SECTION 21 2400CA - CLEAN AGENT CHEMICAL SUPPRESSION 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.

B. Section 21 0000 – General Fire Suppression Requirements.

1.2 APPLICABLE STANDARDS AND PUBLICATIONS

A. The design, installation, testing and maintenance of the Clean Agent Extinguishing System shall be in accordance with the applicable requirements set forth in the latest edition of the following codes, standards, and third party approval agencies:

1. Illinois Building Code, Fire Code, and required references
3. Requirements of the local Authority Having Jurisdiction (AHJ)
4. NFPA 2001: Standard on Clean Agent Fire Extinguishing Systems
5. NFPA 70: National Electrical Code
8. FM Global
9. Underwriters Laboratories (UL)

1.3 SUMMARY

A. Section Includes:

1. Piping and piping specialties.
2. Extinguishing-agent containers.
3. Extinguishing agent.
5. Releasing control panel.
6. Accessories.
7. Connection devices for and wiring between system components.
8. Connection devices for power and integration into building’s fire-alarm system.

B. Section Excludes:

1. Power supply (120/208 VAC) to system control panel.
2. Interface (conduit and wiring) to HVAC units, dampers, electric power supplies, relays, or shunt-trip breakers.
3. Interface (conduit and wiring) to local/remote fire alarm system
4. Connection to listed central station fire alarm system.
5. Connection to University SCADA system covered by Division 25.
6. Room sealing, other than penetrations made by the suppression system contractor during system installation. Suppression system contractor shall coordinate room sealing requirements with project’s General Contractor and all sub-contractors.

1.4 DEFINITIONS

A. AHJ: Authority Having Jurisdiction.

1.5 ACTION 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:

   1. Prepared by persons with the following qualifications:

      a. Properly licensed and qualified professional engineer licensed in the State of Illinois,
      b. Trained and certified by the manufacturer of the Clean Agent Suppression system.

   3. Comply with the recommendations in the “Documentation” Section of the “Fundamentals of Fire Alarm Systems” Chapter in NFPA 72.
   4. Include plans, elevations, sections, details, and attachments to other work.
   5. Include design calculations: Enclosure volume, agent quantity, backup battery, voltage drop, detector spacing, etc.
   6. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   7. Include plans to indicate mounting location of field devices, including size and routing of cable and conduits.
   8. Submittals shall be signed and sealed by a qualified Professional Engineer registered in the State of Illinois prior to submitting them to the Authority Having Jurisdiction.
   9. Submittals shall be approved by the Authority Having Jurisdiction prior to submitting them to Architect.

D. Delegated-Design Submittal: For clean agent systems indicated to comply with performance requirements and design criteria, including analysis data signed by the professional engineer responsible for their preparation.

   1. Indicate compliance with performance requirements and design criteria, including analysis data.
   2. Include design calculations for selecting the spacing and sensitivity of detection devices, complying with NFPA 72 and FM Global requirements.
3. Include design calculations for weight, volume, and concentration of extinguishing agent required for each hazard area.
4. Include design calculations for enclosure pressure relief/venting as required to avoid structural damage to the hazard enclosure, equipment, or building.
5. 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.

6. 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.

7. Indicate the Following on Access Floor Space Plans:
   a. Extinguishing-agent containers, piping and discharge nozzles, detectors, and accessories.
   b. Method of supporting piping.

8. 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.

1.6 INFORMATIONAL SUBMITTALS

A. 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. Lighting fixtures.
   3. HVAC Air outlets and inlets.

B. Permit Approved Drawings: Working plans, prepared according to NFPA 2001, that have been approved by Authorities Having Jurisdiction. Include design calculations.

C. Field quality-control reports.

D. Installer Qualifications:
   1. Authorized distributor of the system manufacturer. Shall maintain an inventory of replacement parts.
2. Trained by the system manufacturer to design, install, test, and maintain the clean agent extinguishing system.
3. Provide proof of emergency service available on a twenty-four hour, seven-days-a-week basis.
4. Maintain or have access to a recharging station capable of recharging the largest suppression system within 72 hours after a discharge.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For special agent system to include in emergency, operation, and maintenance manuals.

B. Deliver copies to Authorities Having Jurisdiction and include the following:
   1. Comply with the “Records” Section of the “Inspections, Testing and Maintenance” Chapter of NFPA 72.
   2. Provide “Record of Completion Documents” according to NFPA 72 article “Permanent Records” in the “Records” section of the “Inspection, Testing and Maintenance” Chapter in NFPA 72.
   3. Record copy of site-specific software.
   4. Provide “Maintenance, Inspection and Testing Records” according to NFPA 72 article of the same name and include the following:
      a. Frequency of testing of installed components.
      b. Frequency of inspection of installed components.
      c. Requirements and recommendations related to results of maintenance.
      d. Manufacturer’s user training manuals.
   5. Manufacturer’s required maintenance related to system warranty requirements.
   6. Abbreviated operating instructions for mounting at the control panel.
   7. Copy of NFPA 25.

C. As-built Drawings: Indicate actual installation configuration at time of project completion including all equipment locations, pipe routing, conduit routing, room configurations, etc.

D. Northwestern University Maintenance Requirement Forms, refer to Division 01 for more information.

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: Area smoke detectors, quantity as required, minimum two (2).

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. Comply with FM Global requirements for general installation of clean agent systems, and for system inspections, testing and maintenance.

C. Additional FM Global Compliance: Provide components that are FM Global Approved and that are listed in FM Global's "Approval Guide."

D. UL Compliance: Provide equipment listed in UL's "Fire Protection Equipment Directory."

E. All devices, components, and equipment shall be new, standard products of the manufacturer's latest design and suitable to perform the functions intended. The name of the manufacturer, part number, and serial number shall appear on all major components.

F. Locks for all cabinets shall be keyed alike.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide a Fike; FM-200 system, or an equal system by one of the following manufacturers:

1. Chemetron Fire Systems; a UTC Fire & Security company.
2. Fenwal Protection Systems.

B. Description: Clean-agent fire-extinguishing system shall be an engineered system for total flooding of the hazard area.

C. 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: (FM-200 per NFPA 2001).

1. Minimum design concentration: As calculated, by volume in all areas and/or protected spaces at the minimum anticipated temperature within the protected area.
2. The system design shall not exceed a maximum exposure limit concentration level per NFPA 2001, unless provisions for room evacuation before agent release are provided. All personnel should be able to leave the protected space prior to the discharge or at least within 5 minutes of the commencement of discharge.

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

2.2 SYSTEM OPERATING SEQUENCE

A. Verified Detection:

1. Actuating First Detector (Pre-Alarm):
   a. Visual and audible indication on local control panel.
b. Energize audible and visual alarms inside the protected hazard area (unique pattern).

c. Transfer relays to shut HVAC duct dampers serving protected area and send "pre-alarm" signal to main fire-alarm system panel.

2. Actuating Second Detector (Pre-discharge):

   a. Visual and audible indication on local control panel.
   
   b. Energize audible and visual alarms inside the protected hazard area (unique pattern).
   
   c. Transfer relay to shut down power to protected area man-door security lock, that then allows man-door to be opened from Corridor side (bypassing security system).
   
   d. Transfer relays to shut down recirculating air-conditioning units serving protected area.
   
   e. Start time delay for extinguishing-agent discharge for 30 seconds.
   
   f. Initiate system abort sequence, if abort switch is pressed and held in "abort" position. Release of hand pressure on the abort switch will cause agent discharge if the discharge time delay has expired.

3. Extinguishing-agent discharge (Release Alarm): Pre-discharge time delay expires or manual release switch is operated.

   a. Visual and audible indication on local control panel.
   
   b. Energize audible and visual alarms inside and outside the protected area (unique pattern).
   
   c. Transfer relay to send "Extinguishing Agent Release" to main fire alarm system panel.
   
   d. Release clean agent suppression system agent.

B. Supervisory signal initiation shall be by the following device:

1. Either clean agent container low pressure switch.

C. Trouble signal initiation shall be by one or more of the following devices and actions:

1. Open circuits, shorts, and grounds in designated circuits.
2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
3. Loss of primary power at fire-alarm control unit.
4. Ground or a single break in fire-alarm control unit internal circuits.
5. Abnormal AC voltage at fire-alarm control unit.
7. Failure of battery charging.
8. Abnormal position of any switch at fire-alarm control unit or annunciator.

D. System Supervisory and Trouble Signal Actions:

1. Visual and audible indication on control panel.
2. Transfer relays to send signal to fire-alarm system.

E. Operating manual release switches will cause the immediate discharge of the extinguishing agent, overriding the system’s discharge time delay and abort functions. Panel operation shall duplicate the extinguishing-agent discharge sequence described in the previous paragraphs.
1. Electric manual release switches shall be located at each hazard exit.

F. Operating abort switches will delay extinguishing-agent discharge while being activated. Release of hand pressure on the switch will cause agent discharge if the discharge time delay has expired.

2.3 PIPING MATERIALS


B. Plain end couplings are not allowed on any piping systems.

C. No welding allowed.

2.4 VALVES

A. General Valve Requirements:
   1. UL listed and FM Global approved for use in fire-protection systems.
   2. Compatible with type of clean agent used.
   3. Automatic excessive pressure relief provision.
   4. Low pressure gauge.

B. Container Valves: With fast acting rupture disc with solenoid actuator, 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.

2.5 EXTINGUISHING AGENT CONTAINERS

A. Description: High strength alloy 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. 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. Location: Located within hazard area, or as near as possible to reduce the required amount of pipe and fittings.
2.6 FIRE-EXTINGUISHING CLEAN AGENT

A. FM-200 Clean Agent: Heptafluoropropane.
   
   1. Basis-of-Design Product: Subject to compliance with requirements, provide FM-200 product by one of the following:
      
      a. DuPont.
      b. Great Lakes Chemical Corporation; a Chemtura company.

2.7 DISCHARGE NOZZLES

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

2.8 CONTROL PANELS

A. Description: FM Global approved and NRTL listed, including equipment and features required for testing, supervising, and operating fire-extinguishing system. Listed and approved for releasing service, and suitable for deluge/pre-action sprinkler service.

   1. Subject to compliance with requirements, provide Fike®; SHP-PRO® or comparable product by one of the following:
      
      a. Chemetron Fire Systems; a UTC Fire & Security company.
      b. Fenwal Protection Systems.

B. Power Requirements: 120-V ac; with electrical contacts for connection to system components, fire-alarm system, and Division 25 SCADA system, and transformer or rectifier as needed to produce power at voltage required for initiating devices, notification appliances, trouble signals, supervisory signals, digital alarm communicator transmitter, and auxiliary power.

   1. Alarm current draw of the entire clean agent suppression system shall not exceed 80 percent of the control panel’s power supply rating.

C. Enclosure: NEMA ICS 6, Type 1, steel cabinet.

   1. Mounting: Surface.
   2. Finish: Red baked on enamel finish

D. Supervised Circuits: Wired NFPA 72, Class B

   1. Two detection circuits; capable of sequential detector release actuation method.
   2. Three initiating device circuits; capable of monitoring contact closure devices.
   4. Agent release circuit capable of actuating suppression system.
   5. Auxiliary power circuit (resettable/non-resettable) for field devices.
   6. Minimum of three Form-C relay contacts for auxiliary control functions.
   7. Additional Form-C relay contacts with addition of supplemental relay cards as required.

E. Control-Panel Features:

   1. Microprocessor controlled.
2. LED indicators to provide positive indication of system status.
3. Diagnostic LED indicator to display system and trouble events.
5. Automatic switchover to standby power at loss of primary power.
6. Storage container, low-pressure indicator.
7. Service disconnect to interrupt system operation for maintenance with visual status indication on the panel.
8. Silence and reset switch.
9. 120 VAC power input.
10. Five optional abort types.

F. Standby Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.
   1. Batteries: Sealed lead calcium, sized to operate system for 24 hours and alarm for minimum of 15 minutes.

G. Optional Cards: Cards mount directly to and receive their operational power from the Fike SHP PRO® control board (or comparable card by Chemetron or Fenwall).
   1. Relay Module: Provides four additional Form-C relay contacts for auxiliary control functions.

2.9 SYSTEM SMOKE DETECTORS

A. General Requirements:
   2. 24-V dc, nominal.
   3. Two-wire type.
   4. Self-restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
   5. Integral Visual-Indicating Light: LED type, indicating detector has operated and power-on status.
   6. UL Listed.

B. Photoelectric Detectors: LED light source and silicon photodiode receiving element.

C. Base Mounting: Detector shall be mounted on a twist-lock, fixed base.
   1. Select according to operational characteristics: Verified detection release.
   2. Base provides terminals for connection to control unit.

D. Signals to the Central Fire Alarm Control Panel: Any type of local system Alarm, Trouble, or Supervisory event is reported to the central fire alarm control panel as a composite signal for each event type.

2.10 SWITCHES

A. General Description: Surface FM Global approved and NRTL listed, low voltage, includes contacts for connection to control panel.
B. Manual Release Switch: Unit can manually discharge extinguishing agent with operating device that remains engaged until unlocked.
   1. Stainless steel faceplate.
   2. Dual-action requiring two distinct operations to initiate suppression system release.
   3. Red plastic release button, keyed reset.
   4. "MANUAL RELEASE" caption.

C. Abort Switch: Unit can manually prevent the release of the suppression system while pressed.
   1. Stainless steel faceplate.
   2. Red plastic abort button, momentary contact (dead-man type).
   3. Available with key-operated switch.
   4. "SYSTEM ABORT" caption.

D. Low-Agent Pressure Switches: Installed on extinguishing agent container; pneumatic operation.

E. Suppression Disconnect Switches: Unit enables releasing circuit (i.e., clean agent) to be disconnected from the control panel.
   1. Stainless steel faceplate.
   2. Key operated selector switch (armed/disarmed).
   3. LEDs to provide indication of switch status (armed/disarmed).
   4. "SUPPRESSION DISCONNECT" caption.

2.11 ALARM DEVICES

A. General Requirements: Listed and labeled by an NRTL and/or FM Global approved, low voltage, and surface mounting.

B. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly. Connected to notification appliance signal circuits, equipped for mounting as indicated and with screw terminals for system connections.

C. Horns, comply with UL 464: Electric-vibrating-polarized type, 24-V dc. Horns shall produce a sound-pressure level of 90 dBa minimum, measured 10 feet (3 m) from horn.

D. Visible Notification Appliances, comply with UL 1971: Xenon strobe lights with translucent lens, with "FIRE" or similar caption.
   1. Rated Light Output:
      a. Indicated on drawings.
      b. 15/30/75/110 cd, selectable in the field.
   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.
2.12 INFORMATIONAL SIGNAGE
A. Provide informational signs as required to comply with NFPA 2001 for the specific agent.

2.13 SPECIAL CONNECTIONS
A. For any devices/components that require monitoring or supervision, provide with at least two sets of contacts, one for connection to the fire alarm system and one for connection to the SCADA system (covered under Division 25)

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.
   1. The general contractor shall be responsible for sealing and securing the protected enclosure against agent loss and/or leakage during the required agent “hold” period.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 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. Comply with types and standards listed in NFPA 2001.

3.3 PIPING APPLICATIONS
A. Comply with types and standards listed in NFPA 2001.

3.4 CLEAN-AGENT PIPING INSTALLATION
A. Install clean-agent extinguishing piping and other components level and plumb, according to manufacturers’ written instructions.
B. 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.
C. Install extinguishing-agent containers anchored to substrate.
D. All pipe threads shall be sealed with Teflon tape pipe sealant applied to the male threads only.
E. Install pipe and fittings, valves, and discharge nozzles according to requirements listed in NFPA 2001.
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.

3.5 DETECTION, ACTUATION, ALARM, AND CONTROL SYSTEMS INSTALLATION

A. Install control panels, detection system components, alarms, and accessories, complying with requirements of NFPA 72 and NFPA 2001, Section "Detection, Actuation, and Control Systems," as required for supervised system application.

B. Smoke Detector Spacing:
   2. Comply with NFPA 72, "Heat-Sensing Fire Detectors" Section in the “Initiating Devices” Chapter, for heat detector spacing.
   3. Smoke ceiling spacing shall not exceed 30 feet (9 m).
   4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Appendix A in NFPA 72.
   5. HVAC: Locate detectors not closer than 3 feet (1 m) from air-supply diffuser or return-air opening.
   6. Lighting Fixtures: Locate detectors not closer than 12 inches (300 mm) from any part of a lighting fixture.

C. Audible Alarm-Indicating Devices: Wall mounted with tops above the finished floor not less than 90 inches (2.29 m), and below the ceiling not less than 6 in. (150 mm). Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.

D. Visible Alarm-Indicating Devices: Wall mounted with entire lends not less than 80 in. (2.03 m) and not greater than 96 in. (2.44 m) above the finished floor. Where ceiling height does not permit mounting at minimum height, mount within 6 inches (150 mm) of the ceiling.

E. Combination Audible-Visual Devices: Where combination audible and visual devices are used, mount devices according to Visual Alarm-Initiating Device requirements.

F. Control Unit: Surface mount, with top of cabinet not more than 72 inches (1830 mm) above the finished floor.

G. Annunciator: Install with top of panel not more than 72 inches (1830 mm) above the finished floor.

3.6 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, to building's fire-alarm system, and to building SCADA system (covered under Division 25).
3.7 IDENTIFICATION

A. Identify system components, equipment, wiring, cabling, and terminals. Comply with requirements for identification specified in applicable Division 26 Section covering 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.

E. Install framed operating instructions in a location visible from control unit.

3.8 SYSTEM WIRING

A. Wiring shall be installed by qualified individuals, in a neat and workmanlike manner in accordance with the National Electrical Code (NEC), Article 725 and 760, except as otherwise permitted for limited energy circuits as described in NFPA 72. Installation shall meet all local, state, province and/or country codes.

B. All wiring shall be installed in electrical metallic tubing (EMT) or conduit, and must be kept separate from all other building wiring. Runs of conduit shall be straight, neatly arranged, properly supported and installed parallel and perpendicular to walls and partitions.

C. Conductors shall be sized according to the design documents and color coded to allow easy circuit identification.

D. All wires shall be tagged at all junction boxes.

E. All wires shall be tested for the presence of opens, shorts and grounds prior to connection to control panel. Final wire terminations to control panel shall be made under the direct supervision of a factory trained representative.

F. All system components shall be securely supported independent of the wiring.

G. Ground control panel and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to control panel.

3.9 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. Submit test plan for review and approval by the owner or owner’s designated representative prior to performing tests.

E. Detection, Actuation, Alarm, and Control Systems Tests:
   1. Visual Inspection: Conduct the visual inspection prior to testing.
      a. Inspection shall be based on completed Record Drawings and system documentation that is required by NFPA 72 in it “Completion Documents, Preparation” Table in the “Documentation” Section of the “Fundamental of Fire Alarm Systems” Chapter, and as per FM Global requirements.
      b. Comply with “Visual Inspection Frequencies” Table in the “Inspection” Section of the “Inspection, Testing and Maintenance” Chapter in FNPA 72; retain the “Initial/Reacceptance” column and list only the installed components.
   2. Operational Test: After electrical circuitry has been energized, apply power to control panel and confirm proper unit operation. Comply with “Test Methods” Table in the “Testing” Section of the “Inspection, Testing, and Maintenance” Chapter in NFPA 72, and comply with FM global requirements.
   3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

F. Clean-Agent Fire Extinguishing Systems Test:
   1. Flow Test: Using nitrogen or other inert gas, perform a flow test on the piping network to verify that flow is continuous and unobstructed through piping and nozzles.
   2. Pressure/Leak Test: test the piping in a closed circuit per manufacturer instructions.
   3. Room Pressurization Test: After all construction work is complete, conduct a room pressurization test in accordance with NFPA 2001 in each clean agent suppression system hazard area. Test shall confirm enclosures ability to retain the agent concentration level for the required hold time. If the test fails, the suppression system contractor shall coordinate room sealing with the general contractor. Additional tests shall be conducted until successful test results are achieved. Include final test results in project ‘Closeout Submittals’.

G. System will be considered defective if it does not pass tests and inspections.


3.10 DEMONSTRATION / TRAINING

A. Engage a factory-authorized service representative to train Owner’s maintenance personnel to adjust, operate, and maintain the clean-agent fire-extinguishing systems.
B. Training session shall include system control panel operation, manual and abort functions, trouble procedures, auxiliary functions, and emergency procedures. Allow a minimum of 4 hours for training.

C. All training shall be video-taped by the Fire Protection contractor. Two copies shall be turned over to the Owner’s maintenance staff.

D. Prior to final acceptance, provide four copies of a complete operation and maintenance manual to the Architect. 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.

3.11 SERVICE CONTRACT DURING WARRANTY PERIOD

A. Suppression system installing contractor shall provide two (2) inspections of the systems installed under this contract, during the warranty period. The first inspection shall be at the six month interval, and the second shall be at the twelve month interval after system acceptance.

B. Inspections shall be conducted in accordance with the equipment manufacturer’s guidelines and the recommendations of NFPA 72 and NFPA 2001. Use forms provided in NFPA 72 for initial tests and inspections.

C. Prepare and submit test and inspection reports.

3.12 WARRANTY

A. Clean Agent System manufacturer shall guarantee all components furnished under this contract against defects in design, materials, and workmanship for no less than five (5) years from the date of handover to Owner at beneficial occupancy.

END OF SECTION 21 2400CA