

SECTION 15365

FM – 200 CLEAN AGENT EXTINGUISHING SYSTEM

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Fire detection system.
- B. Control and supervision systems.
- C. FM – 200 storage and distribution suppression system.

1.2 RELATED SECTIONS

- A. Section 08710 - Hardware: Release hardware for automatic closing doors.
- B. Section 15010 - General provisions for fire protection works.
- C. Section 15055 - Painting.
- D. Section 15241 - Noise and vibration criteria for building and seismic control.
- E. Section 15330 - Fire Suppression Systems.
- F. Section 15952 - Controls and Instrumentation: Dampers.
- G. Section 16120 - Wire and Cable.
- H. Section 16180 - Equipment Wiring Systems.
- I. Section 16721 - Fire Alarm and Detection Systems: Building fire alarm system and devices.

1.3 REFERENCES

- A. ANSI/ASME B16.3 - Malleable Iron Threaded Fittings Class 150 and 300.
- B. ANSI/ASME B16.9 - Factory Made Wrought Steel Buttwelding Fittings.
- C. ANSI/ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
- D. ANSI/ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
- E. ANSI/ASME B31.1 - Power Piping.
- F. ANSI/ASME SEC 8 - Pressure Vessels.
- G. ANSI/ASME SEC 9 - Welding and Brazing Qualifications.
- H. ANSI/AWS A5.8 - Specifications for Brazing Filler Metal.
- I. ANSI/AWS D1.1 - Structural Welding Code.
- J. ANSI/NFPA 2001 – FM – 200 Fire Extinguishing Systems.
- K. ANSI/NFPA 70 - National Electric Code.

مشروع أعمال الكهرباء و مقاومة الحريق – UNHCR RSD/T

- L. ANSI/NFPA 72A - Local Protective Signaling Systems.
- M. ANSI/NFPA 72E - Automatic Fire Detectors.
- N. ASME B40.1 - Gauges - Pressure Indicating Dial Type-C Elastic Element.

- O. ASTM A53 - Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.
- P. ASTM A106 - Seamless Carbon Steel Pipe for High-Temperature Service.
- Q. ASTM A135 - Electric-Resistance-Welded Steel Pipe.

- R. ASTM A234 - Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.

- S. ASTM B32 - Solder Metal.

- T. ASTM B88 - Seamless Copper Water Tube.
- U. FM - Factory Mutual Approval Guide.
- V. FS GG-G-76 - Gauges, Pressure and Vacuum, Dial Indicating (for Air, Steam, Oil, Water, Ammonia, Chloro- fluoro hydrocarbon Gases, and Compressed Gases).

- W. MIL-M-12218 -

- X. NEMA ICS 6 - Enclosures for Industrial Controls and Systems.
- Y. UL - Fire Protection Equipment Directory.
- Z. UL 393 - Indicating Pressure Gauges for Fire and Protection Services.
- AA. UL 404 - Gauges, Indicating Pressure, for Compressed Gas Service.

1.4 SYSTEM DESCRIPTION

- A. Design, fabrication, and installation: In compliance with requirements and recommendations of ANSI / NFPA 2001.

- B. Fire Protection System: Total flooding of hazard area with 7 percent concentration by volume of C3 HF7 hepta fluoro propane HFC – 227 e.a (FM – 200) in max. 10 seconds discharge time, to extinguish fire.

- C. System is fixed installation with equipment designed and installed to provide fire-extinguishing capability for under floor & occupied area of areas shown and clarified in design drawings.

1.5 DESIGN REQUIREMENTS

- A. Provide sufficient amount of FM -200 liquid to convert into FM -200 vapor. Consider the following when computing volume:
 - 1. Volume of hazard area.
 - 2. Specific volume of FM -200 vapor.
 - 3. Additional quantities of FM -200 required to compensate for openings, pipe losses, and nitrogen dilution.
 - 4. Forced ventilation, fan coast downtime and damper actuation time.

مشروع أعمال الكهرباء و مقاومة الحريق – UNHCR RSD/T

5. Mechanical smoke control system.
6. Other special conditions affecting extinguishing efficiency.
- B. Locate FM - 200 supply and backup supply in each hazard area.
- C. Interface system with building fire alarm system, smoke control system & emergency power off system.

1.6 PERFORMANCE REQUIREMENTS

- A. Provide total flooding of 7 percent FM -200 concentration by volume, in maximum 10 seconds discharge time.

1.7 SUBMITTALS

- A. Shop Drawings: To bear stamp of approval of authority having jurisdiction, Fire Marshall, Owner's fire insurance underwriter. Indicate detailed layout of system, including piping and location of each component. Include control diagrams, wiring diagrams, and written sequence of operation.
- B. Product Data: To bear stamp of approval of authority having jurisdiction, Fire Marshall, Owner's fire insurance underwriter. Furnish each piece of equipment comprising the system including cylinders, manifolds, control panel, nozzles, detectors, alarm bells or horns, switches, and annunciators.
- C. Samples: Submit one sample of each detector, manual pull station, and nozzle.
- D. Design Data: Submit design calculations bearing stamp of approval of authority having jurisdiction, Fire Marshall, Owner's fire insurance underwriter. Results shall include calculations that verify system pressures, nozzle flow rate, orifice code numbers, piping pressure losses, component flow data, and pipe sizes.
- E. Test Reports: Indicate successful completion of tests.
- F. Manufacturer's Installation Instructions: Indicate installation of equipment and system components.
- G. Manufacturer's Certificate: Certify that system meets or exceeds specified requirements and ANSI/NFPA 2001.
- H. Welders Certification: Submit certificate indicating compliance with [ANSI/ASME SEC 9] [ANSI/AWS D1.1].

1.8 PROJECT RECORD DOCUMENTS

- A. Accurately record exact location of equipment, equipment identification markings, conduit and piping routing details, and agent storage positions.

1.9 OPERATION AND MAINTENANCE DATA

- A. Include electrical schematic written description of system design, drawings illustrating control logic and equipment locations, and technical brochures describing equipment.
- B. Include list of recommended spare parts.

مشروع أعمال الكهرباء و مقاومة الحريق – UNHCR RSD/T

- C. Include checklists and procedures for emergency situations, troubleshooting techniques, abort functions, system control panel operation, trouble procedures, and safety requirements.

1.10 QUALITY ASSURANCE

- A. Perform Work in accordance with ANSI/NFPA 70, ANSI/NFPA 72A, and ANSI/NFPA 72E; applicable UL, ULC, FM, LPC & ISO standards; and requirements of applicable codes and ordinances.
- B. Indicate manufacturer's name and pressure rating on valve body. Indicate manufacturer, type, and size, part number, orifice code or orifice diameter on discharge nozzles. Markings shall be standard and visible after installation.
- C. Welding Materials and Procedures: Conform to ANSI/ASME SEC 9.
- D. Welders Certification: To ANSI/ASME SEC 9 ANSI/AWS D1.1.
- E. Maintain one copy of each document on site.

1.11 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing of products specified in this Section with minimum five years documented experience.
- B. Installer: Company specializing in performing the work of this Section with minimum ten years documented experience approved by manufacturer, who maintains a UL listed FM - 200 recharging station and is capable of providing replacement charge within 24 hours.
- C. Design system using a UL, ULC, LPC or FM approved calculation method under direct supervision of a Professional Engineer:
 - 1. Experienced in design of this work.
 - 2. Licensed at the place where the Project is located.

1.12 REGULATORY REQUIREMENTS

- A. Conform to applicable ANSI/NFPA 2001 code for system.
- B. Conform to ANSI/NFPA 70 and ANSI/NFPA 72A code for electrical wiring and wiring devices.
- C. Provide certification of inspection approval of FM -200 fire protection system by authority having jurisdiction.

1.13 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site
- B. Accept materials and components on site in shipping containers. Inspect for damage.
- C. Deliver and store equipment in shipping containers with labelling in place. Deliver FM 200 in approved containers.

1.14 WARRANTY

مشروع أعمال الكهرباء و مقاومة الحريق – UNHCR RSD/T

- A. Provide one year warranty.
- B. Warranty: Include coverage for replacement FM – 200

1.15 MAINTENANCE SERVICE

- A. Conduct inspections 6 and 12 months from Date of Substantial Completion to verify proper operation of system and to check agent container weight and pressure. Include a thorough check of controls, detection and alarm systems.
- B. Submit documents, certifying satisfactory system conditions. Include manufacturer's certificate of acceptance of Inspector's qualifications.

1.16 EXTRA MATERIALS

- A. Submit maintenance materials.
- B. Provide one complete set of special tools required for servicing and maintaining equipment .
- C. Provide one of each type of detector.

1.17 PIPE AND PIPING SPECIALTIES

- A. Steel Pipe: ASTM A53 or A106, Schedule 40, black.
 - 1. Fittings: ANSI/ASME B16.3 malleable iron class 300 for sizes 2 inch (50 mm) and smaller, or ASTM A234, forged steel welding type fittings.
 - 2. Joints: Screwed, ANSI/AWS D1.1 welded, or grooved and shouldered pipe end couplings.
- B. Copper Tubing: ASTM B88, Type M, L & K hard drawn.
 - 1. Fittings: ANSI/ASME B16.18 cast copper or ANSI/ASME B16.22 wrought copper.
 - 2. Joints: ASTM B32, solder 95-5 Tin Antimony, ANSI/AWS A5.8, BCup silver braze.
- C. Pipe Hangers: ANSI/ASME B31.1, UL or FM approved split clamp up to 2-1/2 inch (60 mm) size, riser clamps over 2-1/2 inch (60 mm) size, adequate to offset discharge thrust.
- D. Escutcheons: Chrome plated pressed or stamped brass, one- piece or split pattern, minimum 2 inches (50 mm) larger than opening.
- E. Gauges: ASME B40.1, UL 393, UL 404, [FS GG-G-76] [3-1/2 inch (90 mm)] diameter cast aluminum case, phosphor bronze bourdon tube, rotary brass movement, brass socket, front re-calibration adjustment, black figures on white background, 1 percent mid-scale accuracy, scale calibrated both psi and kPa.

1.18 MANUAL PULL STATIONS

- A. Single action control: Molded surface housing fitted with "pull down" lever which locks in position after releasing spring-loaded contact switch.
- B. Double action control: Molded surface housing fitted with "push in" tab and "pull down" lever which locks in position after releasing spring-loaded contact switch.

- C. Labeling: Locate engraved label adjacent to each manual pull station, indicating area protected, and that actuation will cause Halon discharge.

1.19 IONIZATION DETECTORS

- A. Detector, ANSI/NFPA 72E, UL listed, adjustable sensitivity, operating on ionization principle, activated by combustion products, plug-in, twist-lock unit easily removed from base.
- B. Ionization chambers: Dual, one for fire detection and second for reference, stabilizing detector for changes in temperature, humidity, and pressure.
- C. Amplifier-Switching Circuit and Indicator Lamp: Solid state, two-wire, operating on detector line voltage. On alarm, unit shall lock and be reset at control panel.
- D. Adjustment: Manual for normal or high sensitivity, with sensitivity setting visible and requiring no special tools.

1.20 PHOTOELECTRIC DETECTORS

- A. Detector: ANSI/NFPA 72E, UL listed, adjustable sensitivity, with LED light source and photocell, activated by smoke, plug-in, twist-lock unit easily removed from base.
- B. Amplifier-Switching Circuit and Indicator Lamp: Solid state, two-wire operating on detector line voltage. On alarm, unit shall lock and be reset at control panel.
- C. Adjustment: Manual for normal or high sensitivity, with sensitivity setting visible and requiring no special tools.

1.21 DISCHARGE NOZZLES

- A. Discharge: To provide required rates of discharge and coverage and to distribute FM – 200 uniformly throughout protected area.
- B. Construction: One piece chrome plated brass or aluminum nozzle with textured finish with female pipe thread integral on body. Direct discharge parallel to ceiling.
- C. Identification: Permanently mark nozzles to show equivalent single orifice diameter.

1.22 FM – 200 CYLINDERS

- A. Cylinders: Standard model and size for ease of replacement and addition. Design, fabricate, certify, and stamp cylinders in accordance with ANSI/ASME SEC 8.
- B. Contents: Fill cylinders with required FM – 200 . Pressurize with dry nitrogen to 360 PSIG (2482 KPa) plus or minus 5 percent total pressure at 70 degrees F.
- C. Identification: Permanent plate, specifying agent, tare and gross weight, pounds of FM –200 and pressurization level; installed so plate is visible and readable.
- D. Safety Release: Equip cylinders with frangible disc safety device.

مشروع أعمال الكهرباء و مقاومة الحريق – UNHCR RSD/T

- E. Cylinder Valves: Heavy duty forged brass, incorporating safety release pressure operated manual control, solenoid discharge valve, and pressure gauge. Provide solenoid pilot valves for each cylinder or bank of cylinders.
- F. Manifold: Provide for systems with more than one cylinder, with rack to secure each cylinder and check valves between each cylinder discharge and manifold.

1.23 CONTROL CABINET

- A. UL, or FM approved as alarm and releasing device, with solid state internal circuitry enclosed in NEMA ICS 6, Type 1 cabinet.
- B. Provide supervision to ANSI/NFPA 72A, Class (A) of following circuits for wire break or ground faults:
 - 1. Zone detection loops.
 - 2. Remote manual discharge stations.
 - 3. Suppression system solenoid valves.
 - 4. Power supply and circuit wiring and fuse.
 - 5. Battery interconnecting wires and fuse.
 - 6. Alarm in abort mode.
- C. Equip panel with following standard features:
 - 1. Visual and audible annunciation of trouble or alarm signals.
 - 2. Panel reset switch.
 - 3. Trouble alarm silence switch with ring back feature.
 - 4. Cross zone detection.
 - 5. Battery test meter and switch.
 - 6. Manual discharge switch.
 - 7. Dead man abort switch.
 - 8. Programmable timers for pre-discharge and discharge, 0 - 60 second cycle.
 - 9. Isolated relay contactors for external alarm or equipment and ventilation shutdown.
 - 10. Relay contactors for general trouble signal.
 - 11. Relay contactor activated by detector zone board in alarm or trouble mode.
- D. Provide sealed lead – acid batteries and charger for continuous operation of detection, alarm, actuation and supervision functions for 48 hours. Provide automatic battery switch-over upon failure of primary power supply.

مشروع أعمال الكهرباء و مقاومة الحريق – UNHCR RSD/T

E. Conceal control switches and indicators, with exception of Power On, Master Trouble, Supervisory Trouble, Circuit 1 Alarm, Circuit 2 Alarm and Release Indicators. Provide the following annunciation.

1.	Power On	:	Green.
2.	System Trouble	:	Amber.
3.	Battery Trouble	:	Amber.
4.	Circuit 1 Trouble	:	Amber.
5.	Circuit 2 Trouble	:	Amber.
6.	Ground Fault	:	Amber.
7.	Release trouble	:	Amber.
8.	Alarm Circuit 1	:	Red.
9.	Alarm Circuit 2	:	Red.
10.	Agent Release	:	Red.
11.	Alarm Silence	:	Amber.
12.	Battery Polarity	:	Amber.

مشروع أعمال الكهرباء و مقاومة الحريق – UNHCR RSD/T

- 13. Abort Trouble : Amber.
- 14. Alarm Output Trouble : Amber.
- 15. Supervisory Trouble : Amber.

1.24 MISCELLANEOUS EQUIPMENT

- A. Alarm Bells: Low voltage to allow supervision of circuit wiring, of modular design, with minimum sound level of 88 db at 10 ft (3 meters).
- B. Alarm Horns: Low voltage to allow supervision of circuit wiring, with minimum sound level of 90 db at 10 feet (3 meters)

1.25 OPERATING SEQUENCE

- A. Actuation of one detector in either zone circuit:
 - 1. Illuminate zone indicator.
 - 2. Energize alarm horn.
 - 3. Shut down air-conditioning system and close dampers.
 - 4. Close doors to area.
 - 5. Signal building fire alarm system.
- B. Actuation of second detector on second zone circuit:
 - 1. Illuminate zone indicator.
 - 2. Energize alarm horn.
 - 3. Shut down power to protected equipment.
 - 4. Actuate time delay for up to 60 seconds.
 - 5. Release FM – 200 into protected area.
 - 6. If abort switch is engaged, delay release.
 - 7. Upon abort switch disengagement release FM –200 unless system cleared and reset.
- C. Discharge of FM –200.
 - 1. Sounds alarm horns.
 - 2. Operates strobes.
- D. Temperature Detection.
 - 1. Lower Temperature: Illuminate indicator and energize horn.
 - 2. Higher Temperature: Shut down power to protected equipment.

PART 2 - EXECUTION

2.1 EXAMINATION

- A. Verify that spaces are ready to receive work .
- B. Verify that enclosing walls are continuous above ceilings and below raised floors to enable required concentration to be built up and maintained for required time to ensure effective fire extinction.

2.2 INSTALLATION

مشروع أعمال الكهرباء و مقاومة الحريق – UNHCR RSD/T

- A. Install in accordance with manufacturer's instructions and ANSI/NFPA 2001
- B. Ream pipe and tube ends. Remove burrs. [Bevel plain end ferrous pipe.] Remove scale and dirt on inside and outside before assembly. Blow out pipe before nozzles or discharge devices are installed.
- C. Route piping in orderly manner, concealed, plumb and parallel to building structure, and maintain gradient. Install piping to conserve building space, and not interfere with use of space and other work.
- D. Securely support piping in accordance with ANSI/ASME B31.1 with allowance for FM –200 thrust forces, and thermal expansion and contraction.
- E. Use grooved mechanical couplings and fasteners only in accessible locations. Roll groove piping only.
- F. Install unions downstream of valves and at equipment or apparatus connections.
- G. Prepare pipe, fittings, supports, and accessories for finish painting, in accordance with Section 15055.
- H. Identify in accordance with ANSI/NFPA 2001 requirements. Place directional arrows and system labels wherever piping changes direction and minimum 20 feet (6 meters) on straight runs.
- I. Secure cylinders as indicated on Drawings. [Where manifolded, mount and support by rack as indicated. For each system provide same size cylinders containing equal amounts of liquid.]
- J. In rooms with suspended ceiling tiles, clip or retain tiles within 4 foot (1.2 m) radius of the nozzles to prevent lifting during discharge.
- K. Install wiring in accordance with Section [16120] & [16180] requirements.
- L. Make final connections between equipment and system wiring under direct supervision of factory trained representative of manufacturer.
- M. Install engraved plastic instruction plate, detailing emergency procedures, at control panel and at each manual discharge and abort switch location. At control panel identify control logic units, contacts, and major circuits with permanent nameplates.
- N. At hazard area walls pack space between pipe, pipe sleeve or surface penetration with mineral fiber with elastomer calk to depth of 1/2 inch (13 mm). Provide escutcheons where exposed piping passes through walls, floors, and ceilings. Seal pipe penetrations of fire separations.
- O. Locate discharge nozzle approximately 6 inches (150 mm) above or below ceiling and 6 inches (150 mm) below raised floors. Avoid interference with other piping and equipment.
- P. Locate remote manual releases at one or more doors to protect area where indicated. Locate deadman abort switch adjacent.
- Q. Provide signal to building fire alarm system. Refer to Section 16721.
- R. Provide interlock with automatic closing door releases.
- S. Provide interlock with motorized dampers. Refer to Section 15952.

2.3 TESTING

مشروع أعمال الكهرباء و مقاومة الحريق – UNHCR RSD/T

- A. Provide testing and analysis.
- B. Test distribution piping and valving, prior to nozzle installation, to 50 psig (340 kPa) air pressure test. Inspect joints using soap water solution or halide torch or lamp. Repair leaks and retest. Maintain test pressure for four hours.
- C. Upon completion of installation provide final checkout inspection by factory trained representative of manufacturer to ascertain proper system operation. Leave system in a fully commissioned and automatic readiness state with circuitry energized and supervised.
- D. Test circuits including automatic discharge, manual discharge, equipment shut-down, alarm devices, and storage container pressure. Test supervision of each circuit.
- E. Check each ionization detector with a sensitivity meter, adjust. Record sensitivity, and include record in test report.
- F. Submit original copies of tests, indicating that factory trained technical representatives of the manufacturer have inspected and tested systems and are satisfied with methods of installation, connections and operation.

2.4 MANUFACTURER'S FIELD SERVICES

- A. Prepare and start systems.
- B. Provide experienced manufacturer's field engineer to supervise installation and performance testing of the system.

2.5 DEMONSTRATION

- A. Provide systems demonstration.
- B. Demonstrate that components except cylinder discharge assembly, are functioning properly and in conjunction with controls system.
- C. Submit integrated step-by-step test procedure for approval 30 days prior to start of demonstration.
 - 1. Arrange meeting prior to demonstration with representatives of the Owner, the Owner's Underwriter, and the installer.
 - 2. Perform visual inspection and overall review of system installed.
 - 3. Place minimum of three UL listed recording analyzers in space. Provide certification that testing devices have been checked by recognized testing authority within two weeks of date of demonstration.
 - 4. Certify that replacement charge can be provided within 24 hours of demonstration.
- D. Discharge system using manual-release switch mounted on control panel. Run discharge test with compressed nitrogen at 360 psig (2500 kPa) FM –200 After discharge, check cylinders for complete pressure release.
- E. After satisfactory completion of discharge test, fill cylinders with amount of FM –200 specified in design calculations.

UNHCR RSD/T – مشروع أعمال الكهرباء و مقاومة الحريق

2.6 SCHEDULES

Location	Detectors Smoke Heat	Zone Abort Switch	Manual Discharge	Alarm Bell Horn
Hazard Area One	3	1	2	
Ceiling	4	1	1	
Ceiling	4	1	2	
Sub Floor	4	1		
Sub Floor	4	2		
Hazard Area Two	1	1	2	
Ceiling	2	3		
Ceiling 2	4			

END OF SECTION 15365

مشروع أعمال الكهرباء و مقاومة الحريق – UNHCR RSD/T