SECTION 212200 - CLEAN-AGENT FIRE-EXTINGUISHING SYSTEMS

Revise this Section by deleting and inserting text to meet Project-specific requirements.

1. GENERAL
   * + 1. RELATED DOCUMENTS
          1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
       2. SUMMARY
          1. Section Includes:

Clean-agent systems.

Pipe and fittings.

Valves.

Extinguishing-agent containers.

Fire-extinguishing clean agent.

Discharge nozzles.

Manifold and orifice unions.

Fire control panels.

Detection devices.

Manual stations.

Switches.

Alarm devices.

* + - 1. DEFINITIONS

Retain definition(s) remaining after this Section has been edited.

* + - * 1. ATS: Acceptance Testing Specifications.
        2. EPO: Emergency Power Off.
      1. SUBMITTALS
         1. Submittals for this section are subject to the re-evaluation fee identified in Article 4 of the

General Conditions.

* + - * 1. Manufacturer’s installation instructions shall be provided along with product data.
        2. Submittals shall be provided in the order in which they are specified and tabbed (for

combined submittals).

* + - * 1. Product Data: For each type of product indicated.

**USE PARAGRAPH BELOW WITH EPD REQUIREMENT WHEN PROJECT ESTIMATE IS $1M OR MORE.**

* + - * 1. Submit an Environmental Product Declaration (EPD) from the manufacturer for steel pipe within this specification section, if available. A statement of the contractor’s good faith effort to obtain the EPD shall be provided if not available.

Manufacturer-provided EPDs must be Product Specific Type III (Third-Party Reviewed), in adherence with ISO 14025 *Environmental labels and declarations*, ISO 14044 *Environmental management – Life cycle assessment*, and ISO 21930 *Core rules for environmental product declarations of construction products and services*.

* + - * 1. Shop Drawings: For clean-agent fire-extinguishing system signed and sealed by a qualified professional engineer.

Include plans, elevations, sections, details, and attachments to other work.

Include design calculations.

Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

Retain subparagraph below if equipment includes wiring.

Wiring Diagrams: For power, signal, and control wiring.

Retain "Delegated-Design Submittal" Paragraph below if Work of this Section is required to withstand specific design loads and design responsibilities have been delegated to Contractor.

* + - * 1. Delegated-Design Submittal: For clean-agent fire-extinguishing system signed and sealed by the qualified professional engineer.

Indicate compliance with performance requirements and design criteria, including analysis data.

Include design calculations for weight, volume, and concentration of extinguishing agent required for each hazard area.

Indicate the Following on Reflected Ceiling Plans:

Ceiling penetrations and ceiling-mounted items.

Extinguishing-agent containers if mounted above floor, piping and discharge nozzles, detectors, and accessories.

Method of attaching hangers to building structure.

Other ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, and access panels.

Indicate the Following on Occupied Work Area Plans:

Controls and alarms.

Extinguishing-agent containers, piping and discharge nozzles if mounted in space, detectors, and accessories.

Equipment and furnishings.

Indicate the Following on Access Floor Space Plans:

Extinguishing-agent containers, piping and discharge nozzles, detectors, and accessories.

Method of supporting piping.

Indicate the Following on Ceiling Plans:

Extinguishing-agent containers, piping and discharge nozzles, detectors, and accessories.

Method of supporting piping.

Other equipment located in the ceiling space that is being protected including sprinkler piping, HVAC equipment, raceways, or conduit.

Retain "Coordination Drawings" Paragraph below if Drawings do not include detailed plans or if Project involves unusual coordination requirements.

* + - * 1. 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:

Domestic water piping.

Items Penetrating Finished Ceiling Include the Following:

Lighting fixtures.

Air outlets and inlets.

<**Insert item**>.

<**Insert item**>.

* + - * 1. Design Data:

Retain first paragraph below if design by Contractor is specified in "Performance Requirements" Paragraph.

Permit Approved Drawings: Working plans, prepared according to NFPA 2001 “Standard on Clean Agent Fire Extinguishing Systems”, that have been approved by authorities having jurisdiction. Include design calculations.

Retain "Seismic Qualification Data" Paragraph below if required by seismic criteria applicable to Project. Coordinate with Section 210548 "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment." See ASCE/SEI 7 for certification requirements for equipment and components.

* + - * 1. Seismic Qualification Data: Certificates, for extinguishing-agent containers and control panels from manufacturer.

Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

Retain first paragraph below if Contractor is responsible for field quality-control testing and inspecting.

* + - * 1. Field quality-control reports.
      1. CLOSEOUT SUBMITTALS
         1. Operation and Maintenance Data: For special agent system to include in emergency, operation, and maintenance manuals.
      2. MAINTENANCE MATERIAL SUBMITTALS
         1. 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 Director’s Representative.

Detection Devices: Not less than 20 percent of amount of each type installed.

Container Valves: Not less than 10 percent of amount of each size and type installed.

Nozzles: Not less than 20 percent of amount of each type installed.

Extinguishing Agent: Not less than 100 percent of amount installed in largest hazard area. Include pressure-rated containers with valves.

* + - 1. QUALITY ASSURANCE
         1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70 “Standard for Electrical Safety in the Workplace”, by a qualified testing agency, and marked for intended location and application.

Retain "FM Global Compliance" Paragraph below if FM-Approved components are required.

* + - * 1. FM Global Compliance: Provide components that are FM Approved and that are listed in FM Global's "Approval Guide."
        2. UL Compliance: Provide equipment listed in UL's "Fire Protection Equipment Directory."

1. PRODUCTS
   * + 1. CLEAN-AGENT SYSTEMS
          1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=9242) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

Ansul by Johnson Controls Company

Fike Corporation

Siemens Industry, Inc., Building Technologies Division

United Technologies

Approved equivalent.

Convey basic system design intent here. "Description" Paragraph below contains sample descriptions of basic systems. Revise to define the zoning of the system if not indicated on Drawings.

* + - * 1. 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.

Retain "Delegated Design" Paragraph below to require Contractor to design system.

* + - * 1. 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.

Retain one of three "Performance Requirements" paragraphs below. Verify agent concentration, holding time, and other requirements with authorities having jurisdiction.

* + - * 1. Performance Requirements: Discharge HFC 227ea within 10 seconds and maintain 7.1 percent concentration by volume at 70 deg F for 10-minute holding time in hazard areas.

Revise concentration in first subparagraph below to maximum (up to 10 percent) if required. Revise both subparagraphs below if more than one hazard area is required to be protected.

HFC 227ea concentration in hazard areas greater than [**9.0**] <**Insert percent**> percent immediately after discharge or less than [**5.8**] <**Insert percent**> percent throughout holding time will not be accepted without written authorization from Director’s Representative and authorities having jurisdiction.

System Capabilities: Minimum 620-psig calculated working pressure and 360-psig initial charging pressure.

* + - * 1. Performance Requirements: Discharge FK-5-1-12 within 10 seconds and maintain 6.6 percent concentration by volume at 70 deg F for 10-minute holding time in hazard areas.

Revise concentration in first subparagraph below to maximum (up to 10 percent) if required. Revise both subparagraphs below if more than one hazard area is required to be protected.

FK-5-1-12 concentration in hazard areas greater than [**10.0**] <**Insert percent**> percent immediately after discharge or less than [**6.5**] <**Insert percent**> percent throughout holding time will not be accepted without written authorization from Director’s Representative and authorities having jurisdiction.

System Capabilities: Minimum 720-psig calculated working pressure and 360-psig initial charging pressure.

* + - * 1. Performance Requirements: Discharge IG-541 within 60 seconds and maintain 38 percent concentration by volume at 70 deg F for 10-minute holding time in hazard areas.

Revise concentration in first subparagraph below to maximum (up to 43 percent) if required. Revise both subparagraphs below if more than one hazard area is required to be protected.

IG-541 concentration in hazard areas greater than [**40**] <**Insert percent**> percent immediately after discharge or less than [**32**] <**Insert percent**> percent throughout holding time will not be accepted without written authorization from Director’s Representative and authorities having jurisdiction.

System Capabilities: Minimum 2175-psig calculated working pressure upstream from orifice union, minimum 1000-psig calculated working pressure downstream from orifice union, and 2175-psig initial charging pressure.

Retain one of first two paragraphs below with any agent retained above and insert specific requirements. Coordinate with "Control Panels" Article.

* + - * 1. 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.
        2. Verified Detection: Devices located in single zone. Sound alarm on activating single-detection device, and discharge extinguishing agent on actuating second-detection device.

Retain one of two "System Operating Sequence" paragraphs below. Retain first paragraph for ionization or photoelectric smoke detectors, or combination of both. Retain second paragraph for cross-zoned, air-sampling detectors and for photoelectric smoke detectors.

* + - * 1. System Operating Sequence:

Actuating First Detector: Visual indication on annunciator panel. Energize audible and visual alarms (slow pulse), shut down air-conditioning and ventilating systems serving protected area, close doors in protected area, and send signal to fire-alarm system.

Include actuation of sprinkler systems only if coordinated with Section 211313 "Wet-Pipe Sprinkler Systems" and Section 211316 "Dry-Pipe Sprinkler Systems."

Actuating Second Detector: Visual indication on annunciator panel. Energize audible and visual alarms (fast pulse), shut down power to protected equipment, start time delay for extinguishing-agent discharge for [**30**] <**Insert time**> seconds, and discharge extinguishing agent.[**On agent discharge, release preaction valve to allow water to fill sprinkler system.**]

Extinguishing-agent discharge will operate audible alarms and strobe lights inside and outside the protected area.

* + - * 1. System Operating Sequence: System shall be cross-zoned, air-sampling detectors and photoelectric detectors reporting to a fully programmable microprocessor-based control panel programmed to operate as follows:

If one photoelectric detector and air-sampling detector reaches the third detection level (Fire 1), agent discharge will be initiated as described for the third detection level (Fire 1) below.

Air-Sampling System:

First Detection Level (Alert): Mild audible and visual indication on annunciator panel. Strobe lights flash slowly in the protected area.

Second Detection Level (Action): Strong audible and visual indication on annunciator panel. Strobe lights flash rapidly in the protected area.

Revise first subparagraph below to include additional functions required on release. Include actuation of sprinkler systems only if coordinated with Section 211313 "Wet-Pipe Sprinkler Systems" and Section 211316 "Dry-Pipe Sprinkler Systems."

Third Detection Level (Fire 1): Strong audible and visual indication on annunciator panel. Energize horn(s), bell(s), and strobe light(s) in the protected area and outside entry doors. Shut down air-conditioning and ventilating systems serving the protected area, and close doors in the protected area. Send signal to fire-alarm system, initiate 30-second time delay for extinguishing-agent discharge, and discharge extinguishing agent. At agent discharge, terminate power to equipment in the protected area [**, and release preaction valve to allow water flow to sprinkler system**].

Fourth Detection Level (Fire 2): Same as Fire 1.

* + - * 1. Manual stations shall immediately discharge extinguishing agent when activated.

Retain first paragraph below if abort switches are required.

* + - * 1. Operating abort switches will delay extinguishing-agent discharge while being activated, and switches must be reset to prevent agent discharge. Release of hand pressure on the switch will cause agent discharge if the time delay has expired.
        2. EPO: Will terminate power to protected equipment immediately on actuation.
        3. Low-Agent Pressure Switch: Initiate trouble alarm if sensing less than set pressure.
        4. Power Transfer Switch: Transfer from normal to stand-by power source.

Retain paragraph below with "Seismic Qualification Certificates" Paragraph in "Submittals" Article for projects requiring seismic design. Model building codes and ASCE/SEI 7 establish criteria for buildings subject to earthquake motions. Verify requirements of authorities having jurisdiction.

* + - * 1. Seismic Performance: Fire-suppression piping and containers shall withstand the effects of earthquake motions determined according to [**ASCE/SEI 7**] <**Insert requirement**>.

Retain subparagraph below to define the term "withstand" as it applies to this Project. Definition varies with type of building and occupancy and is critical to valid certification. Option is used for essential facilities where equipment must operate immediately after an earthquake.

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**]."

* + - 1. PIPE AND FITTINGS

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.

* + - * 1. See [**"HFC 227ea Agent Piping Applications"**] [**"IG-541 Agent Piping Applications"**] [**"FK-5-1-12 Agent Piping Applications"**] Article for applications of pipe, tube, fitting, and joining materials.
        2. Piping, Valves, and Discharge Nozzles: Comply with types and standards listed in NFPA 2001, Section "Distribution," for charging pressure of system.
        3. Steel Pipe: ASTM A 53 “Standard Specification for Pipe, Steel, Black and Hot-Dipper, Zinc-Coated, Welded and Seamless”, Type S, Grade B or ASTM A 106 “Standard Specification for Seamless Pressure Pipe”, [**Grade A**] [**and**] [**Grade B**]; Schedule 40, Schedule 80, and Schedule 160, seamless steel pipe.

Threaded Fittings:

Malleable-Iron Fittings: ASME B16.3 “Malleable Iron Threaded Fittings Classes 150 and 300”, Class 300.

Flanges and Flanged Fittings: ASME B16.5 “Pipe Flanges & Flanged Fittings”, Class 300 unless Class 600 is indicated.

HFC 227ea systems are usually 360-psig charging-pressure systems. Verify system charging pressure.

Fittings Working Pressure: 620 psig minimum.

Flanged Joints: Class 300 minimum.

Forged-Steel Welding Fittings: ASME B16.11 “Forged Fittings, Socket-Welding and Threaded”, Class 3000, socket pattern.

Steel, Grooved-End Fittings: FM Approved and NRTL listed, ASTM A 47 “Standard Specification for Ferritic Malleable Iron Castings” malleable iron or ASTM A 536 “Standard Specification for Ductile Iron Castings” ductile iron, with dimensions matching steel pipe and ends factory grooved according to AWWA C606 “Standard for Grooved and Shouldered Joints”.

Coordinate joining materials selection with pipe, tube, and fitting selections.

* + - * 1. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

ASME B16.21 “Nonmetallic Flat Gaskets for Pipe Flanges”, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

* + - * 1. Flange Bolts and Nuts: ASME B18.2.1 “Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws”, carbon steel.
        2. Welding Filler Metals: Comply with AWS D10.12 “Guide for Welding Mild Steel Pipe” for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
        3. Steel, Keyed Couplings: UL 213, AWWA C606 “Standard for Grooved and Shouldered Joints, approved or listed for clean-agent service, and matching steel-pipe dimensions. Include ASTM A 536 “Standard Specification for Ductile Iron Castings”, ductile-iron housing, rubber gasket, and steel bolts and nuts.
      1. VALVES
         1. General Valve Requirements:

UL listed or FM Approved for use in fire-protection systems.

Compatible with type of clean agent used.

* + - * 1. Container Valves: With rupture disc or solenoid and manual-release lever, capable of immediate and total agent discharge and suitable for intended flow capacity.
        2. Valves in Sections of Closed Piping and Manifolds: Fabricate to prevent entrapment of liquid or install valve and separate pressure relief device.
        3. Valves in Manifolds: Check valve; installed to prevent loss of extinguishing agent when container is removed from manifold.
      1. EXTINGUISHING-AGENT CONTAINERS
         1. Description: 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.

Retain one of two options in first subparagraph below.

Finish: [**Red**] [**Manufacturer's standard color**], enamel or epoxy paint.

Retain one of two "Manifold" subparagraphs below or delete as required for arrangement.

Manifold: Fabricate with valves, pressure switches, and connections for multiple storage containers, as indicated.

Manifold: Fabricate with valves, pressure switches, selector switch, and connections for main- and reserve-supply banks of multiple storage containers.

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.

* + - 1. FIRE-EXTINGUISHING CLEAN AGENT

Retain only one of three paragraphs below.

LEED 2009 NC, CS, and LEED 2009 for Schools Credits EA 4 require that fire-suppression agent be free of CFCs, HCFCs, and halons. All three paragraphs below comply with Credit EA 4.

* + - * 1. HFC 227ea Clean Agent: Heptafluoropropane.

[Manufacturers:](http://www.specagent.com/Lookup?ulid=9242) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

DuPont

KIDDE; Carrier Global Corporation.

Chemours

Approved equivalent.

* + - * 1. FK-5-1-12 Clean Agent: Dodecaflouro-2-methylpentan-3-one.

[Manufacturers:](http://www.specagent.com/Lookup?ulid=1603) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[3M](http://www.specagent.com/Lookup?uid=123457084813).

KIDDE; Carrier Global Corporation.

Ansul

Approved equivalent.

* + - * 1. IG-541 Clean Agent: Mixture of nitrogen, argon, and carbon dioxide inert gases.

[Manufacturers:](http://www.specagent.com/Lookup?ulid=1604) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Ansul; brand of Johnson Controls International plc, Building Solutions North America](http://www.specagent.com/Lookup?uid=123457084814).

Approved equivalent.

* + - 1. DISCHARGE NOZZLES

* + - * 1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=6216) Subject to compliance with requirements, [**provide products by the following**] [**provide products by one of the following**] [**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:

[Ansul; brand of Johnson Controls International plc, Building Solutions North America](http://www.specagent.com/Lookup?uid=123457084818).

Kidde; Carrier Global Corporation.

Approved equivalent.

* + - * 1. Equipment manufacturer's standard one-piece brass or aluminum alloy of type, size, discharge pattern, and capacity required for application.
        2. Material: Corrosion-resistant metal.
        3. Stamped with orifice size and type.
      1. MANIFOLD AND ORIFICE UNIONS

Retain this article only if IG-541 agent is specified.

* + - * 1. Description: NRTL-listed device with minimum 2175-psig pressure rating, to control flow and reduce pressure of IG-541 gas in piping.

NPS 2 and Smaller: Piping assembly with orifice, sized for system design requirements.

NPS 2-1/2 and Larger: Piping assembly with nipple, sized for system design requirements.

* + - 1. FIRE CONTROL PANELS

* + - * 1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=6217) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Ansul; brand of Johnson Controls International plc, Building Solutions North America](http://www.specagent.com/Lookup?uid=123457084822).

Kidde; Carrier Global Corporation.

Approved equivalent.

* + - * 1. Description: FM Approved or NRTL listed, including equipment and features required for testing, supervising, and operating fire-extinguishing system.
        2. 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 accessories and alarm devices.
        3. Enclosure: NEMA ICS 6 “Industrial Control and Systems: Enclosures”, Type 1, enameled-steel cabinet.

Mounting: [**Recessed flush with surface**] [**Surface**].

* + - * 1. Supervised Circuits: Separate circuits for each independent hazard area.

Detection circuits equal to the required number of zones, or addressable devices assigned to the required number of zones.

Manual pull-station circuit.

Alarm circuit.

Release circuit.

Abort circuit.

EPO circuit.

* + - * 1. Control-Panel Features:

Verify availability and applicability of control-panel features.

Electrical contacts for shutting down fans, activating dampers, and operating system electrical devices.

Automatic switchover to standby power at loss of primary power.

Storage container, low-pressure indicator.

Service disconnect to interrupt system operation for maintenance with visual status indication on the annunciator panel.

* + - * 1. 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.
        2. Standby Power: [**Sealed lead calcium**] [**Sealed, valve-regulated, recombinant lead acid**] [**Vented, wet-cell pocket, plate nickel cadmium**] batteries with capacity to operate system for 24 hours and alarm for minimum of 15 minutes. Include automatic battery charger that has a varying charging rate between trickle and high depending on battery voltage, and that is capable of maintaining batteries fully charged. Include manual voltage control, dc voltmeter, dc ammeter, electrical contacts for connection to control panel, automatic transfer switch, and suitable enclosure.
      1. DETECTION DEVICES
         1. General Requirements for Detection Devices:

Comply with NFPA 2001 “Standard on Clean Agent Fire Extinguishing Systems”, NFPA 72 “National Fire Alarm and Signaling Code”, and UL 268 “Smoke Detectors for Fire Alarm Systems”.

24-V dc, nominal.

* + - * 1. Ionization Detectors: Dual-chamber type, having sampling and referencing chambers, with smoke-sensing element.
        2. Photoelectric Detectors: LED light source and silicon photodiode receiving element.

Coordinate paragraph below with Drawings.

* + - * 1. Remote Air-Sampling Detector System: Includes air-sampling pipe network, a laser-based photoelectric detector, a sample transport fan, and a control unit.

Other pipe materials may be specified in first subparagraph below, depending on codes and authorities having jurisdiction.

Pipe Network: CPVC tubing connects control unit with calibrated sampling holes.

Smoke Detector: Particle-counting type with continuous laser beam. Sensitivity adjustable to a minimum of four preset values.

Sample Transport Fan: Centrifugal type, creating a minimum static pressure of 0.05-inch wg at all sampling ports.

Control Unit: Multizone unit as indicated on Drawings. Provides same system power supply, supervision, and alarm features as specified for the control panel plus separate trouble indication for airflow and detector problems.

* + - * 1. Signals to the Central Fire Alarm Control Panel: Any type of local system trouble is reported to the central fire alarm control panel as a composite "trouble" signal. Alarms on each system zone are individually reported to the central fire alarm control panel as separately identified zones.
      1. MANUAL STATIONS
         1. General Description: [**Surface**] [**Semirecessed**] FM Approved or NRTL listed, with clear plastic hinged cover, 120-V ac or low voltage compatible with controls. Include contacts for connection to control panel.
         2. Manual Release: "MANUAL RELEASE" caption, and red finish. Unit can manually discharge extinguishing agent with operating device that remains engaged until unlocked.

Switches in paragraphs below are normally used for computer facilities. Retain if required.

* + - * 1. Abort Switch: "ABORT" caption, momentary contact, with green finish.
        2. EPO Switch: "EPO" caption, with yellow finish.
      1. SWITCHES
         1. Description: FM Approved or NRTL listed, where available, [**120-V**] <**Insert value**> ac or low voltage compatible with controls. Include contacts for connection to control panel.

Retain switches below if required.

Low-Agent Pressure Switches: Pneumatic operation.

Power Transfer Switches: Key-operation selector, for transfer of release circuit signal from main supply to reserve supply.

Door Closers: Magnetic retaining and release device or electrical interlock to cause the door operator to drive the door closed.

* + - 1. ALARM DEVICES
         1. Description: Listed and labeled by an NRTL or FM Approved, low voltage, and surface mounting. Comply with requirements in Section 284621.11 "Addressable Fire-Alarm Systems" or Section 284621.13 "Conventional Fire-Alarm Systems" for alarm and monitoring devices.

Retain required devices in remaining paragraphs.

* + - * 1. Bells: Minimum 6-inch diameter.
        2. Horns: 90 to 94 dBA.
        3. Strobe Lights: Translucent lens, with "FIRE" or similar caption.

1. EXECUTION
   * + 1. EXAMINATION
          1. Examine areas and conditions, with Installer present, for compliance with hazard-area leakage requirements, installation tolerances, and other conditions affecting work performance.
          2. Proceed with installation only after unsatisfactory conditions have been corrected.

Retain only one of first three articles below.

* + - 1. HFC 227ea AGENT PIPING APPLICATIONS
         1. Flanged pipe and fittings and flanged joints may be used to connect to specialties and accessories and where required for maintenance.
         2. NPS 2 and Smaller: Schedule 40, steel pipe; malleable-iron threaded fittings; and threaded joints.
         3. NPS 2-1/2 and Larger: Schedule 40, steel pipe; [**forged-steel welding fittings; and welded joints**] [**steel, grooved-end fittings; steel, keyed couplings; and grooved joints**].
      2. IG-541 AGENT PIPING APPLICATIONS
         1. 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**].
         2. 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. FK-5-1-12 AGENT PIPING APPLICATIONS
         1. Flanged pipe and fittings and flanged joints may be used to connect to specialties and accessories and where required for maintenance.
         2. NPS 2 and Smaller: Schedule 40, steel pipe; malleable-iron threaded fittings; and threaded joints.
         3. NPS 2-1/2 and Larger: Schedule 40, steel pipe; [**forged-steel welding fittings; and welded joints**] [**steel, grooved-end fittings; steel, keyed couplings; and grooved joints**].
      4. CLEAN-AGENT PIPING INSTALLATION
         1. Install clean-agent extinguishing piping and other components level and plumb, according to manufacturers' written instructions.
         2. Grooved Piping Joints: Groove pipe ends according to AWWA C606 “Standard for Grooved and Shouldered Joints” dimensions. Assemble grooved-end steel pipe and steel, grooved-end fittings with steel, keyed couplings and lubricant according to manufacturer's written instructions.
         3. Install extinguishing-agent containers anchored to substrate.
         4. Install pipe and fittings, valves, and discharge nozzles according to requirements listed in NFPA 2001 “Standard on Clean Agent Fire Extinguishing Systems”, Section "Distribution."

Install valves designed to prevent entrapment of liquid or install pressure relief devices in valved sections of piping systems.

Support piping using supports and methods according to NFPA 13 “Standard for the Installation of Sprinkler Systems”.

Retain first subparagraph below if piping is required to withstand seismic design loads.

Install seismic restraints for extinguishing-agent containers and piping systems.

Install control panels, detection system components, alarms, and accessories, complying with requirements of NFPA 2001 “Standard on Clean Agent Fire Extinguishing Systems”, Section "Detection, Actuation, and Control Systems," as required for supervised system application.

* + - 1. CONNECTIONS

Coordinate piping installation and specialty arrangement requirements with schematics on Drawings and with requirements specified. If Drawings are explicit enough, these requirements may be reduced or omitted.

* + - * 1. Drawings indicate general arrangement of piping, fittings, and specialties.
        2. Where installing piping adjacent to equipment, allow space for service and maintenance.
        3. Connect electrical devices to control panel and to building's fire-alarm system.
      1. IDENTIFICATION
         1. Identify system components and equipment. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
         2. Identify piping, extinguishing-agent containers, other equipment, and panels according to NFPA 2001 “Standard on Clean Agent Fire Extinguishing Systems”.
         3. 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.

Revise paragraph below to include warning devices that are to be installed.

* + - * 1. 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.
      1. FIELD QUALITY CONTROL

Retain one of first three paragraphs below to identify who shall perform tests and inspections. If retaining second option in first paragraph, or if retaining second or third paragraph, retain "Field quality-control reports" Paragraph in "Submittals" Article.

* + - * 1. Testing Agency: [**Director’s Representative will engage**] [**Engage**] a qualified testing agency to perform tests and inspections.

Retain first paragraph below to require a factory-authorized service representative to perform inspections, tests, and adjustments.

* + - * 1. Manufacturer's Field Service: Engage a Company Field Advisor per OGS Spec Section 014216 to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

Retain first paragraph below to require Contractor to perform tests and inspections.

* + - * 1. Perform tests and inspections.

Retain subparagraph below to require a factory-authorized service representative to assist Contractor with inspections, tests, and adjustments.

Manufacturer's Field Service: Engage a Company Field Advisor per OGS Spec Section 014216 to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

Retain first paragraph below to describe tests and inspections to be performed.

* + - * 1. Tests and Inspections:

After installing clean-agent extinguishing piping system and after electrical circuitry has been energized, test for compliance with requirements.

Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Sections "Inspection and Test Procedures" and "System Function Tests." Certify compliance with test parameters.

Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new units, and retest.

Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

* + - * 1. Units will be considered defective if they do not pass tests and inspections.
        2. Prepare test and inspection reports.
      1. CLEANING
         1. 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.
      2. SYSTEM FILLING
         1. Preparation:

Verify that piping system installation is completed and cleaned.

Check for complete enclosure integrity.

Check operation of ventilation and exhaust systems.

* + - * 1. Filling Procedures:

Fill extinguishing-agent containers with extinguishing agent and pressurize to indicated charging pressure.

Install filled extinguishing-agent containers.

Energize circuits.

Adjust operating controls.

* + - 1. DEMONSTRATION
         1. [**Engage a Company Field Advisor per OGS Spec Section 014216 to train**] [**Train**] Facility’s maintenance personnel to adjust, operate, and maintain clean-agent fire-extinguishing systems.

END OF SECTION 212200