

SECTION 21 22 00
CLEAN AGENT FIRE SUPPRESSION SYSTEMS

SPEC WRITER NOTE:
Delete between // --- // if not applicable to the project. Also delete any other item or paragraph including NFPA references which are not applicable and renumber the paragraphs. Show the locations of the protected area and the cylinder storage areas.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Design, installation and testing of a calculated automatic and manual fixed total flooding clean agent fire extinguishing system and releasing system in accordance with NFPA 2001, NFPA 72, NFPA 70, and NFPA 75 and manufacturer's written instructions for the locations shown on the contract drawings. The installation shall include all mechanical, controls and electrical components necessary for a complete and operating clean agent fire suppression system.

1.2 RELATED WORK

- A. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES
B. Section 07 84 00, FIRESTOPPING
C. Section 09 91 00, PAINTING
D. Section 28 05 13, CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY
E. Section 28 05 28.33, CONDUIT AND BACKBOXES FOR ELECTRONIC SAFETY AND SECURITY
F. Section 28 31 00, FIRE DETECTION AND ALARM

1.3 DESIGN CRITERIA

SPEC WRITER NOTE: This specification has been written on the basis of protecting an occupied data center. If a different hazard is to be protected, modify the specification to address the hazard.

- A. The clean agent fire extinguishing system shall be a fixed total flooding type utilizing clean agent designed to provide a uniform concentration throughout the protected spaces in accordance with NFPA 2001 for a Class C fire.

SPEC WRITER NOTE: Refer to NFPA 2001 and manufacturer's literature for design concentrations. This specification is

based on using a design concentration for a Class C fire in a data center.

1. The system shall provide a minimum design concentration by volume, throughout the protected spaces at the minimum anticipated temperature within the protected space.

SPEC WRITER NOTE: Refer to NFPA 2001 Appendix A for no observable adverse effects level (NOAEL) concentrations for clean agents. Capping the design concentration to the NOAEL, limits the clean agent design concentration to a level considered safe for occupancy.

2. The design concentration within any protected space shall not exceed by volume the no observable adverse effects level (NOAEL). Special means such as mechanical exhaust, shall not be permitted to be used to achieve this criterion.

SPEC WRITER NOTE: The criteria below along with the NOAEL above, limits the clean agents that can meet this specification to FK-5-1-12 (Novec 1230), HFC-227ea (FM-200) and IG 541 (Inergen).

3. The clean agent shall have a global warming potential (GWP) of less than 4000 and the clean agent shall be readily available throughout the continental United States.
4. Provide the quantity of clean agent as required by NFPA 2001 and manufacturer's written instructions. Such factors as unenclosed openings (if any), "rundown" time of fans, time required for dampers to close, and any other feature of the facility that could affect concentration shall be taken into consideration.

SPEC WRITER NOTE:
The A/E's structural engineer must determine if seismic protection is required in accordance with VA Seismic Design Requirements H-18-8. The seismic calculation should be provided to the COR and the following section added when seismic protection is required.

- //5. Provide seismic bracing for the clean agent fire extinguishing system components.//

1.4 SUBMITTALS

A. Submit as one package in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Prepare detailed working drawings that are signed by a NICET Level IV Special Hazards Suppression Systems Technician. As the Government review is for technical adequacy only, the installer remains responsible for correcting any conflicts with other trades and building construction that arise during installation. Partial submittals will not be accepted. Material submittals shall be approved prior to the purchase or delivery to the job site. Suitably bind submittals in notebooks or binders and provide an index referencing the appropriate specification section. In addition to the hard copies, provide submittal items in Paragraphs 1.4 (A) 1 through 1.4 (A) 5 electronically in pdf format on a compact disc or as directed by the Contracting Officers Representative (COR). Submittals shall include, but not be limited to, the following:

1. Qualifications:

- a. Provide a copy of the installing contractors // Special Suppression Systems // and state // contractors license.
 - b. Provide a copy of the NICET certification for the NICET Level IV Special Hazards Suppression System Technician who will prepare and sign the detailed working drawings.
 - c. Provide documentation showing that the installer has been actively and successfully engaged in the installation of clean agent fire suppression systems for the past ten years.
2. Drawings: Submit detailed 1:100 (1/8 inch) scale (minimum) working plans and drawings of the clean agent fire extinguishing system conforming to NFPA 2001. Submit detailed 1:100 (1/8 inch) scale (minimum) working plans and drawings of the releasing system conforming to NFPA 72. Drawings shall include graphical scales that allow the user to determine lengths when the drawings are reduced in size.
3. Manufacturers Data Sheets:
- a. Provide for all materials and equipment proposed for use on the clean agent fire extinguishing system, including the releasing system. Include listing information and installation instructions in data sheets. Where data sheet describes items in addition to that item being submitted, clearly identify proposed item on the sheet.

4. Calculation Sheets:
 - a. Submit flow calculation sheets in tabular form conforming to the requirements of NFPA 2001. Calculations shall include total storage capacity, flooding concentrations, enclosure leakage rates, discharge times, flow through distribution network, pipe sizes, and nozzle orifice sizes.
 - b. Submit battery calculations sheets in tabular form conforming to the requirements of NFPA 72.
 - c. Submit voltage drop calculations in tabular form. Calculations shall indicate circuit amperage draw, wire resistance, circuit length, and voltage drop. The voltage drop shall demonstrate that voltage provided at the each appliance is within its operating voltage range. Voltage drop calculations shall assume an initial voltage of 20.4 volts.
 - //d. Submit calculations of loads for sizing of sway bracing.//
5. Clean Agent Recharging Certification: Provide a letter to the COR or his designated representative certifying that the installer maintains or has access to a clean agent recharging station. The installer shall also provide proof of the ability to recharge the largest clean agent fire extinguishing system capacity within 48 hours.
6. Test Plan: Provide a test plan to the COR or his designated representative. The testing plan shall describe the procedures to be used to test the system. The testing plan shall include a step-by-step procedure of all tests to be performed, including indication of which tests will present a disruption to building occupants. No tests shall be conducted until the testing plan is approved by the COR or his designated representative.
7. Final Document Submittals: Provide as-built drawings, testing and maintenance instructions in accordance with the requirements in Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Submittals shall include, but not be limited to, the following:
 - a. A complete set of as-built drawings showing the installed system with the specific interconnections between the system switches and the fire alarm equipment. Provide a complete set in the formats as follows. Submit items 2 and 3 below on a compact disc or as directed by the COR.
 - 1) One full size (or size as directed by the COR) printed copy.

- 2) One complete set in electronic pdf format.
 - 3) One complete set in AutoCAD format or a format as directed by the COR.
- b. System Certification: Upon completion of the clean agent fire extinguishing system installation, including testing, the authorized representative of the manufacturer of the major equipment shall certify that the installation complies with all manufacturer's requirements and that satisfactory total system operation has been achieved. Provide a copy of the Record of Completion for the releasing system in accordance with NFPA 72.
 - c. Operating and Maintenance Manuals that include step-by-step procedures required for operation, shutdown, and routine maintenance and testing. The manuals shall include the manufacturer's name, model number, parts list, the name of the local supplier, simplified wiring and controls diagrams, troubleshooting guide, and recommended service organization, including address and telephone number, for each item of equipment.
 - d. One paper copy of the System Certification and Record of Completion and the Operating and Maintenance Manuals listed above shall be provided in a binder. In addition, these materials shall be provided in pdf format on a compact disc or as directed by the COR.
 - e. Provide one additional copy of the Operations and Maintenance Manual for the system in a binder and mount in an accessible location adjacent to the storage cylinder(s).

1.5 QUALITY ASSURANCE

SPEC WRITER NOTE: Most states do not have or issue Special Hazards Suppression Systems contractor licenses; therefore as a minimum, the contractor must hold a contractor's license in the state where the work is to be performed.

- A. Installer Reliability: The installer shall possess a valid State of // (insert state in which work is being performed) // Special Suppression Systems // contractor's license. The installer shall have been actively and successfully engaged in the installation of clean agent special suppression systems for the past ten years. The installer shall maintain or have access to a clean agent recharging station. The

installer shall provide proof of the ability to recharge the largest clean agent fire extinguishing system capacity within 48 hours.

- B. Materials and Equipment: All equipment and devices shall be UL listed or approved by FM. All materials, devices, and equipment shall be approved by the VA. All materials and equipment shall be free from defect.

1.6 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

SPEC WRITER NOTE: Specify the latest edition of publications at time of award of A/E contract.

- B. National Fire Protection Association (NFPA):
 - 70-2014.....National Electric Code
 - 72-2013.....National Fire Alarm Code
 - 75-2013.....Fire Protection of Information Technology Equipment
 - 170-2014.....Fire Safety Symbols
 - 2001-2014.....Installation of Clean Agent Fire Extinguishing Systems
- C. Underwriters Laboratories, Inc. (UL):
 - 2011..... Fire Protection Equipment Directory
- D. Factory Mutual Engineering Corporation (FM):
 - 2015..... Approval Guide

1.7 WARRANTY

All work performed and all material and equipment furnished under this contract shall be free from defects and shall remain so for a period of one year from the date of acceptance of the entire installation by the COR.

PART 2 PRODUCTS

2.1 GENERAL

All equipment and components shall be new and the manufacturer's current model. All equipment and components shall be UL listed or FM approved for its intended use. The authorized representative of the manufacturer of the major equipment shall certify that the installation complies with all manufacturer's requirements and that satisfactory total system operation has been achieved.

2.2 CLEAN AGENT FIRE EXTINGUISHING SYSTEM

A. General:

1. The clean agent fire extinguishing system shall be UL listed and shall be in accordance with NFPA 2001.

B. Piping and fittings:

1. All piping and fittings shall be in compliance with NFPA 2001.
2. Multi-outlet fittings, other than tees, shall not be permitted.
3. All piping shall be reamed, blown clear, and swabbed with appropriate solvent to remove mill varnish and cutting oils before assembly.
4. Ordinary cast iron steel and non-metallic piping and fittings and flexible hoses shall not be used unless specifically required by the manufacturer.

C. Piping Support:

1. All piping shall be supported in accordance with the manufacturer's written instructions.
2. Piping shall be supported within 12 inches (304 mm) of discharge nozzles. The supports shall prevent the upward movement of the nozzle.

SPEC WRITER NOTE:

The A/E's structural engineer must determine if seismic protection is required in accordance with VA Seismic Design Requirements H-18-8. The seismic calculation should be provided to the COR and the following section added when seismic protection is required.

3. //Seismic bracing shall be installed.//

D. Storage Cylinders:

1. Provide storage cylinders as required by the manufacturer's written instructions and in accordance with NFPA 2001.
2. Cylinder assemblies shall be of steel construction designed to meet the requirements of the U.S. Department of Transportation.
3. Filling of the storage cylinders shall be by an authorized systems distributor in conjunction with a factory authorized agent filling station. Initial filling and recharge shall be performed in accordance with manufacturer's written instructions and shall not require replacement components for normal service.
4. Cylinders shall be securely attached to the wall. Provide factory- or field-fabricated retaining brackets consisting of steel straps

and channels; suitable for container support, maintenance, and tank refilling or replacement.

5. For halocarbon clean agents, storage cylinders shall be provided with a low agent pressure switch.

E. Valve Actuators:

1. Electric valve actuators shall be of brass construction and stackable design with swivel connections to allow removal of actuators for maintenance or testing.
2. Operation of actuators shall not require replacement of components. No electro-explosive devices may be used to actuate the valve assembly. Actuators shall include an indication if they are set or actuated.
3. Electric valve actuators shall be magnetic latch, continuous duty type for 24 VDC operation.
4. Actuation devices shall be UL listed or FM approved for use with the system.
5. Removal of the electric valve actuator shall cause a trouble on the clean agent control panel.

F. Discharge Nozzles:

1. Nozzles shall be permanently marked with the manufacturer's part number. The nozzles shall be threaded directly to the discharge piping without the use of special adaptors.

2.3 RELEASING SYSTEM

A. General

1. The releasing system shall be an analog addressable intelligent reporting, microprocessor controlled system, capable of remote sensitivity testing of the smoke detectors, and be installed in accordance with NFPA 70, NFPA 72, and NFPA 2001.

B. Clean Agent Control Panel:

1. General:
 - a. The clean agent control panel shall be UL listed or FM approved and include a UL listed or FM approved releasing module.
 - b. Each protected space shall be provided with its own clean agent control unit.
 - c. All circuits shall be monitored for integrity.
 - d. Visually and audibly annunciate all alarm, supervisory, and trouble signals including, but not limited to main power failure,

open circuit, short circuit, ground faults, and system bypass activation.

- e. The panel or releasing module shall include a 0-60 second programmable timer.
- f. The clean agent control panel shall be provided with separate contacts to provide common supervisory, alarm, and trouble signals to the main building fire alarm system.

2. Enclosure:

- a. The clean agent control unit shall be housed in a cabinet suitable for both recessed and surface mounting. The cabinet and front panel shall be corrosion protected, given a rust-resistant prime coat, and manufacturer's standard finish.
- b. The cabinet shall contain all necessary relays, terminals, lamps, and legend plates to provide control for the system.

3. Power Supply:

SPEC WRITER NOTE: Ensure that a power connection for the clean agent control unit has been shown on the contract drawings.

- a. The clean agent control unit shall derive its normal power from a 120 volt, 60 Hz dedicated supply connected to the emergency power system. Standby power shall be provided by a 24 volt DC battery as hereinafter specified. The normal power shall be transformed, rectified, coordinated, and interfaced with the standby battery and charger.
- b. The power supply for smoke detection systems shall be taken from the clean agent control unit.

4. Circuit Supervision: Each alarm initiating device circuit, signaling line circuit, and notification appliance circuit, shall be supervised against the occurrence of an open, short circuit, or ground fault condition in the field wiring. These conditions shall cause a trouble signal to sound in the control unit until manually silenced by an off switch.

- a. Initiating device circuits (IDC) shall be wired Class B in accordance with NFPA 72.
- b. Signaling line circuits (SLC) shall be wired Class B in accordance with NFPA 72.
- c. Notification appliance circuits (NAC) shall be wired Class B in accordance with NFPA 72.

5. Supervisory Alarm Devices: The low agent pressure switch and maintenance lock-out switch shall initiate a supervisory signal.
6. Trouble signals:
 - a. Arrange the trouble signals for automatic reset (non-latching).
 - b. System trouble switch off and on lamps shall be visible through the control unit door.
7. Function Switches: Provide the following switches in addition to any other switches required for the system:
 - a. Remote Alarm Transmission By-pass Switch: Shall prevent transmission of all signals to the building fire alarm control unit when in the "off" position. A clean agent control unit system trouble signal shall be energized when switch is in the off position.
 - b. Alarm Off Switch: Shall disconnect power to notification appliance circuits on the clean agent control panel. A system trouble signal shall be activated when the switch is in the off position.
 - c. Trouble Silence Switch: Shall silence the trouble signal whenever the trouble silence switch is operated. This switch shall not reset the trouble signal.
 - d. Reset Switch: Shall reset the system after an alarm, provided the initiating device has been reset. The system shall lock in alarm until reset.
 - e. Lamp Test Switch: A test switch or other approved convenient means shall be provided to test the indicator lamps.
 - f. AHU By-Pass: Provide a means to disable air handling units shutdown and dampers from closing upon operation of an initiating device designed to interconnect with these devices. A system trouble signal shall be activated when switch is in the off position.
8. Reset2 Capability: Each clean agent control unit shall be installed and programmed so that each must be reset locally after an alarm, before the main fire alarm control unit can be reset.

C. Conduit, Boxes, and Wire

1. Conduit shall be in accordance with Section 28 05 28.33 CONDUIT AND BACKBOXES FOR ELECTRONIC SAFETY AND SECURITY and as follows:
 - a. All new conduits shall be installed in accordance with NFPA 70.

- b. Conduit fill shall not exceed 40 percent of interior cross sectional area.
 - c. All new conduits shall be 3/4 inch (19 mm) minimum.
2. Wire:
- a. Wiring shall be installed in conduit.
 - b. Wiring shall be in accordance with NEC article 760, Section 28 05 13, CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY, and as recommended by the manufacturer of the fire alarm system. All wires shall be color coded. Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 18 AWG for initiating device circuits and 14 AWG for notification appliance circuits.
 - c. Signaling line circuits shall be twisted and shielded unless other wiring methods are specifically required by the fire alarm equipment manufacturer in writing.
3. Terminal Boxes, Junction Boxes, and Cabinets:
- a. These shall be galvanized steel in accordance with UL requirements.
 - b. All boxes shall be sized and installed in accordance with NFPA 70.
 - c. Covers shall be repainted red in accordance with Section 09 91 00, PAINTING and shall be identified with white markings as "CA FA" or as directed by the COR for junction boxes and as "CLEAN AGENT FIRE ALARM SYSTEM" for cabinets and terminal boxes. Lettering shall be a minimum of 3/4 inch (19 mm) high.
 - d. Terminal boxes and cabinets shall have a volume 50 percent greater than required by NFPA 70. Minimum sized wire shall be considered as 14 AWG for calculation purposes.
 - e. Terminal boxes and cabinets shall have identified screw type terminal strips and shall be located in an accessible location. Terminal strips shall be labeled as to what circuit it is or as approved by the COR.
- D. Standby Power Supply
1. Batteries:
- a. The batteries shall be of the sealed, maintenance free type, 24-volt nominal.
 - b. The batteries shall have sufficient capacity to power the clean agent control panel and its peripherals for not less than 24

hours plus 5 minutes of alarm to an end voltage of 1.14 volts per cell, upon a normal AC power failure.

c. Battery racks shall be steel with an alkali-resistant finish.

2. Battery Charger:

a. The battery charger shall be completely automatic, with constant potential charger maintaining the battery fully charged under all service conditions. Charger shall operate from a 120-volt, 60 hertz emergency power source.

b. The battery charger shall be rated for fully charging a completely discharged battery within 48 hours while simultaneously supplying any loads connected to the battery.

c. The battery charger shall have protection to prevent discharge through the charger.

d. The battery charger shall have protection for overloads and short circuits on both AC and DC sides.

e. A trouble condition shall actuate the fire alarm trouble signal.

f. The battery charger shall have automatic AC line voltage regulation, automatic current-limiting features, and adjustable voltage controls.

SPEC WRITER NOTE: Clearly identify locations or the spacing requirements of smoke detectors on the contract drawings in accordance with NFPA 75 and NFPA 72. The A/E must establish the air changes per hour in each of the spaces requiring detection so that the smoke detector spacing per detector can be calculated per the High Air Movement Areas criteria of NFPA 72.

E. Spot-type Smoke Detectors

1. Smoke detectors shall be photoelectric plug-in type and UL listed for use with the clean agent control panel being furnished. Each detector shall be monitored individually, via an integral, analog addressable element.

2. Photoelectric detectors shall be factory calibrated and readily field adjustable. The sensitivity of any photoelectric detector shall be factory set at 3.0 plus or minus 0.25 percent obscuration per foot.

3. Smoke detectors of the protected spaces shall be spaced in accordance with NFPA 72 for high air movement areas. Air velocities

- within the protected spaces shall be suitable for the listed detection air velocity range of the smoke detector.
4. Each protected space shall have at least 2 detectors.
 5. Provide red stickers with an "A" on the ceiling below the location of the above ceiling smoke detectors when above ceiling detectors are provided. Provide red stickers with a "U" on the ceiling above the location of the under floor smoke detectors. Each sticker shall also include the address of the detector. The address shall be the same as that address that shows on the fire alarm control unit when the detector is activated.
 6. For smoke detectors located under the floor, the smoke detectors shall be mounted with a steel angle or channel support independent of the raised floor structure. The smoke detectors shall be mounted in a vertical orientation.

SPEC WRITER NOTE: Clearly identify manual activation stations on the contract drawings at each exit from the protected space.

F. Manual Activation Stations:

1. Shall be non-break glass, address reporting type.
2. Station front shall be constructed of durable material such as cast or extruded metal or high impact plastic. Stations shall be semi-flush type.
3. Shall be of dual action pull down type with suitable operating instructions provided on front in raised or depressed letters, and clearly labeled "AGENT RELEASE."
4. Operating handles shall be constructed of a durable material. On operation, the lever shall lock in alarm position and remain so until physically reset. A key shall be required to gain front access for resetting, or conducting tests and drills.
5. Shall be located at least 3.28 ft (1m) from any fire alarm manual pull station.

G. Notification Appliances:

SPEC WRITER NOTE: Clearly identify pre-discharge bells on the contract drawings within the protected space.

1. Pre-discharge Bells:
 - a. Shall be 24 VDC and be capable of producing an alarm signal of not less than 85 dBa at 10 feet.

- b. Shall be at least 6 inches (150 mm) in diameter.

SPEC WRITER NOTE: Clearly identify pre-discharge strobes on the contract drawings within the protected space.

2. Pre-discharge Strobes:

- a. Be listed in accordance with UL 1971.
- b. Shall be a minimum of 75 candela.
- c. Shall be provided with an amber lens.
- d. Shall be synchronized with other pre-discharge strobes in the protected space.

SPEC WRITER NOTE: Clearly identify discharge strobes on the contract drawings outside of each entrance to the protected space.

3. Discharge Strobes:

- a. Be listed in accordance with UL 1971.
- b. Shall be a minimum of 75 candela.
- c. Shall be provided with a red lens.
- d. Shall be synchronized with other discharge strobes outside the protected space.

H. Addressable Interface Module

- 1. Addressable interface modules shall be installed in individual boxes in accordance with the manufacturer's product listing. The addressable interface module shall be provided with a protective cover provided by the device manufacturer. The protective cover shall have the provision for viewing the operational LED of the addressable interface module. Addressable interface modules shall not be installed in a back-box with other devices or relays.
- 2. The installer shall provide, install, and test addressable interface modules as necessary to comply with the sequence of operations, whether shown on the drawings or not.

I. Graphic Floor Plans:

- 1. Provide readable scaled graphics of the protected area. The graphics shall show the location and address of each the ceiling smoke detectors, above ceiling smoke detectors, and under floor smoke detectors, on separate plans.
- 2. The graphic shall be framed and shall be located in an area approved by the COR.

3. Where approved by the COR a single graphic floor plan shall be permitted.

J. Abort Switches:

1. The abort switch front shall be constructed of durable material such as cast or extruded metal or high impact plastic. The abort switch shall be semi-flush type.
2. The abort switch shall not be a locking or keyed type.
3. The abort switch shall be of single action dead-man spring loaded type with suitable operating instructions provided on front in raised or depressed letters, and clearly labeled "ABORT."

2.4 SWITCHES

A. Maintenance Lock-out Switch

1. Shall be key-operated only allowing the removal of the key in the "Normal" position. A red indicator lamp shall be included on the switch assembly to be illuminated when in the "Lock-out" position. The clean agent control panel shall indicate a supervisory alarm condition when in the "Lock-out" position.
2. The terminals shall be of the screw type.
3. Shall be provided adjacent to the clean agent control panel.

2.5 SIGNAGE

- A. Signage shall have white lettering on a red plastic background.
- B. The letters shall be 1 inch (25 mm) high with a stroke width of 3/8 inches (9.5 mm).

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation shall be accomplished by the licensed contractor. Provide a factory trained qualified technician, experienced in the installation and operation of the type of system being installed, to supervise the installation and testing of the system.
- B. Install clean agent fire extinguishing system piping and fittings level and plumb, according to manufacturer's written instructions.
- C. Where installing piping adjacent to equipment, allow space for service and maintenance.
- D. Identify piping, agent storage cylinders, and control panels with signage in accordance with NFPA 2001.
- E. Provide signage for the pre-discharge bells and strobes. The sign shall say "FIRE. [Agent Surname] RELEASE IMMINENT". The sign shall be

permanently affixed to the wall within 12 inches (304 mm) of the pre-discharge strobe.

- F. Provide signage for the discharge strobes. The sign shall say "[Agent Surname] DISCHARGE". The sign shall be permanently affixed to the wall within 12 inches (304 mm) of the discharge strobe.
- G. Provide signage on the exterior of the protected space at each entrance. The sign shall say "THIS SPACE IS PROTECTED BY A CLEAN AGENT FIRE EXTINGUISHING SYSTEM. DO NOT ENTER WITHOUT AUTHORIZATION DURING OR AFTER DISCHARGE. THE RED STROBE INDICATES SYSTEM DISCHARGE." The sign shall be permanently affixed to the wall adjacent to the door.
- H. Provide signage adjacent to each manual activation station. The sign shall say "ACTUATION OF THIS DEVICE WILL CAUSE FIRE SUPPRESSION GAS TO DISCHARGE. BEFORE ACTUATING, ENSURE THAT PERSONNEL ARE CLEAR OF THE AREA." The sign shall be permanently affixed to the wall within 12 inches (304 mm) of the station.
- I. Firestopping shall be provided for all penetrations of fire resistance rated construction. Firestopping shall comply with Section 07 84 00, FIRESTOPPING.
- J. Repairs: Repair damage to the building or equipment resulting from the installation of the clean agent fire extinguishing system by the installer at no additional expense to the Government.
- K. Supervise clean agent control panel for alarm, supervisory, and trouble signals by the building fire alarm system in accordance with Section 28 31 00, FIRE DETECTION AND ALARM.

SPEC WRITER NOTE: If computer room air conditioning units come with a factory installed duct detector, the duct detector should be monitored by the clean agent control panel as a supervisory alarm. The shutdown of the CRAC upon activation of the duct detector is usually done separate from, and is not part of the clean agent system controls.

- L. Where duct detectors are provided within computer room air conditioning units, addressable interface modules shall be used to monitor the activation of the duct detector as a supervisory signal on the clean agent control unit.
- M. Control emergency power off with addressable interface modules.

SPEC WRITER NOTE: The sequence of operations should be reviewed with the facility. Modify sequence of operations

to meet the facility's operational goals, security protocols, and other desired goals.

3.2 SEQUENCE OF OPERATIONS

- A. The clean agent extinguishing fire extinguishing system shall operate as follows:

SPEC WRITER NOTE: Automatic dampers and held-open doors within the protected area enclosure should be controlled by the clean agent releasing fire alarm system.

1. Activation of any single smoke detector shall:
 - a. Energize an alarm LED lamp on the activated detector and clean agent control panel.
 - b. Transmit an alarm signal to the building's fire alarm system.
2. Activation of a second smoke detector shall:
 - a. Energize an alarm LED lamp on the activator detector.
 - b. Activate pre-discharge bell notification appliance and pre-discharge strobe notification appliance.
 - c. Shut down power to electronic equipment within the protected space, close dampers, release door hold open devices, and shut down air handling units serving the protected space.
 - d. Initiate a programmable 30-second time delay (agent release) sequence.
3. Activation of a manual activation station shall:
 - a. Energize an alarm LED lamp on the clean agent control panel.
 - b. Activate pre-discharge bell notification appliance and pre-discharge strobe notification appliance.

SPEC WRITER NOTE: Customize based upon the requirements of the project.

 - c. Shut down power to electronic equipment within the protected space, close dampers, release door hold open devices, and shut down air handling units serving the protected space.
 - d. Transmit an alarm signal to the building's fire alarm system.
 - e. Initiate a programmable 20-second time delay (agent release) sequence.
4. Activation of the abort switch shall:
 - a. Cease the time delay. Once the abort switch is released, the time delay countdown shall resume from where it ceased. The time delay shall not reset.

- b. Transmit a trouble signal to the building's fire alarm system.
- 5. Upon completion of the time delay, the system shall:
 - a. De-energize the pre-discharge bell and pre-discharge strobe notification appliance.
 - b. Activate a discharge strobe notification appliance inside and outside of the protected area.
 - c. Energize valve actuator for agent cylinders releasing gaseous agent into the protected area.
- 6. Activation of the low agent tank pressure switch and maintenance lock-out switch shall:
 - a. Energize a supervisory LED lamp on the clean agent control panel.
 - b. Transmit a supervisory alarm signal to the building's fire alarm system.
- 7. Presence of any fault, bypass function, or removal of the electric valve actuator shall:
 - a. Energize a trouble LED lamp on the clean agent control panel.
 - b. Transmit a trouble signal to the building's fire alarm system.
- 8. Activation of duct detector within a computer room air condition unit shall energize a supervisory signal LED lamp on the clean agent control panel.

SPEC WRITER NOTE: For projects where a Commissioning Agent is being contracted in accordance with Section 01 09 00, coordinate commissioning with Section 21 08 00.

3.3 INSPECTION AND TEST

- A. Room Enclosure Test: A room pressurization test shall be conducted for the protected space. The testing shall be done in accordance with NFPA 2001 Annex C. The contractor shall be responsible for sealing the enclosure to ensure the success of the room pressurization test. The test shall be deemed successful if the tested leakage rate is less than or equal to the leakage rate assumed in the calculations.
- B. Pressure Test: Pneumatically pressure test piping in a closed circuit in accordance with NFPA 2001.
- C. Flow Test: Subject system to a flow test utilizing nitrogen to verify that flow is continuous and that the piping and nozzles are unobstructed.

- D. Preliminary Testing: System function operation test system as specified in NFPA 2001 and NFPA 72, in the presence of the COR or his designated representative.
- E. Final Inspection and Testing: Subject system to tests in accordance with NFPA 2001 and NFPA 72, and when all necessary corrections have been accomplished, advise COR to schedule a final inspection and test. Connection to the fire alarm system shall have been in service for at least ten days prior to the final inspection, with adjustments made to prevent false alarms. Furnish all instruments, labor and materials required for the tests and provide the services of the installation foreman or other competent representative of the installer to perform the tests. Correct deficiencies and retest system as necessary, prior to the final acceptance. Include the operation of all features of the systems under normal operations in test.

3.4 TRAINING

- A. The manufacturer's authorized representative shall provide instruction and training to the VA on the dates requested by the COR as follows:
 - 1. Six 1-hour sessions to employees working in protected area, engineering staff, security police and VA Fire Department personnel where there is a VA Fire Department present on site for simple operation of the system. Two sessions at the start of installation, 2 sessions at the completion of installation and 2 sessions 3 months after the completion of installation.
 - 2. Four 2-hour sessions to engineering staff for detailed operation of the system. Two sessions at the completion of installation and 2 sessions 3 months after the completion of installation.

SPEC WRITER NOTE: Where desired by the facility to do the normal maintenance, include the following requirement.

- //3. Three 8-hour sessions to electrical technicians for maintaining, programming, modifying, and repairing the system at the completion of installation and one 8-hour refresher session 3 months after the completion of installation.//

- B. Each initial training session shall be videotaped.

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