



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 SCOPE OF WORK

- A. The Contractor shall furnish all labor, equipment, and materials; shall secure all required approvals; and shall perform all operations required in connection with the design and installation of a new stand-alone clean agent fire detection and suppression system as hereinafter described. The new clean agent systems shall utilize FK-5-1-12 (e.g. SAPPHIRE™), or an approved equal.
- B. The hazard area consists of four (4) existing document storage rooms room. Contractor is required to measure precise hazard area volume. Each separate room shall be considered a single agent-releasing zone for a total of four (4) releasing zones. The two rooms on either side of the main corridor will further be combined into a notification zone for a total of two (2) notification zones.
- C. Inspect and repair/modify hazard area enclosure as necessary to ensure the required clean agent design concentration will be maintained for the required 10 minutes. This includes installation and/or repair of walls, dampers, doors, windows, and floor/ceiling/wall penetrations as required.
- D. Provide equipment and connections for the clean agent fire alarm releasing panel (FARP) to be monitored for alarm, supervisory, and trouble signals by the building fire alarm system.
- E. The Contractor shall be responsible for the detailed design and engineering for installation in accordance with these specifications. These specifications do not necessarily contain all information required for installation of the system, but are intended to be used as a guide for the purposes of designing the system and preparing bids. As such, they indicate:
 - 1. Minimum requirements for fixed total flooding clean agent suppression system protection using FK-5-1-12.
 - 2. Types and minimum installation criteria for system devices.
 - 3. General locations for system devices and equipment. Contractor shall propose exact locations.
 - 4. Minimum design requirements.

1.3 SUMMARY

- A. Section Includes:
 - 1. Clean-agent systems.
 - 2. Pipe and fittings.
 - 3. Valves.
 - 4. Extinguishing-agent containers.
 - 5. Fire-extinguishing clean agent.
 - 6. Discharge nozzles.
 - 7. Manifold and orifice unions.
 - 8. Fire control panels.
 - 9. Detection devices.
 - 10. Manual stations.
 - 11. Switches.
 - 12. Alarm devices.

1.4 DEFINITIONS

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

C. FARP: Fire Alarm Releasing Panel

D. FACP: Fire Alarm Control Panel

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Sustainable Design Submittals:

1. Product Data: Documentation that clean- agent chemicals are compliant. Product data submittal shall include:
 - a. Detection devices.
 - b. Manual pull stations.
 - c. Manual discharge switches.
 - d. Clean agent signage.
 - e. Control panel and all associated modules.
 - f. Release devices.
 - g. Battery charger and batteries.
 - h. Alarm devices.
 - i. Agent storage cylinders.
 - j. Mounting brackets.
 - k. Discharge nozzles.
 - l. Abort stations.
 - m. Pipe and fittings.
 - n. Maintenance lock-out switch.
 - o. Classified through-penetration firestop systems.
 - p. Pressure-relief vents

C. 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 weight, volume, and concentration of extinguishing agent required for each hazard area.
3. Include design flow calculations including:
 - a. Quantity of agent per nozzle.
 - b. Type of nozzle.
 - c. Pressure at nozzle.
 - d. Nozzle body nominal pipe size.
 - e. Number and size of cylinder.
 - f. Total agent mass or weight.
 - g. Pipe size per pipe section.
 - h. Pipe schedule per pipe section.
 - i. Number, size, and type of fitting per pipe section.
 - j. Actual length per pipe section.
 - k. Equivalent length per pipe section.
 - l. Discharge time.
4. Include battery calculations
5. Include sequence of operations of clean agent system.
6. 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.
7. 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.

8. Indicate the Following on Access Floor Space Plans:
 - a. Extinguishing-agent containers, piping and discharge nozzles, detectors, and accessories.
 - b. Method of supporting piping.
9. 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.
- D. Test Reports:
 1. Room Integrity Test Reports
 2. Pneumatic pipe testing results

1.6 INFORMATIONAL SUBMITTALS

- A. Design Data:
 1. Permit Approved Drawings: Working plans, prepared according to NFPA 2001, that have been approved by authorities having jurisdiction. Include design calculations.
- B. Field quality-control reports.
- C. Acceptance testing reports.

1.7 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For special agent system to include in emergency, operation, and maintenance manuals.
- B. Record Drawings: Two (2) full-size copies of the final record drawings and an electronic copy of the record drawings in pdf and AutoCAD format. Coordinate AutoCAD edition with Owner. Record drawings shall include all field changes.

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."

1.10 WARRANTY

- A. All system components furnished under this contract shall be guaranteed against defects in design, material and workmanship for the full warranty time which is standard with the manufacturer and/or supplier, but not less than one (1) year from the date of the system acceptance. In addition, the installing contractor must guarantee the systems against false actuation or leakage due to faulty equipment, design

or workmanship for a period of one (1) year from final acceptance. In the event of agent leakage or system discharge from any of the above conditions, the installing contractor shall completely recharge and recondition the system at no cost to the Owner.

PART 2 - PRODUCTS

2.1 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:
1. Ansul Incorporated; Tyco International.
 2. Chemetron Fire Systems.
 3. Fike Corporation.
 4. Pem All Fire Extinguisher Corp.; Pem Systems, Inc.
 5. Pyro-Chem; Tyco Fire Suppression & Building Products.
 6. Siemens Building Technologies, Inc.
- B. Description: Clean-agent fire-extinguishing system shall be an engineered system for total flooding of the hazard area. The clean agent system shall serve four (4) hazard areas consisting of existing document storage rooms. The clean-agent system shall be designed to consist of a multiple storage tank arrangement utilizing a manifold with selector valves for each separate zone.
- 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: Discharge FK-5-1-12 within 10 seconds and maintain 4.5 percent concentration by volume at 70 deg F 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 **4.5** percent throughout holding time will not be accepted without written authorization from Owner and authorities having jurisdiction.
 2. System Capabilities: Minimum 620-psig calculated working pressure and 360-psig initial charging pressure.
- E. Verified Detection: Devices located in single zone. Sound alarm on activating single-detection device, and discharge extinguishing agent on actuating second-detection device.
- F. System Operating Sequence:
1. 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.
 2. 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** seconds, and discharge extinguishing agent.
 3. Extinguishing-agent discharge will operate audible alarms and strobe lights inside and outside the protected area.
- G. Manual stations shall discharge extinguishing agent after a 15 second time delay when activated.
- H. Abort stations shall, when operated, interrupt the agent discharge, ventilation shutdown, and automatic damper closure functions. The abort stations shall be Class B as defined by NFPA 72 and wired momentary devices (dead-man) requiring constant pressure to maintain contact closure. Agent-release manual pull station activation shall override any abort station. Activation of the abort station shall result in a supervisory signal that shall be transmitted to the FARP.
- I. Low-Agent Pressure Switch: Initiate trouble alarm if sensing less than set pressure.

2.2 PIPE AND FITTINGS

- 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.
- C. Steel Pipe: ASTM A 53/A 53M, Type S, Grade B or ASTM A 106/A 106M, Grade A and Grade B; 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 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.
- 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 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.

2.3 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.

2.4 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: 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.

2.5 FIRE-EXTINGUISHING CLEAN AGENT

- A. FK-5-1-12 Clean Agent: Dodecafluoro-2-methylpentan-3-one.
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Fike
 - b. Or approved equal.

2.6 DISCHARGE NOZZLES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Ansul Incorporated; Tyco International.
 2. Chemetron Fire Systems.
 3. Or approved equal.
- B. Equipment manufacturer's standard one-piece brass or aluminum alloy of type, size, discharge pattern, and capacity required for application.
- C. Material: Corrosion-resistant metal.
- D. Stamped with orifice size and type.

2.7 FIRE CONTROL PANELS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Ansul Incorporated; Tyco International.
 2. Chemetron Fire Systems.
 3. Fike.
 4. Or Approved Equal
- B. Description: FM Approved or NRTL listed, including equipment and features required for testing, supervising, and operating fire-extinguishing system.
- C. 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.
- D. Enclosure: NEMA ICS 6, Type 1, enameled-steel cabinet.
 1. Mounting: **Surface.**
- E. 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.
- F. 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.
- G. Standby Power: VLRA 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.

2.8 DETECTION DEVICES

- A. General Requirements for Detection Devices:
 - 1. Comply with NFPA 2001, NFPA 72, and UL 268.
 - 2. 24-V dc, nominal.
- B. Photoelectric Detectors: LED light source and silicon photodiode receiving element.
- C. 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.

2.9 MANUAL STATIONS

- A. General Description: **Surface** 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.

2.10 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.

2.11 AUXILIARY DEVICES

- A. Monitor Modules: Addressable microelectronic module providing a system address for alarm initiating devices for wired applications with normally open contacts. Include address setting means on the module.
- B. Control/Relay Modules: Provide intelligent control relay modules. The Control Relay Module shall provide one form "C" dry relay contact rated at 2 amps @ 24 VDC to control external appliances or equipment shutdown. The control relay shall be rated for pilot duty and releasing systems. The position of the relay contact shall be confirmed by the system firmware.

2.12 NOTIFICATION APPLIANCES

- A. General Requirements for Notification Appliances
 - 1. Connected to notification-appliance signal circuits, zoned as indicated, equipped for mounting as indicated, and with screw terminals for system connections.
- B. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet from the horn, using the coded signal prescribed in UL 464 test protocol.
- C. Visible Notification Appliances: Xenon strobe lights complying with UL 1971, with amber polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- high letters on the lens.
 - 1. Rated Light Output
 - a. 15/30/75/110 cd, selectable in the field.
 - 2. Mounting: Wall mounted unless otherwise indicated.
 - 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 finished, red.

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.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FK-5-1-12 AGENT PIPING APPLICATIONS

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

3.3 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.

3.4 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. Electrical power, wiring, and devices are specified in Section 284621.11 "Addressable Fire-Alarm Systems" or Section 284621.13 "Conventional Fire-Alarm Systems."

3.5 IDENTIFICATION

- A. Identify piping, extinguishing-agent containers, other equipment, and panels according to NFPA 2001.
- B. 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.
- C. 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.

- D. Label all devices, appliances, and auxiliary devices with device address. Address shall match deferred submittal drawings. Labels shall be permanent in nature. Permanent marker is not acceptable.

3.6 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.

3.7 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.

3.8 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.

3.9 DEMONSTRATION

- A. **Train** Owner's maintenance personnel to adjust, operate, and maintain clean-agent fire-extinguishing systems.

END OF SECTION 212200