the hazard area including the room cavity above the ceiling, below the ceiling, and below the raised floor. System includes separate zones above and below the ceiling and beneath the raised floor. If smoke is detected below the raised floor, extinguishing agent shall be discharged in the underfloor zone only. If smoke is detected below the ceiling, extinguishing agent shall be discharged in zones above and below the ceiling and below the floor. If smoke is detected above the ceiling, extinguishing agent shall be discharged in the zone above the ceiling only.
- C. Delegated Design: Design clean-agent fire-extinguishing system and obtain approval from authorities having jurisdiction. Design system for Class A, B, and C fires as appropriate for

areas being protected, and include safety factor. Use clean agent indicated and in concentration suitable for normally occupied areas.

- D. Performance Requirements: (HFC-227ea per NFPA 2001).
1. Minimum design concentration: <Insert value>% by volume in all areas and/or protected spaces at the minimum anticipated temperature within the protected area.
 2. Per NFPA 2001, the system design shall not exceed a maximum exposure limit concentration level of 10.5% by volume, unless provisions for room evacuation before agent release are provided. All personnel should be able to leave the protected space prior to the discharge or at least within 5 minutes of the commencement of discharge.
- E. Performance Requirements: (FE-125 per NFPA 2001).
1. Minimum design concentration: 8% by volume in all areas and/or protected spaces at the minimum anticipated temperature within the protected area.
 2. Per NFPA 2001, the system design shall not exceed a maximum exposure limit concentration level of 11.5% by volume, unless provisions for room evacuation before agent release are provided. All personnel should be able to leave the protected space prior to the discharge or at least within 5 minutes of the commencement of discharge.
- F. Performance Requirements: (IG-55 per NFPA 2001).
1. Minimum design concentration: 34.2% by volume in all areas and/or protected spaces at the minimum anticipated temperature within the protected area.
 2. Per NFPA 2001, the system design shall not exceed a maximum exposure limit concentration level of 43% by volume, unless provisions for room evacuation before agent release are provided. All personnel should be able to leave the protected space prior to the discharge or at least within 5 minutes of the commencement of discharge.
- G. Seismic Performance: Fire-suppression piping and containers shall withstand the effects of earthquake motions determined according to [ASCE/SEI 7] <Insert requirement>.
1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified [**and the unit will be fully operational after the seismic event**]."
- H. Cross-Zoned Detection: Devices located in two separate zones. Sound alarm on activating single-detection device, and discharge extinguishing agent on actuating single-detection device in other zone.
- I. Verified Detection: Devices located in single zone. Sound alarm on activating single-detection device, and discharge extinguishing agent on actuating second-detection device.
- J. Single Detector Release: Devices located in a single zone. Sound alarm on activating single-detection device, and discharge extinguishing agent.

2.2 SYSTEM OPERATING SEQUENCE

- A. Cross-Zone or Verified Detection:

1. Actuating First Detector (Alarm):
 - a. Visual and audible indication on control panel.
 - b. Visual indication on optional annunciator panel.
 - c. Energize audible and visual alarms inside the protected hazard area (unique pattern).
 - d. Transfer relays to shut down air-conditioning and ventilating systems serving protected area, close doors in protected area, and send signal to fire-alarm system.
 2. Actuating Second Detector (Pre-discharge):
 - a. Visual and audible indication on control panel.
 - b. Visual indication on optional annunciator panel.
 - c. Energize audible and visual alarms inside the protected hazard area (unique pattern).
 - d. Transfer relays to shut down power to protected equipment.
 - e. Start time delay for extinguishing-agent discharge for **[30]** seconds.
 - f. Initiate system abort sequence.
 3. Extinguishing-agent discharge (Release): Pre-discharge time delay expires or manual release switch is operated.
 - a. Visual and audible indication on control panel.
 - b. Visual indication on optional annunciator panel.
 - c. Energize audible and visual alarms inside and outside the protected area (unique pattern).
 - d. Release clean agent suppression system agent.
 - e. Release pre-action valve to allow water to fill sprinkler system.
- B. System Operating Sequence: Single Detector Release.
1. Actuating First Detector (Pre-discharge):
 - a. Visual and audible indication on control panel.
 - b. Visual indication on optional annunciator panel.
 - c. Energize audible and visual alarms inside the protected hazard area (unique pattern).
 - a. Transfer relays to shut down air-conditioning and ventilating systems serving protected area, close doors in protected area, and send signal to fire-alarm system.
 - b. Transfer relays to shut down power to protected equipment.
 - c. Start time delay for extinguishing-agent discharge for **[30]** seconds.
 - d. Initiate system abort sequence.
 2. Extinguishing-agent discharge (Release):
 - a. Visual and audible indication on control panel.
 - b. Visual indication on optional annunciator panel.
 - c. Energize audible and visual alarms inside and outside the protected area (unique pattern).
 - d. Discharge extinguishing agent upon expiration of the discharge time delay.
 - e. Release pre-action valve to allow water to fill sprinkler system.
- C. Supervisory signal initiation shall be by one or more of the following devices and systems:
1. Clean agent container low pressure switch.
 2. **<Insert additional supervisory initiating devices>**

- D. Trouble signal initiation shall be by one or more of the following devices and actions:
1. Open circuits, shorts, and grounds in designated circuits.
 2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
 3. Loss of primary power at fire-alarm control unit.
 4. Ground or a single break in fire-alarm control unit internal circuits.
 5. Abnormal AC voltage at fire-alarm control unit.
 6. Break in standby battery circuitry.
 7. Failure of battery charging.
 8. Abnormal position of any switch at fire-alarm control unit or annunciator.
- E. System Supervisory and Trouble Signal Actions:
1. Visual and audible indication on control panel.
 2. Visual indication on optional annunciator panel.
 3. Transfer relays to send signal to fire-alarm system.
- F. Operating manual release switches will cause the immediate discharge of the extinguishing agent, overriding the system's discharge time delay and abort functions. Panel operation shall duplicate the extinguishing-agent discharge sequence described in the previous paragraphs.
1. Electric manual release switches shall be located at each hazard exit.
 2. Push button actuators shall be located on extinguishing agent container solenoid actuator. Requires a discharge pressure switch to be mounted on the discharge piping. Switch shall be wired to the control panel to indicate system activation when actuator is pressed.
- G. Operating abort switches will delay extinguishing-agent discharge while being activated. Release of hand pressure on the switch will cause agent discharge if the discharge time delay has expired.
- H. EPO: Will terminate power to protected equipment immediately on actuation.
- I. Low-Agent Pressure Switch: Initiate trouble alarm if sensing less than set pressure.

2.3 PIPING MATERIALS

- A. See "Writing Guide" Article in the Evaluations for a discussion on the Section Text's organization and the most efficient way to revise the Section Text. See "Manufacturer's Installation Manual" Article for applications of pipe, tube, fitting, and joining materials.
- B. Piping, Valves, and Discharge Nozzles: Comply with types and standards listed in NFPA 2001, Section 4.2 "Distribution," for charging pressure of system.

2.4 PIPE AND FITTINGS

- A. Steel Pipe: ASTM A-106, Seamless, [**Grade A**] [**Grade B**]; ASTM A-106, Seamless, Grade C; ASTM A-53, ERW, [**Grade A**] [**Grade B**]; Schedule 40.
1. Threaded Fittings:

- a. Malleable-Iron Fittings: ASME B16.3, Class 300.
 - b. Flanges and Flanged Fittings: ASME B16.5, Class 300.
 - c. Fittings Working Pressure: 416 psig (2868 kPa) minimum.
 - d. Threaded malleable or ductile iron: Class 300
 - e. Flanged Joints: Class 300 minimum.
2. Steel, Grooved-End Fittings: FM Approved and NRTL listed, ASTM A 47/A 47M malleable iron or ASTM A 536 ductile iron, with dimensions matching steel pipe and ends factory grooved according to AWWA C606.
- B. Steel Pipe: ASTM A-106, Seamless, **[Grade A] [Grade B]**; ASTM A-106, Seamless, Grade C; ASTM A-53, ERW, **[Grade A] [Grade B]**; Schedule 40.
1. Threaded Fittings:
 - a. Malleable-Iron Fittings: ASME B16.3, Class 300.
 - b. Flanges and Flanged Fittings: ASME B16.5, Class 300.
 - c. Fittings Working Pressure: 500 psig (3447 kPa) minimum.
 - d. Threaded malleable or ductile iron: Class 300
 - e. Flanged Joints: Class 300 minimum.
 2. Steel, Grooved-End Fittings: FM Approved and NRTL listed, ASTM A 47/A 47M malleable iron or ASTM A 536 ductile iron, with dimensions matching steel pipe and ends factory grooved according to AWWA C606.
- C. Steel Pipe: ASTM A-106, Seamless, **[Grade A] [Grade B]**; ASTM A-106, Seamless, Grade C; ASTM A-53, ERW, **[Grade A] [Grade B]**; Schedule 80 or 160.
1. Threaded Fittings :
 - a. Forged Steel Fittings: ASME B16.3, Class 2000 and Class 3000.
 - b. Flanges and Flanged Fittings: ASME B16.5, Class 1500.
 - c. Fittings Working Pressure: [2900 psig (19,996 kPa)] or [4350 psig (29,993 kPa)] minimum, upstream of the pressure reducer. Pressure rating downstream of pressure reducer determined by system flow calculations.
 - d. Flanged Joints: Class 1,500 minimum.
 2. Forged-Steel Welding Fittings: ASME B16.11, Class 3000, socket pattern.
 3. Steel, Grooved-End Fittings: FM Approved and NRTL listed, ASTM A 47/A 47M malleable iron or ASTM A 536 ductile iron, with dimensions matching steel pipe and ends factory grooved according to AWWA C606.
- D. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.
- E. Flange Bolts and Nuts: ASME B18.2.1, carbon steel.
- F. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

- G. Steel, Keyed Couplings: UL 213, AWWA C606, approved or listed for clean-agent service, and matching steel-pipe dimensions. Include ASTM A 536, ductile-iron housing, rubber gasket, and steel bolts and nuts.

2.5 VALVES

- A. General Valve Requirements:
 - 1. UL listed or FM Approved for use in fire-protection systems.
 - 2. Compatible with type of clean agent used.
 - 3. Automatic excessive pressure relief provision.
 - 4. Low pressure gauge.
- B. Container Valves: With fast acting rupture disc with solenoid actuator and manual-release lever, capable of immediate and total agent discharge and suitable for intended flow capacity.
- C. Valves in Sections of Closed Piping and Manifolds: Fabricate to prevent entrapment of liquid, or install valve and separate pressure relief device.
- D. Valves in Manifolds: Check valve; installed to prevent loss of extinguishing agent when container is removed from manifold.

2.6 EXTINGUISHING-AGENT CONTAINERS

- A. Description: High strength alloy steel tanks complying with ASME Boiler and Pressure Vessel Code: Section VIII, for unfired pressure vessels. Include minimum working-pressure rating that matches system charging pressure, valve, pressure switch, and pressure gage.
 - 1. Finish: [White] [RED] [Manufacturer's standard color], enamel or epoxy paint.
 - 2. Manifold: Fabricate with valves, pressure switches, and connections for multiple storage containers, as indicated.
 - 3. Manifold: Fabricate with valves, pressure switches, selector switch, and connections for main- and reserve-supply banks of multiple storage containers.
 - 4. Storage-Tank Brackets: Factory- or field-fabricated retaining brackets consisting of steel straps and channels; suitable for container support, maintenance, and tank refilling or replacement.
- B. Location: Located within hazard area, or as near as possible to reduce the required amount of pipe and fittings.

2.7 FIRE-EXTINGUISHING CLEAN AGENT

- A. HFC-227ea Clean Agent: Heptafluoropropane.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Fike®; HFC-227ea or comparable product by one of the following:
 - a. DuPont.
 - b. Great Lakes Chemical Corporation; a Chemtura company.

- c. <Insert manufacturer's name>.
- B. HFC-125 Clean Agent: Pentafluoroethane.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Fike®; ECARO-25™ or comparable product by one of the following:
 - a. <Insert manufacturer's name>.
- C. IG-55 Clean Agent: Mixture of nitrogen and argon inert gases.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Fike®; [PROINERT®] [PROINERT®2] or comparable product by one of the following:
 - a. <Insert manufacturer's name>.

2.8 DISCHARGE NOZZLES

- A. Equipment manufacturer's standard one-piece brass or aluminum alloy of type, size, discharge pattern, and capacity required for application.

2.9 MANIFOLD AND ORIFICE UNIONS

- A. Description: NRTL-listed device with minimum 2175-psig (15-MPa) pressure rating, to control flow and reduce pressure of IG-55 gas in piping.
 - 1. NPS 2 (DN 50) and Smaller: Piping assembly with orifice, sized for system design requirements.
 - 2. NPS 2-1/2 (DN 65) and Larger: Piping assembly with nipple, sized for system design requirements.

2.10 CONTROL PANELS

- A. Description: FM Approved or NRTL listed, including equipment and features required for testing, supervising, and operating fire-extinguishing system. Listed and approved for releasing service, and suitable for deluge/pre-action sprinkler service.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Fike®; SHP-PRO® or comparable product by one of the following:
 - a. <Insert manufacturer's name>.
- B. Power Requirements: [120] [240]-V ac; with electrical contacts for connection to system components and fire-alarm system, and transformer or rectifier as needed to produce power at voltage required for initiating devices, notification appliances, trouble signals, supervisory signals, digital alarm communicator transmitter, and auxiliary power.
 - 1. Alarm current draw of the entire clean agent suppression system shall not exceed 80 percent of the control panel's power supply rating.

- C. Enclosure: NEMA ICS 6, Type 1, steel cabinet.
1. Mounting: **[Recessed flush with surface]** **[Surface]**.
 2. Finish: **[Red]** **[Gray]** baked on enamel finish
- D. Supervised Circuits: Wired NFPA 72, **[Class B]** **[Class A]**
1. Two detection circuits; capable of cross zone; sequential; single detector release actuation methods.
 2. Three initiating device circuits; capable of monitoring contact closure devices.
 3. Three notification appliance circuits.
 4. Agent release circuit capable of actuating suppression system.
 5. Solenoid release circuit capable of actuating suppression system or sprinkler solenoids.
 6. Auxiliary power circuit (resettable/non-resettable) for field devices.
 7. Three Form-C relay contacts for auxiliary control functions.
 8. Eight additional Form-C relay contacts with addition of supplemental relay cards.
- E. Control-Panel Features:
1. Microprocessor controlled.
 2. Ten LED indicators to provide positive indication of system status.
 3. Diagnostic LED indicator to display system and trouble events.
 4. Configurable via dip-switches.
 5. Automatic switchover to standby power at loss of primary power.
 6. Storage container, low-pressure indicator.
 7. Service disconnect to interrupt system operation for maintenance with visual status indication on the panel.
 8. Silence and reset switch.
 9. 120 VAC or 240 VAC power input.
 10. Five optional abort types.
 11. Simultaneous monitoring and release of clean agent and sprinkler suppression systems.
- F. Annunciator Panel: Graphic type showing protected, hazard-area plans, as well as locations of detectors and abort, EPO, and manual stations. Include lamps to indicate device-initiating alarm, electrical contacts for connection to control panel, and stainless-steel or aluminum enclosure.
- G. Standby Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.
1. Batteries: Sealed lead calcium, sized to operate system for [24] hours and alarm for minimum of [15] minutes.
- H. Optional Cards: Cards mount directly to and receive their operational power from the SHP PRO® control board.
1. Class A Input Module: Converts all five initiating devices circuits to NFPA 72, Class A wiring.
 2. Class A Output Module: Converts all three notification appliance and releasing circuits to NFPA 72, Class A wiring.

3. Relay Module: Provides four additional Form-C relay contacts for auxiliary control functions.

2.11 SYSTEM SMOKE DETECTORS

A. General Requirements:

1. Comply with NFPA 2001, NFPA 72, and UL 268.
2. 24-V dc, nominal.
3. Two-wire type.
4. Self-restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
5. Integral Visual-Indicating Light: LED type, indicating detector has operated and power-on status.

B. Ionization Detectors: Dual-chamber type, having sampling and referencing chambers, with smoke-sensing element.

C. Photoelectric Detectors: LED light source and silicon photodiode receiving element.

D. Base Mounting: Detector shall be mounted on a twist-lock, fixed base.

1. Select according to operational characteristics: Verified detection, Cross-zone detection, and Single-detector release.
2. Base provides terminals for connection to control unit.

E. Signals to the Central Fire Alarm Control Panel: Any type of local system Alarm, Trouble, or Supervisory event is reported to the central fire alarm control panel as a composite signal for each event type.

2.12 HEAT DETECTORS

A. General Requirements:

1. Comply with NFPA 2001, NFPA 72, and UL 521.
2. 24-V dc nominal.
3. Two-wire type.
4. Self-restoring: Detectors do not require resetting after actuation to restore them to normal operation.
5. Integral Visual-Indicating Light: LED type, indicating detector has operated and power on status.

B. Fixed Temperature Type: Actuated by a temperature that exceeds a fixed temperature of **<135 deg F (57 deg C)> <190 deg F (88 deg C)>**.

C. Combination Type: Actuated by either a fixed temperature of **<135 deg F (57 deg C)> <190 deg. F (88 deg C)>** or a rate of rise that exceeds 12 deg F (11 deg C) per minute unless otherwise indicated.

- A. Base Mounting: Detector shall be mounted on a twist-lock, fixed base.
 - 1. Select according to operational characteristics: Verified detection, Cross-zone detection, and Single-detector release.
 - 2. Base provides terminals for connection to control unit.

2.13 LINEAR HEAT DETECTION

- A. General Requirements:
 - 1. Comply with NFPA 2001, NFPA 72, and UL 521.
 - 2. Temperature Rating: Actuated by a temperature that exceeds a fixed temperature of **<155 deg F (68 deg C)> <172 deg F (78 deg C)> <190 deg F (88 deg C)> <220 deg F (104 deg C)>**.
 - 3. Connects to the control panels detection and input circuits; providing a contact closure input.

2.14 SWITCHES

- A. General Description: [**Surface**] [**Semi-recessed**] FM Approved or NRTL listed, low voltage, includes contacts for connection to control panel.
- B. Manual Release Switch: Unit can manually discharge extinguishing agent with operating device that remains engaged until unlocked.
 - 1. Stainless steel faceplate.
 - 2. Dual-action requiring two distinct operations to initiate suppression system release.
 - 3. Red plastic release button, keyed reset.
 - 4. "MANUAL RELEASE" caption.
- C. Abort Switch: Unit can manually prevent the release of the suppression system while pressed.
 - 1. Stainless steel faceplate.
 - 2. Red plastic abort button, momentary contact (dead-man type).
 - 3. Available with key-operated switch.
 - 4. "SYSTEM ABORT" caption.
- D. Main-Reserve Switch: Unit allows transfer of release circuit signal from main supply to reserve supply.
 - 1. Stainless steel faceplate.
 - 2. Black plastic selector button (main/reserve)
 - 3. "CONTAINER SELECT" caption.
- E. EPO Switch: "EPO" caption, with yellow finish.
- F. Low-Agent Pressure Switches: Installed on extinguishing agent container; pneumatic operation.

- G. Suppression Disconnect Switches: Unit enables releasing circuit (i.e., clean agent or sprinkler) to be disconnected from the control panel.
 - 1. Stainless steel faceplate.
 - 2. Key operated selector switch (armed/disarmed).
 - 3. LEDs to provide indication of switch status (armed/disarmed).
 - 4. "SUPPRESSION DISCONNECT" caption.
- H. Discharge Pressure Switches: Installed on suppression piping to provide indication of manual actuation of the clean agent suppression system back to the control panel.

2.15 ALARM DEVICES

- A. General Requirements: Listed and labeled by an NRTL or FM Approved, low voltage, and surface mounting.
- B. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly. Connected to notification appliance signal circuits, equipped for mounting as indicated and with screw terminals for system connections.
- C. Bells, comply with UL 464: High dBa output; <24-V dc> <120-V ac>; vibrating type; minimum 6-inch (150-mm) diameter. Bells shall produce a sound-pressure level of 90 dBa minimum, measured 10 feet (3 m) from horn.
- D. Horns, comply with UL 464: Electric-vibrating-polarized type, 24-V dc. Horns shall produce a sound-pressure level of 90 dBa minimum, measured 10 feet (3 m) from horn.
- E. Visible Notification Appliances, comply with UL 1971: Xenon strobe lights with translucent lens, with "FIRE" or similar caption.
 - 1. Rated Light Output:
 - a. Indicated on drawings.
 - b. 15/30/75/110 cd, selectable in the field.
 - 2. Mounting: Indicated on Drawings.
 - 3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
 - 4. Flashing shall be in a temporal pattern, synchronized with other units.
 - 5. Strobe Leads: Factory connected to screw terminals.
 - 6. Mounting Faceplate: Factory finish, red.

2.16 INFORMATIONAL SIGNAGE

- A. Provide informational signs as required to comply with NFPA 2001 for the specific agent.

2.17 ANNUNCIATOR PANEL

- A. Description: Annunciator shall provide a graphic display of the protected area, and shall provide LEDs to indicate the location of system detectors.

1. Mounting: Steel enclosure; black finish; flush or surface mounted.

2.18 DIGITAL ALARM COMMUNICATOR TRANSMITTER

- A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632 and be listed and labeled by an NRTL.
- B. Features:
 1. 100 event history buffer.
 2. Communication Protocols: Modem IIIa², SIA, and 4/2
 3. LEDs for heartbeat, system trouble, and telephone line trouble (one per line).
 4. Dual telephone line interface.
 5. Self-Test: Conducted automatically every 10 minutes with report transmitted to central station.
 6. Communication failure indication.
 7. Operating Power: 24-V dc continuous power from control panel.
- C. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from the control panel and automatically capture one telephone line(s) and dial a preset number for a remote central station. When contact is made with the central station, signals shall be transmitted. If service on either line is interrupted for longer than 36 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.
- D. Mounting: Digital alarm communicator transmitter must be mounted adjacent to the control panel within 20 feet (6.1 m) with interface wiring in conduit.
- E. Secondary Power: Auxiliary power supply with integral rechargeable battery and automatic charger; UL listed for Fire Protective Signaling System service.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with hazard-area leakage requirements, installation tolerances, and other conditions affecting work performance.
 1. The general contractor shall be responsible for sealing and securing the protected enclosure against agent loss and/or leakage during the required agent "hold" period.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PIPING APPLICATIONS

- A. Flanged pipe and fittings and flanged joints may be used to connect to specialties and accessories and where required for maintenance.
- B. **NPS 2 (DN 50)** and Smaller: Schedule 40, steel pipe; malleable-iron threaded fittings; and threaded joints.
- C. **NPS 2-1/2 (DN 65)** and Larger: Schedule 40, steel pipe; **[forged-steel welding fittings; and welded joints]** **[steel, grooved-end fittings; steel, keyed couplings; and grooved joints]**.

3.3 PIPING APPLICATIONS

- A. Piping between Storage Containers and Orifice Union: Schedule **[80]** **[160]**, steel pipe; **[forged-steel welding fittings; and welded joints]** **[malleable-iron fittings with threaded or flanged joints]**.
- B. Piping Downstream from Orifice Union: Schedule **[40]** **[80]**, steel pipe; **[forged-steel welding fittings; and welded joints]** **[malleable-iron fittings with threaded or flanged joints]**.

3.4 CLEAN-AGENT PIPING INSTALLATION

- A. Install clean-agent extinguishing piping and other components level and plumb, according to manufacturers' written instructions.
- B. Each pipe section shall be cleaned internally after preparation and before assembly by means of swabbing, using a suitable nonflammable cleaner. Pipe network shall be free of particulate matter and oil residue before installing nozzles or discharge devices.
- C. Grooved Piping Joints: Groove pipe ends according to AWWA C606 dimensions. Assemble grooved-end steel pipe and steel, grooved-end fittings with steel, keyed couplings and lubricant according to manufacturer's written instructions.
- D. Install extinguishing-agent containers anchored to substrate.
- E. All pipe threads shall be sealed with Teflon tape pipe sealant applied to the male threads only.
- F. Install pipe and fittings, valves, and discharge nozzles according to requirements listed in NFPA 2001, Section 4.2 "Distribution."
 - 1. Install valves designed to prevent entrapment of liquid, or install pressure relief devices in valved sections of piping systems.
 - 2. Support piping using supports and methods according to NFPA 13.
 - 3. Install seismic restraints for extinguishing-agent containers and piping systems.

3.5 DETECTION, ACTUATION, ALARM, AND CONTROL SYSTEMS INSTALLATION

- A. Install control panels, detection system components, alarms, and accessories, complying with requirements of NFPA 72 and NFPA 2001, Section "Detection, Actuation, and Control Systems," as required for supervised system application.
- B. Smoke or Heat Detector Spacing:
 - 1. Comply with NFPA 72, "Smoke-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for smoke detector spacing.
 - 2. Comply with NFPA 72, "Heat-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for heat detector spacing.
 - 3. Smoke ceiling spacing shall not exceed 30 feet (9 m).
 - 4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Appendix A in NFPA 72.
 - 5. HVAC: Locate detectors not closer than 3 feet (1 m) from air-supply diffuser or return-air opening.
 - 6. Lighting Fixtures: Locate detectors not closer than 12 inches (300 mm) from any part of a lighting fixture.
- C. Audible Alarm-Indicating Devices: Wall mounted with tops above the finished floor not less than 90 inches (2.29 m), and below the ceiling not less than 6 in. (150 mm). Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.
- D. Visible Alarm-Indicating Devices: Wall mounted with entire lens not less than 80 in. (2.03 m) and not greater than 96 in. (2.44 m) above the finished floor. Where ceiling height does not permit mounting at minimum height, mount within 6 inches (150 mm) of the ceiling.
- E. Combination Audible-Visual Devices: Where combination audible and visual devices are used, mount devices according to Visual Alarm-Initiating Device requirements.
- F. Control Unit: **[Surface]** **[Flush]** mount, with top of cabinet not more than 72 inches (1830 mm) above the finished floor.
- G. Annunciator: Install with top of panel not more than 72 inches (1830 mm) above the finished floor.

3.6 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where installing piping adjacent to equipment, allow space for service and maintenance.
- C. Connect electrical devices to control panel and to building's fire-alarm system.

3.7 IDENTIFICATION

- A. Identify system components, equipment, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- B. Identify piping, extinguishing-agent containers, other equipment, and panels according to NFPA 2001.
- C. Install signs at entry doors for protected areas to warn occupants that they are entering a room protected with a clean-agent fire-extinguishing system.
- D. Install signs at entry doors to advise persons outside the room the meaning of the horn(s), bell(s), and strobe light(s) outside the protected space.
- E. Install framed operating instructions in a location visible from control unit.

3.8 SYSTEM WIRING

- A. Wiring shall be installed by qualified individuals, in a neat and workmanlike manner in accordance with the National Electrical Code (NEC), Article 725 and 760, except as otherwise permitted for limited energy circuits as described in NFPA 72. Installation shall meet all local, state, province and/or country codes.
- B. All wiring shall be installed in electrical metallic tubing (EMT) or conduit, and must be kept separate from all other building wiring. Runs of conduit shall be straight, neatly arranged, properly supported and installed parallel and perpendicular to walls and partitions.
- C. Conductors shall be sized according to the design documents and color coded to allow easy circuit identification.
- D. All wires shall be tagged at all junction boxes.
- E. All wires shall be tested for the presence of opens, shorts and grounds prior to connection to control panel. Final wire terminations to control panel shall be made under the direct supervision of a factory trained representative.
- F. All system components shall be securely supported independent of the wiring.
- G. Ground control panel and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to control panel.

3.9 FIELD QUALITY CONTROL

- A. Testing Agency: **[Owner will engage] [Engage]** a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

- C. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- D. Submit test plan for review and approval by the owner or owner's designated representative prior to performing tests.
- E. Detection, Actuation, Alarm, and Control Systems Tests:
 - 1. Visual Inspection: Conduct the visual inspection prior to testing.
 - a. Inspection shall be based on completed Record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" Table in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter.
 - b. Comply with "Visual Inspection Frequencies" Table in the "Inspection" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
 - 2. Operational Test: After electrical circuitry has been energized, apply power to control panel and confirm proper unit operation. Comply with "Test Methods" Table in the "Testing" Section of the "Inspection, Testing, and Maintenance" Chapter in NFPA 72.
 - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- F. Clean-Agent Fire Extinguishing Systems Test:
 - 1. Flow Test: Using nitrogen or other inert gas, perform a flow test on the piping network to verify that flow is continuous and unobstructed through piping and nozzles.
 - 2. Pressure/Leak Test: pneumatically test the piping in a closed circuit for a period of 10 minutes at 40 psi (276 kPa). At the end of 10 minutes, the pressure drop shall not exceed 20 percent of the test pressure. Repair leaks and retest until no leaks exist.
 - 3. Room Pressurization Test: After all construction work is complete, conduct a room pressurization test in accordance with NFPA 2001 in each clean agent suppression system hazard area. Test shall confirm enclosure's ability to retain the agent concentration level for the required hold time. If the test fails, the suppression system contractor shall coordinate room sealing with the general contractor. Additional tests shall be conducted until successful test results are achieved. Include final test results in project 'Closeout Submittals'.
- G. System will be considered defective if it does not pass tests and inspections.
- H. Prepare test and inspection reports: Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.

3.10 DEMONSTRATION

- A. **[Engage a factory-authorized service representative to train] [Train]** Owner's maintenance personnel to adjust, operate, and maintain the clean-agent fire-extinguishing systems.

3.11 SERVICE CONTRACT

- A. Suppression system installing contractor shall provide two (2) inspections of the systems installed under this contract, during the manufacturer's one-year warranty period. The first inspection shall be at the six month interval, and the second shall be at the twelve month interval after system acceptance.
- B. Inspections shall be conducted in accordance with the equipment manufacturer's guidelines and the recommendations of NFPA 72 and NFPA 2001. Use forms provided in NFPA 72 for initial tests and inspections.
- C. Prepare and submit test and inspection reports.

3.12 WARRANTY

- A. Clean Agent System manufacturer shall guarantee all components furnished under this contract against defects in design, materials, and workmanship for no less than one (1) year from the date of system acceptance.

END OF SECTION 212200