

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.02 SUMMARY**

- A. Section Includes:
  - 1. Piping and piping specialties.
  - 2. Extinguishing-agent containers.
  - 3. Extinguishing agent.
  - 4. Detection and alarm devices.
  - 5. Control and alarm panels.
  - 6. Accessories.
  - 7. Connection devices for and wiring between system components.
  - 8. Connection devices for power and integration into building's fire-alarm system.

**1.03 DEFINITIONS**

- A. ATS: Acceptance Testing Specifications.
- B. EPO: Emergency Power Off.

**1.04 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: For clean-agent fire-extinguishing system signed and sealed by a qualified professional engineer.
  - 1. Include plans, elevations, sections, details, and attachments to other work.
  - 2. Include design calculations.
  - 3. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 4. Wiring Diagrams: For power, signal, and control wiring.
- 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.

**21 2200 CLEAN-AGENT FIRE-EXTINGUISHING SYSTEMS**  
**PAGE 2**

2. Include design calculations for weight, volume, and concentration of extinguishing agent required for each hazard area.
  3. 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.
  4. 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.
  5. Indicate the Following on Access Floor Space Plans:
    - a. Extinguishing-agent containers, piping and discharge nozzles, detectors, and accessories.
    - b. Method of supporting piping.
  6. 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.
- E. 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.
- F. Permit Approved Drawings: Working plans, prepared according to NFPA 2001, that have been approved by authorities having jurisdiction. Include design calculations.
- G. 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.

**21 2200 CLEAN-AGENT FIRE-EXTINGUISHING SYSTEMS**  
**PAGE 3**

- H. Field quality-control reports.
- I. Operation and Maintenance Data: For special agent system to include in emergency, operation, and maintenance manuals.

**1.05 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."

**1.06 EXTRA MATERIALS**

- 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.

**PART 2 - PRODUCTS**

**2.01 CLEAN-AGENT SYSTEMS**

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - 1. Ansul Incorporated.
  - 2. Chemetron Fire Systems; a UTC Fire & Security company.
  - 3. Fike Corporation.
  - 4. Pem All Fire Extinguisher Corporation; a division of Pem Systems Inc.
  - 5. Pyro-Chem.
  - 6. Siemens Building Technologies, Inc.; Fire Safety Division.
- C. 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,

**21 2200 CLEAN-AGENT FIRE-EXTINGUISHING SYSTEMS**  
**PAGE 4**

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.

- D. 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.
- E. Performance Requirements: Discharge FK-5-1-12 within 10 seconds and maintain 6.6 percent concentration by volume at 70 deg F (21 deg C) for 10-minute holding time in hazard areas.
  - 1. FK-5-1-12 concentration in hazard areas greater than 10.0 percent immediately after discharge or less than 6.5 percent throughout holding time will not be accepted without written authorization from Owner and authorities having jurisdiction.
  - 2. System Capabilities: Minimum 620-psig (4278-kPa) calculated working pressure and 360-psig (2484-kPa) initial charging pressure.
- F. Verified Detection: Devices located in single zone. Sound alarm on activating single-detection device, and discharge extinguishing agent on actuating second-detection device.
- G. 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:
  - 1. 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.
  - 2. Air-Sampling System:
    - a. First Detection Level (Alert): Mild audible and visual indication on annunciator panel. Strobe lights flash slowly in the protected area.
    - b. Second Detection Level (Action): Strong audible and visual indication on annunciator panel. Strobe lights flash rapidly in the protected area.
    - c. 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.
    - d. Fourth Detection Level (Fire 2): Same as Fire 1.
- H. Manual stations shall immediately discharge extinguishing agent when activated.
- I. 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.
- J. EPO: Will terminate power to protected equipment immediately on actuation.

**21 2200 CLEAN-AGENT FIRE-EXTINGUISHING SYSTEMS**  
**PAGE 5**

- K. Low-Agent Pressure Switch: Initiate trouble alarm if sensing less than set pressure.
- L. Power Transfer Switch: Transfer from normal to stand-by power source.
- M. Seismic Performance: Fire-suppression piping and containers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
  - 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."

**2.02 PIPING MATERIALS**

- A. See "FK-5-1-12 Agent Piping Applications" 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 "Distribution," for charging pressure of system.

**2.03 PIPE AND FITTINGS**

- A. Steel Pipe: ASTM A 53/A 53M, Type S, Grade B or ASTM A 106/A 106M, Grade A; Schedule 40, Schedule 80, and Schedule 160, seamless steel pipe.
  - 1. Threaded Fittings:
    - a. Malleable-Iron Fittings: ASME B16.3, Class 300.
    - b. Flanges and Flanged Fittings: ASME B16.5, Class 300 unless Class 600 is indicated.
    - c. Fittings Working Pressure: 620 psig (4278 kPa) minimum.
    - d. Flanged Joints: Class 300 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.
- B. 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.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel.
- D. 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.
- E. 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.

**2.04 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.
- B. Container Valves: With rupture disc or solenoid 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.

**2.05 EXTINGUISHING-AGENT CONTAINERS**

- A. 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.
  - 1. Finish: Red, 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.

**2.06 FIRE-EXTINGUISHING CLEAN AGENT**

- B. FK-5-1-12 Clean Agent: Dodecafluoro-2-methylpentan-3-one.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. 3M.

**2.07 DISCHARGE NOZZLES**

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

**2.08 CONTROL PANELS**

- A. Description: FM Approved or NRTL listed, including equipment and features required for testing, supervising, and operating fire-extinguishing system.

**21 2200 CLEAN-AGENT FIRE-EXTINGUISHING SYSTEMS**  
**PAGE 7**

- 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 accessories and alarm devices.
- C. Enclosure: NEMA ICS 6, Type 1, enameled-steel cabinet.
  - 1. Mounting: Surface.
- D. Supervised Circuits: Separate circuits for each independent hazard area.
  - 1. Detection circuits equal to the required number of zones, or addressable devices assigned to the required number of zones.
  - 2. Manual pull-station circuit.
  - 3. Alarm circuit.
  - 4. Release circuit.
  - 5. Abort circuit.
  - 6. EPO circuit.
- E. Control-Panel Features:
  - 1. Electrical contacts for shutting down fans, activating dampers, and operating system electrical devices.
  - 2. Automatic switchover to standby power at loss of primary power.
  - 3. Storage container, low-pressure indicator.
  - 4. Service disconnect to interrupt system operation for maintenance with visual status indication on the annunciator panel.
- 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: Sealed lead calcium 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.

**2.10 DETECTION DEVICES**

- A. General Requirements for Detection Devices:
  - 1. Comply with NFPA 2001, NFPA 72, and UL 268.
  - 2. 24-V dc, nominal.
- 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. Remote Air-Sampling Detector System: Includes air-sampling pipe network, a laser-based photoelectric detector, a sample transport fan, and a control unit.

**21 2200 CLEAN-AGENT FIRE-EXTINGUISHING SYSTEMS**  
**PAGE 8**

1. Pipe Network: CPVC tubing connects control unit with calibrated sampling holes.
  2. Smoke Detector: Particle-counting type with continuous laser beam. Sensitivity adjustable to a minimum of four preset values.
  3. Sample Transport Fan: Centrifugal type, creating a minimum static pressure of 0.05-inch wg (12.5 Pa) at all sampling ports.
  4. 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.
- E. 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.

**2.11 MANUAL STATIONS**

- A. General Description: 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.
- B. Manual Release: "MANUAL RELEASE" caption, and red finish. Unit can manually discharge extinguishing agent with operating device that remains engaged until unlocked.
- C. Abort Switch: "ABORT" caption, momentary contact, with green finish.
- D. EPO Switch: "EPO" caption, with yellow finish.

**2.12 SWITCHES**

- A. Description: FM Approved or NRTL listed, where available, 120-V ac or low voltage compatible with controls. Include contacts for connection to control panel.
  1. Low-Agent Pressure Switches: Pneumatic operation.
  2. Power Transfer Switches: Key-operation selector, for transfer of release circuit signal from main supply to reserve supply.
  3. Door Closers: Magnetic retaining and release device or electrical interlock to cause the door operator to drive the door closed.

**2.13 ALARM DEVICES**

- A. Description: Listed and labeled by an NRTL or FM Approved, low voltage, and surface mounting. Comply with requirements in Division 28 Section "Digital, Addressable Fire-Alarm System" or Division 28 Section "Zoned (DC Loop) Fire-Alarm System" for alarm and monitoring devices.
- B. Bells: Minimum 6-inch (150-mm) diameter.
- C. Horns: 90 to 94 dBA.
- D. Strobe Lights: Translucent lens, with "FIRE" or similar caption.

**2.14 ELECTRICAL POWER AND WIRING**

- A. Electrical power, wiring, and devices are specified in Division 26.

**PART 3 - EXECUTION**

**3.01 EXAMINATION**

- A. Examine areas and conditions, with Installer present, for compliance with hazard-area leakage requirements, installation tolerances, and other conditions affecting work performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

**3.02 FK-5-1-12 AGENT 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.

**3.03 CLEAN-AGENT PIPING INSTALLATION**

- A. Install clean-agent extinguishing piping and other components level and plumb, according to manufacturers' written instructions.
- B. 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.
- C. Install extinguishing-agent containers anchored to substrate.
- D. Install pipe and fittings, valves, and discharge nozzles according to requirements listed in NFPA 2001, Section "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.
  - 4. Install control panels, detection system components, alarms, and accessories, complying with requirements of NFPA 2001, Section "Detection, Actuation, and Control Systems," as required for supervised system application.

**3.04 CONNECTIONS**

- A. Drawings indicate general arrangement of piping, fittings, and specialties.

**21 2200 CLEAN-AGENT FIRE-EXTINGUISHING SYSTEMS**  
**PAGE 10**

- 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. Electrical power, wiring, and devices are specified in Division 28 Section "Digital, Addressable Fire-Alarm System" or Division 28 Section "Zoned (DC Loop) Fire-Alarm System."

**3.05 IDENTIFICATION**

- A. Identify system components and equipment. Comply with requirements for identification specified in Division 26 Section "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.

**3.06 FIELD QUALITY CONTROL**

- A. Testing Agency: 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. Tests and Inspections:
  - 1. After installing clean-agent extinguishing piping system and after electrical circuitry has been energized, test for compliance with requirements.
  - 2. 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.
  - 3. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
  - 4. 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.
  - 5. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- E. Units will be considered defective if they do not pass tests and inspections.
- F. Prepare test and inspection reports.

**3.07 CLEANING**

- A. 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.

**3.10 SYSTEM FILLING**

- A. Preparation:

- 1. Verify that piping system installation is completed and cleaned.
- 2. Check for complete enclosure integrity.
- 3. Check operation of ventilation and exhaust systems.

- B. Filling Procedures:

- 1. Fill extinguishing-agent containers with extinguishing agent, and pressurize to indicated charging pressure.
- 2. Install filled extinguishing-agent containers.
- 3. Energize circuits.
- 4. Adjust operating controls.

**3.11 DEMONSTRATION**

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

**\*\*END OF SECTION\*\***