
Part 1 - GENERAL**1.1 DESCRIPTION OF WORK**

A. Design and installation of an engineered Kidde ECS Advanced Delivery Systems (ADS), clean agent/waterless fire suppression system employing DuPont FM-200 agent, which is manufactured by Kidde Fire Systems, 400 Main Street, Ashland, MA 01721.

B. All drawings are to be reviewed by the contractor so any items which may affect the operation of the fire suppression system(s) are taken into account when designing the system.

1.2 APPLICABLE STANDARDS & PUBLICATIONS

A. The design, installation, testing and maintenance of the clean agent fire extinguishing system, shall be in accordance with the requirements in the following codes, standards and regulatory bodies:

NFPA 2001: Standard for Clean Agent Fire Extinguishing Systems

NFPA 70: National Electrical Code (NEC)

NFPA 72: National Fire Alarm Code

1. Underwriter Laboratories, Inc (UL)- UL2166: Standard for Halocarbon Clean Agent Extinguishing System
2. Factory Mutual Approval Guide
3. ANSI B1.20.1: Standard for pipe threads, General Purpose
4. Requirements of the Local Authorities Having Jurisdiction (AHJ)
5. Kidde Fire Systems Manual P/N 06-236068-001.

B. The complete system shall have the applicable following listings and approvals:

1. Underwriters Laboratories (UL)
2. Factory Mutual Global (FM)
3. Underwriters Laboratories of Canada (ULC)

C. All components of the clean agent fire extinguishing system shall be the products of the same manufacturer or listed by that manufacturer as compatible with those devices components and equipment.

1.3 SUMMARY

A. Section includes:

1. Extinguishing agent
2. Extinguishing agent cylinders
3. Piping and piping specialties

B. Section Exclusions:

1. Room sealing requirements shall be communicated and coordinated between the suppression system contractor and the project's main General Contractor and all sub-contractors.

1.4 QUALIFICATIONS OF MANUFACTURER, DESIGNER, AND INSTALLER

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- A. Manufacturer
1. The manufacturer/supplier of the system hardware and components shall have a minimum of fifteen (15) years experience in the design and manufacture of systems of similar type
 2. The manufacturer/supplier of the systems shall be certified to ISO 9001 for a minimum period of five (5) years for the design, production and distribution of fire detection, fire alarm and fire suppression systems.
 3. All devices, components and equipment shall be the products of the same manufacturer/supplier.
 4. The system manufacturer/supplier shall have the ability to provide multiple suppression system arrangements to accommodate the performance criteria required by the project.
- B. Designer/Installer Suppression System Contractor
1. The suppression system contractor shall be authorized to purchase and trained by the Kidde Fire Systems (manufacturer) to design, install, test and maintain the ADS system, using FM-200 fire extinguishing agent proposed and shall be able to produce a certificate of training and/or a letter stating they are an authorized supplier of the proposed equipment from the manufacturer, upon request.
 2. The suppression system contractor shall employ a person who can show proficiency equal to a NICET level <II>, <III> or <IV> certification in special hazards design.
 3. The Contractor shall confirm in writing that he stocks a full complement of spare parts and offers 24-hour/7 days a week emergency service for all equipment being furnished.
 4. Maintain or have access to a recharging station capable of recharging the largest suppression system with <48hrs> after discharge

1.5 SUBMITTALS

- A. Supply manufacturers product technical data and catalog cut sheets for each component or device used in the system.
- B. Shop Drawings
1. Prepared by a person holding at least a NICET Level III certification
 2. Meet all systems design chapter requirements per NFPA 2001 and recommendations in the "Working Plans" section.
 3. Include design calculations for enclosure volume, agent quantity based on required design concentration for each hazard area.
 4. Indication of dimensions, weights and loads of equipment assemblies, components, method of field assembly, clearance requirements, mounting and bracing practices, etc
 5. Isometric piping layouts
 6. Plan and Elevation views
 7. Suppression system equipment locations
- C. Flow Calculation Reports
1. The distributor shall provide the following information in the flow calculation report.
 - i. Customer information and project data
 - ii. Hazard information. At a minimum, hazard information shall include the minimum design concentration and adjusted design concentration, minimum and maximum enclosure ambient temperature, minimum agent required, volume of enclosures and any corresponding non-permeable volume, and identify the quantity of discharge nozzles.
 - iii. Cylinder information. At a minimum, cylinder information shall include total agent required, cylinder capacity, cylinder part number, cylinder quantities (both main and reserve), agent fill amount per cylinder and floor loading per cylinder.
 - iv. Pipe network information. At a minimum, pipe network information shall include pipe type, pipe diameter, pipe length, change in elevation, pipe equivalent length

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- and any added accessory equivalent length. In addition, the following nozzle information shall be provided; number of nozzles and identification of enclosure location, flow rate of associated nozzle, nozzle nominal pipe size, nozzle type and nozzle orifice area.
- v. Pipes and pipe fittings. A detailed list of pipe, by schedule, nominal diameter and length, and fittings, by nominal diameter and quantity.
- D. The architect will review all submittals for conformance to the drawings and specifications. The contractor shall be required to resubmit any materials, with appropriate modifications, that are found to be in non-conformance with the requirements of the drawings and these specifications after review by the architect. Approval of the submittals by the architect shall not relieve the Contractor of their responsibility to meet the requirements of the drawings and specifications.
- E. OPTIONAL: Three-Way Ball Valve Information. A calculation shall be completed for each directional valve in the piping network that is used to direct agent to a particular hazard area off of a central bank of cylinders. Modeling of the Three-Way Ball Valve shall be shown in the "open/thru" and "closed/to hazard" position
- F. Commissioning Equipment List: The distributor shall provide a commissioning equipment list for each installed clean agent fire extinguishing system. The equipment list shall identify all installed equipment and configurations.
- G. Test Plan
- 1. The distributor shall submit a test plan that describes how the system equipment and room integrity shall be tested. This shall include a step-by-step description of all tests and shall indicate type and location of test apparatus to be used. At a minimum, the tests to be conducted shall be per NFPA 2001 and any additional supplemental tests required by the AHJ. Tests shall not be scheduled nor conducted until the engineer of record approves the test plan.
- H. Installation Drawings
- 1. Four (4) sets of installation drawings for each installed clean agent fire extinguishing system and one (1) set of the calculation report (if not included in the drawings themselves), owner's manual and product data sheets shall be submitted to the end-user/owner.
 - 2. Upon completion of installation and commissioning acceptance, two (2) sets of "As-Built" installation drawings and One (1) set of the calculation report (if not incorporated into the drawings files) for each installed clean agent fire extinguishing system shall be given to the owner/end-user for use and reference.
- I. Operation and Maintenance Manuals
- 1. Two (2) copies of the Kidde Fire Systems Design, Installation, Operation and Maintenance Manual for the ADS clean agent fire extinguishing system employing FM-200 shall be submitted after complete installation.
- 1.6 **WARRANTY**
- A. Components provided by the manufacturer shall carry a warranty of thirty-six (36) months from date of shipment from the manufacturer's facility or one (1) full year from the date of installation.

2. PRODUCTS

SYSTEM DESCRIPTION

- A. The system shall be a Kidde ECS Advanced Delivery Fire Suppression System (ADS) with FM-200 agent and shall consist of FM-200, agent cylinder(s) with agent at vapor pressure, seamless nitrogen driver cylinder(s) pressurized to 1800-psig at 70°F (124 bar at 21°C), Kidde actuation hardware and Kidde discharge nozzle(s) attached to a pipe network. The ADS system shall be engineered for total flooding of the hazard being protected. The design of this system will be for Class A, B, and C fires as determined by the areas being protected.
- B. Agent Concentration Requirements
1. Achieve a 6.7% (v/v) extinguishing concentration for Class A (Surface Type Fires) hazards.
 2. Achieve a 8.7% (v/v) or greater, as required, extinguishing concentration for Class B (Flammable Liquids) hazards. Refer to Design, Installation, and Operations manual for design concentration guidance of Class B fuels or contact Kidde Fire Systems.
 3. Achieve a 7.0% (v/v) extinguishing concentration for Class C (Energized Electrical Equipment) hazards.

Note: Design Concentrations shall not exceed the agents Lowest Observed Adverse Effects Level (LOAEL) as published in NFPA 2001

4. ADS Cylinder(s) shall be capable of being remotely stored away from the protected hazard while still being able to deliver its 95% of its contents within 10 seconds, which can be verified through the ADS flow calculation program.

2.2 SYSTEM PERFORMANCE

- A. System Discharge
1. The discharge time required to achieve 95% of the minimum design concentration for flame extinguishment shall not exceed 10 seconds.
- B. Duration of Protection
1. 85% of the minimum design concentration shall be maintained for 10-minutes or a sufficiently longer period of time to allow effective emergency action by trained personnel.
- C. Minimum System Design Limits
1. Nozzles
 - i. Nozzles shall be listed and approved for a minimum height of 1 foot (0.31 m) to a maximum height of 16.0 feet (4.87 m) above the floor.
 - ii. Nozzle area coverage for both 360- and 180-degree nozzles shall be a maximum of 46ft x 56-ft (14.0-m x 17.0-m).

2.3 CYLINDER LOCATIONS:

- A. The cylinders of the this advanced delivery system must be able to be stored/located up to 180ft away from the protected hazard.
- B. The location chosen to remotely store/locate the cylinders from the protected hazard must verify its ability to deliver agent to the protected space in the required amount of time through the agent/system calculation software. The inability to meet the design requirements by any system will be considered as not meeting the specifications intent.

2.4 PIPE AND FITTINGS

- A. Distribution piping, and fittings, shall be installed in accordance with NFPA 2001, approved piping standards and the engineered fire suppression system manufacturer's requirements.
- B. Piping materials shall be Schedule 40 black iron, galvanized, stainless steel, or chrome plated conforming to ASTM A106 Seamless Grades A, B or C ; Schedule 40, ASTM A53 ERW Grades A or B ; Schedule 40, ASTM A53 F Furnace Welded ; Schedule 40
- C. Ordinary cast iron pipe shall A-120 steel pipe and non-metallic pipe shall not be used
- D. All fittings shall be 300lb Class fittings conforming, Class 300 malleable or ductile iron up to 6 inch (152mm), Class 300 flanged joints up to 8 inch (203mm), 500 lb. rated grooved up to 8 inch (203mm)
- E. Class 150 and cast-iron fittings shall not be used
- F. Nozzles shall be braced to prevent any movement in the horizontal or vertical planes
- G. Pipe unions are acceptable
- H. Inlets and Outlets of Tees can be on the vertical plane
- I. All piping shall be supported in a close as possible to concentrated loads and each change in direction. Hanger spacing's to be installed in accordance with pipe design practices and hanger manufacturers recommendation on spacing.
- J. All pipe must be reamed and cleaned prior to assembly to remove burrs and cutting oils
- K. The use of Teflon tape or Joint Compound is acceptable, but should only be applied to the male threads

2.5 ACTUATION HARDWARE

- A. The agent cylinders shall be actuated in accordance with the applicable design manual.
- B. While in the stand-by condition, actuators attached to the cylinder valve shall not be exposed to the cylinder's internal pressure so as to avoid introducing additional leak paths or accidental discharges.
- C. Solenoid actuators shall not require scheduled periodic replacement.
- D. The suppression panel shall be UL Listed per UL 864, 9th Edition with the interfacing electric actuators.

2.6 NOZZLES

- A. Total flooding clean agent extinguishing system nozzles shall be made of stainless steel.
- B. Each nozzle shall be located in the space per the manufacturer's guidelines. Nozzles shall have either a 180- or a 360-degree discharge pattern.
- C. Each nozzle discharge pattern shall be available in sizes ranging from 1/2-in NPT to 2-in NPT.
- D. Within each nozzle size and style, the manufacturer shall offer multiple different orifice areas (minimum of 20).
- E. Nozzles shall be UL Listed and FM Approved for use with the manufacturer's clean agent extinguishing system employing FM-200.

2.7 AGENT CYLINDER ASSEMBLIES

- A. FM-200 shall be stored in cylinders manufactured and marked in accordance with US Department of Transportation (DOT) specification 4BW-500 and Transport Canada (TC) specification 4BW-M34. The agent cylinders shall hold the agent at its vapor pressure at approximately 44 psig @ 70°F (3.0 bar gauge @ 21°C). The external nitrogen propellant shall be stored in seamless cylinders manufactured and marked in accordance with US DOT specification 3AA-2015 and TC specification 3AAM-154. The external nitrogen cylinders

shall be conditioned to 1800-psig @ 70°F (124.12 bar gauge @ 21°C). The system manufacturer shall be able to provide US DOT documentation that the registration number marked on the agent cylinder or the nitrogen cylinder corresponds to a manufacturing location at a US address.

1. FM-200 cylinders shall have a safety relief disc on the shoulder of the cylinder.
2. FM-200 cylinders shall have an integral cup check assembly for transfer of nitrogen.
3. FM-200 cylinders shall be equipped with an integral liquid level indicator (LLI). The LLI will allow the agent cylinder to remain connected and secured in place while measuring the agent mass.
4. An optional low pressure switch can be added to the Nitrogen cylinder(s) to provide a means of electrical supervision of driver pressure.

2.8 FIRE EXTINGUISHING AGENT

- A. Fire Suppression Agent: Du Pont™ agent (FM-200®) by E.I Du Pont de Nemours and Company.

2.9 OPTIONAL EQUIPMENT

- A. When protecting multiple hazard areas from a single supply of FM-200, Kidde Three-Way Directional Ball Valves shall be used.
- 1) The Three-Way Directional Ball Valves shall be UL Listed or FM Approved for use with FM-200 and Kidde Engineered Suppression Systems.
 - 2) The Three-Way Directional Ball Valves shall be installed and located in the piping network per the manufacturer's guidelines and design manual

3. EXECUTION

3.1 CLEAN AGENT FIRE EXTINGUISHING SYSTEM INSTALLATION

- A. The system shall be supplied and installed by a factory-authorized, Kidde Fire Systems Distributor. The Distributor shall be trained and certified by Kidde Fire Systems to design, install and maintain the Kidde fire suppression system. The distributor shall install the system in accordance with the manufacturer's design, installation, operation and maintenance manual.

3.2 ELECTRICAL SYSTEM INSTALLATION

- A. All electrical enclosures, raceways, and conduits shall be provided and installed in accordance with applicable codes and intended use, and shall contain only those electrical circuits associated with the fire-detection and control system. No circuit or circuits that are unrelated to the fire alarm or suppression system shall be routed through the enclosures, raceways, and conduits dedicated to the fire alarm or suppression system.
- B. Splicing of circuits shall be kept to a minimum, and is only permitted in an electrical box suitable for the purpose. Appropriate hardware shall be used to make the wire splices. Wires that are spliced together shall have the same color insulation.
- C. White colored wire shall be used exclusively for the identification of the neutral conductor of an alternating-current circuit. Green colored wire shall be used exclusively for the identification of the earth-ground conductor of an AC or DC circuit. Appropriate color-coding shall be utilized for all other field wiring.
- D. All electrical circuits shall be numerically tagged with suitable markings at each terminal point. All circuits shall correspond with the installation draw.

3.3 SYSTEM CHECKOUT

- A. Entire system shall be checked out, inspected, and functionally tested by factory authorized and trained personnel.

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- B. Inspection shall be performed in the presence of the owners representative, engineer or architects representative, insuring authority, and/or the local AHJ (Authority Having Jurisdiction)
 - C. Prior to final acceptance, the contractor shall provide operational and safety training in all concepts of the system to the owners key personnel. Release of clean agent shall not be part of the training requirements

3.4 **ROUTINE MAINTENANCE**

- A. Routine maintenance on equipment shall be performed by a certified Kidde Fire System Distributor, in accordance with the most current version of NFPA 2001 and the manufacturer's installation, operation and maintenance manual.