

CONSTRUCTION STANDARD SPECIFICATION**SECTION 13967****FM-200 CLEAN-AGENT EXTINGUISHING SYSTEM**

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CONSTRUCTION STANDARD SPECIFICATION

SECTION 13967

FM-200 CLEAN-AGENT EXTINGUISHING SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section outlines the requirements for the installation of a HFC-227ea (Heptafluoropropane), hereafter referred to by the trade name FM-200, engineered total flooding fire suppression system with automatic control that includes the following:
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.
- B. The work listed below shall be provided by others or under other Sections of the specifications.
1. 120 VAC power supply to the fire suppression system control panel.
 2. Interlock wiring and conduit for shutdown of HVAC, dampers, and/or electric power supplies, relays, or shunt trip breakers.
 3. Connection to the building fire alarm system.

1.02 REFERENCES

A. Related Construction Standard Specifications

1. Division 1, Section 01065, "ES&H for Construction and Service Contracts".
2. Division 1, Section 01330, "Submittal Procedures".
3. Division 7, Section 07270, "Firestopping".
4. Division 13, Section 13852, "Intelligent Fire Alarm System".
5. Division 13, Section 13855, "High Sensitivity Smoke Detection".
6. Division 16, Section 16001, "Electrical Work".

B. Related Standard Drawings:

1. E-0006STD "Standard Symbols List & General Notes"

C. The current editions of the following standards are a part of this Section:

1. International Building Code and required references
2. NFPA 70 – National Electric Code
3. NFPA 72 – National Fire Alarm Code
4. NFPA 75 – Standard for the Protection of Electronic Computer/Data Processing Equipment
5. NFPA 2001 – Clean Agent Fire Extinguishing Systems

1.03 SYSTEM DESCRIPTION

A. Design system for Class A, B, or C fires as appropriate for areas being protected per the requirements in NFPA 2001. Utilize safety factors specified in NFPA 2001 for the design concentrations for Class A, B, and C fires. Use FM-200 clean agent in concentration suitable for normally occupied areas.

B. Cross-Zoned Detection: Include devices located in two separate zones. Sound alarm on activating single-detection device (1st alarm level for High Sensitivity

Smoke Detection (HSSD) systems), and discharge extinguishing agent on actuating single-detection device in other zone (2nd alarm level for HSSD systems).

C. Each fire suppression system shall have it's own supply of FM-200 in a modular storage design.

D. Sequence of Operation:

1. First Alarm Condition:

- a. First Alarm condition is caused by any one detector in an active alarm state; or the 1st Alarm Level of the High Sensitivity Smoke Detection (HSSD) system is activated.
- b. The local alarm bell will be activated.
- c. The release panel will display text information regarding the alarm.
- d. Shut down of air condition and ventilation systems serving protected area.
- e. Release and close doors in protected area.
- f. An alarm signal will be sent to the building fire alarm system.
- g. The system will remain in this state until some action is taken to reset the system or until another detector alarms.

2. Second Alarm Condition:

- a. Second Alarm condition is caused if there are two detectors in an active alarm state; or the 2nd Alarm Level of the High Sensitivity Smoke Detection (HSSD) system is activated.
- b. The local alarm horn/strobe will be activated.
- c. The release panel will display text information regarding the alarm.
- d. The 60-second time delay will start counting. If the abort switch is held closed, the release will be aborted. As soon as the abort button is released, the discharge delay countdown will restart at the preset duration.

- e. If no other action, the FM-200 will discharge after the time delay expires. Activation of a manual pull station will immediately release the FM-200.
 - f. At discharge, the equipment power will shut down.
- E. Operating manual-release stations will discharge extinguishing agent when activated.
- F. Operating abort switches will delay extinguishing-agent discharge while being activated. Abort switch must be reset to prevent agent discharge. Release of switch will discharge agent.
- G. Time Delays: Time delays should not exceed 30 seconds after the second confirming alarm initiates release of extinguishing agent. Time delays shall not recycle or reset.

1.04 SUBMITTALS

- A. Product Data: Submit for the following equipment:
- 1. Extinguishing-agent containers.
 - 2. Extinguishing agent.
 - 3. Discharge nozzles.
 - 4. Control panels.
 - 5. Detection devices.
 - 6. Manual-release stations.
 - 7. Switches.
 - 8. Alarm devices.
 - 9. Audible/visual notification appliances.
- B. Shop Drawings: The Contractor shall submit the following design information and drawings for acceptance prior to starting work on project:

1. SNL Facilities Management and Operations Center utilizes MicroStation V8 for Windows/NT as its standard CADD software. If MicroStation V8 is not utilized, use AutoCAD.
2. Field investigation layout drawings having a scale of not less than $\frac{1}{4}'' = 1'-0''$ detailing the location of all agent storage tanks, pipe runs including pipe sizes and lengths, control panel(s), detectors, manual pull stations, abort stations, audible and visual alarms, and all mechanical, structural, and electrical interferences.
3. Auxiliary details and information such as maintenance panels, door holders, special sealing requirements, and equipment shutdowns.
4. Separate layouts or drawings for mechanical and electrical work.
5. Separate layout or drawings showing isometric details of agent storage containers, mounting details, and proposed pipe runs and sizes.
6. Electrical layout drawings shall show the location of all devices and include point-to-point conduit runs.
7. Provide copies of flow calculations from an industry recognized commercial program. Calculation sheets must include the manufacturer's name for verification. The individual sections of pipe and each fitting to be used, as shown on isometric drawings, must be identified and included in the calculations. Total agent discharge time must be shown and detailed by zone.
8. Submit drawings, calculations, and system component data sheets for approval by the designated Sandia National Laboratories Fire Protection Engineer before starting construction.
9. Design/submittals shall comply with the requirements of NFPA 2001, Chapter 3.

1.05 QUALITY ASSURANCE

- A. Source Limitations: Obtain extinguishing agent and equipment through one source.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency and marked for intended use.
- C. ASME Compliance: Fabricate piping to comply with ASME B31.1, "Power Piping."

- D. FM Compliance: Provide components that are FM approved and are listed in FM's "Fire Protection Approval Guide."
- E. NFPA Compliance: Fabricate and label clean-agent extinguishing systems to comply with NFPA 2001, "Clean Agent Extinguishing Systems."
- F. UL Compliance: Provide equipment components that are UL listed for clean-agent extinguishing system units in UL's "Fire Protection Equipment Directory."
- G. Contractor Qualifications: Contractor shall have the following qualifications.
 - 1. Be trained by the manufacturer to design, install, test, and maintain FM-200 fire suppression systems.
 - 2. Employ a NICET certified special hazard designer, Level 2, and Fire Alarm System Level 2, or above, who will be responsible for the project.
 - 3. A minimum of five years experience in the design, installation, and testing of FM-200 fire suppression systems.
 - 4. Have an FM-200 recharging station on the Contractor's premises.
 - 5. Provide proof of ability to recharge the FM-200 system within 24 hours after a discharge and list the amount of FM-200 bulk storage available.
 - 6. Provide emergency services within 24 hours notification.

1.06 WARRANTY

- A. All system components furnished and installed under this contract shall be guaranteed against defects in design, materials, and workmanship for the full warranty period which is standard for the manufacturer, but in no case less than one year from the date of systems acceptance.
- B. The Contractor shall provide two inspections of the system(s) installed under this contract during the one year warranty period. The first inspection shall be at the six month interval and the second inspection at the twelfth month interval after system acceptance. Inspections shall be conducted in accordance with the manufacturer's guidelines and comply with the recommendations in NFPA 2001.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Fike Corp.; Fire Protection Systems Div.
 - 2. Fenwal Protection Systems

2.02 PIPING MATERIALS

- A. Piping, Valves, and Discharge Nozzles: Comply with types and standards listed in NFPA 2001, Section "Distribution," and Appendix A, for charging pressure of system.
- B. Plain end couplings are not allowed on any piping systems.

2.03 VALVES

- A. General: Brass; suitable for intended operation.
- B. Container Valves: With rupture disc or solenoid, 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.

2.04 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. 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. Each container shall have a pressure gauge and low pressure switch to provide visual and electrical supervision of the container pressure. The low pressure switch shall be wired to the control panel to provide audible and visual "Trouble" alarm in the event the container pressure drops below 272 psig. The pressure gauge shall be color coded to provide an easy visual indication of container pressure.
- C. Each container shall have a pressure relief valve that automatically operates when the internal temperature exceeds 150 deg F.
- D. Containers shall be actuated by parallel wired initiators located at each agent container.

2.05 FIRE-EXTINGUISHING CLEAN AGENT

- A. Clean Agent: FM-200; HFC 227ea, heptafluoropropane.

2.06 DISCHARGE NOZZLES

- A. Equipment manufacturer's standard one-piece brass or aluminum alloy of type, discharge pattern, and capacity required for application.
- B. Nozzles shall be available in NPT pipe sizes ¼" through 2". Each size shall be available in 180 deg and 360 deg distribution patterns.

2.07 CONTROL PANELS

- A. Description: FM approved or UL listed, including equipment and features required for testing, supervising, and operating fire-extinguishing system.
- B. Power Requirements: 120-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
 2. Locks for all panels shall be keyed alike.

- D. Supervised Circuits: Separate circuits for each independent hazard area.
 - 1. Provide the following crossed-zoned-detection applications:
 - a. Zone 1 detection circuit.
 - b. Zone 2 detection circuit.
 - c. Manual pull-station circuit.
 - d. Alarm circuit.
 - e. Release circuit.
 - 2. Provide the following control-panel features:
 - a. Electrical contacts for shutting down fans, activating dampers, and operating system electrical devices.
 - b. Automatic switchover to standby power at loss of primary power.
 - 3. Standby Power: Sealed lead-acid batteries with capacity to operate system for 72 hours and alarm for minimum of 15 minutes. Include automatic battery charger, with varying charging rate between trickle and high depending on battery voltage, that is capable of maintaining batteries fully charged.

2.08 DETECTION DEVICES

- A. Description: Comply with NFPA 2001 and NFPA 72, and include the following types:
 - 1. Photoelectric Detectors: UL 268, consisting of LED light source and silicon photodiode receiving element.
 - 2. If included in the contract, a Fenwal AnaLASER air-sampling control panel may be utilize to activate the FM-200 fire suppression system control panel.

2.09 MANUAL-RELEASE STATIONS

- A. Description: FM approved or UL listed, with "PULL STATION" caption 24-V dc compatible with controls, and red finish. Include contacts for connection to control

panel. Unit can manually discharge extinguishing agent with operating device that remains engaged until unlocked.

1. Mounting: Surface.

2.10 SWITCHES

A. Description: FM approved or UL listed, where available, 120-V ac or low voltage compatible with controls. Include contacts for connection to control panel.

1. Abort Switches: Dead-man type, requiring constant pressure, for delay of system discharge.

- a. Abort switches do not repeat any time delays.
- b. Abort switches are located within the protected area near the exit.

2. Door Closers: Magnetic retaining and release device.

2.11 ALARM DEVICES

A. Description: FM approved or UL listed, low voltage, and surface mounting, unless otherwise indicated.

B. Horns: 90 to 94 dBA.

C. Strobe Lights: Translucent lens, with "FIRE" or similar caption.

2.12 ELECTRICAL POWER AND WIRING

A. Electrical power, wiring, and devices are specified in Section 16001, "Electrical Work".

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions, with Contractor 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 CLEAN-AGENT EXTINGUISHING PIPING INSTALLATION

- A. Install clean-agent extinguishing piping and other components level and plumb and 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," and related Appendix A paragraphs; and ASME B31.1.
 - 1. Install valves designed to prevent entrapment of liquid or install pressure-relief devices in valved sections of piping systems.
 - 2. Install seismic restraints for extinguishing-agent containers and piping systems.
 - 3. 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.
- E. All piping shall be reamed, blown clear, and swabbed with suitable solvents to remove burrs, mill varnish, and cutting oils before assembly.
- F. All male threads shall be sealed with Teflon tape pipe sealant applied before assembly.

3.03 LABELING

- A. Caution/Advisory Signs: Provide labeling on entrances, piping, extinguishing-agent containers, other equipment, and panels according to NFPA 2001, including:
 - 1. Entrance sign at each entrance to a protected space.
 - 2. Manual Discharge sign at each manual discharge station.
 - 3. Flashing Light sign required at each flashing light over each exit from a protected space.

3.04 WIRING

- A. Raceway and wiring installation shall comply with the requirements in Section 16001, "Electrical Work" and standard drawing E-0006STD.
- B. All wiring shall be installed in electrical metallic tubing (EMT) or conduit.
- C. All system components shall be securely supported independent of the wiring. Runs of conduit and wiring shall be straight, neatly arranged, properly supported, installed parallel and perpendicular to walls and partitions.
- D. The sizes of conductors shall be those specified by the system manufacturer. Color codes shall be used. All wires shall be free from grounds and crosses between conductors.
- E. Install wiring to conform to the National Electric Code for Class 1 Signal Systems, except as otherwise permitted for limited energy circuits, as described in NFPA 72.
- F. The complete system electrical installation, and all auxiliary components, shall be grounded in accordance with NFPA 70.

3.05 TRAINING REQUIREMENTS

- A. Prior to acceptance, provide operational training and materials on the system to the owners of the protected space and other personnel designated by the SNL Fire Protection Engineer.
- B. Training session shall include system control panel operation, manual and abort functions, trouble procedures, auxiliary functions, and emergency procedures.

3.06 OPERATION AND MAINTENANCE

- A. Prior to final acceptance, provide four copies of a complete operation and maintenance manual to the Sandia Construction Observer. The manual shall include the following:
 - 1. All aspects of system operation and maintenance detailed, including piping isometrics, wiring diagrams of all circuits, a written description of system design and sequence of operation.
 - 2. Drawing(s) illustrating control logic.
 - 3. Equipment used in the fire suppression system.

4. Checklists and procedures for emergency situations.
5. Troubleshooting techniques.
6. Maintenance operations and procedures.

3.07 AS-BUILT DRAWINGS

- A. Provide four copies of system “as-built” drawings to the Sandia Construction Observer. Drawings shall include:
 1. Actual equipment locations (control panels, agent containers, detectors, alarms, manual and abort switches).
 2. Piping and conduit routing details.
 3. All room or facilities modifications.
- B. Provide the electronic media of the CADD drawings generated to the Sandia CADD Coordinator.

3.08 SYSTEM INSPECTION AND CHECKOUT

- A. After system installation is completed, the entire system shall be checked out, inspected, and functionally tested by qualified, trained personnel, in accordance with the manufacturer’s recommended procedures and NFPA 2001, Section “Approval of Installations”.
- B. All containers and distribution piping shall be tested for proper mounting and installation. Perform a “puff test” by discharging a sufficient flow of nitrogen through the piping to verify integrity of piping installation.
- C. All electrical wiring shall be tested for proper connection, continuity, and resistance to ground.
- D. The complete system shall be functionally tested in the presence of the Sandia Construction Observer (SCO) and SNL Fire Protection Engineer.
- E. All functions, including system and equipment interlocks, must be operational at least five days prior to the final acceptance tests.

- F. Remove all keys from manual pull stations, control panels, and all other key-operated devices when FM-200 agent becomes operational. Deliver keys to Fire Protection Engineering.
- G. Verify all manual pull stations are in the securely closed position to prevent an inadvertent FM-200 release.

3.09 ACCEPTANCE TESTING

- A. Conduct acceptance tests in the presence of the Sandia Construction Observer and SNL Fire Protection Engineer.
- B. The acceptance test shall include the following:
 - 1. The entire control system shall be tested to determine its functions as designed and intended. All circuits shall be tested, including.
 - a. Automatic actuation
 - b. Manual actuation
 - c. HVAC and power shutdowns
 - d. Audible and visual alarm devices
 - e. Manual override of abort functions
 - f. Smoke/fire damper operation
 - g. Agent container pressure supervision
 - 2. Supervision of all panel circuits, including AC power and battery power supplies, shall be tested and qualified.
 - 3. Conduct a room pressurization test for each protected space to determine the presence of openings that would impact FM-200 system concentration levels during an activation. Testing shall be conducted in accordance with NFPA 2001 requirements.
 - a. If openings are discovered, the Contractor shall be responsible for coordinating the proper sealing of the protected space(s) by the general contractor.

- b. Upon completion of repairs, the Contractor shall conduct additional room pressurization tests, at no additional cost to Sandia National Laboratories, until a successful test is obtained.
- c. Copies of successful test results shall be submitted to the Sandia Construction Observer and Sandia Fire Protection Engineer for record.

- END OF SECTION -