

1. GENERAL

1.1 DESCRIPTION OF WORK

- A. Design and installation of an engineered Kidde ADS clean agent/waterless fire suppression system using 3M™ Novec™ 1230 agent manufactured by Kidde Fire Systems, 400 Main Street, Ashland, MA 01721, USA.
- B. The components of the fire suppression system include the associated detection and fire-suppression control units
- C. All drawings shall be reviewed by the contractor such that all 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:
 1. NFPA
 - (a) NFPA 2001 Standard for Clean Agent Fire Extinguishing Systems
 - (b) NFPA 70 National Electrical Code (NEC)
 - (c) NFPA 72 National Fire Alarm Code
 2. Underwriter Laboratories, Inc (UL) UL2166 Standard for Halocarbon Clean Agent Extinguishing System
 3. Factory Mutual Approval Guide
 4. ANSI B1.20.1 Standard for pipe threads, General Purpose
 5. Requirements of the Local Authorities Having Jurisdiction (AHJ)
 6. Kidde Fire Systems Manual P/N 06-237256-001.
- 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 installer and the project's main General Contractor and all sub-contractors.

1.4 QUALIFICATIONS OF MANUFACTURER, DESIGNER, AND INSTALLER

- 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, manufacture 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 Kidde Fire Systems (the manufacturer) to design, install, test and maintain the ADS system, using Novec 1230 fire extinguishing agent and, upon request, 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.
 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. The Suppression System Contractor shall supply manufacturers' product technical data and catalog cut sheets for each component or device used in the system.
- B. Shop Drawings
 1. Shall be prepared by a person holding at least a NICET Level III certification
 2. Shall meet all systems design chapter requirements per NFPA 2001 and recommendations in the "Working Plans" section.
 3. Shall include design calculations for enclosure volume, agent quantity based on required design concentration for each hazard area.
 4. Shall provide indication of dimensions, weights and loads of equipment assemblies, components, method of field assembly, clearance requirements, mounting and bracing practices, etc
 5. Shall include isometric piping layouts
 6. Shall include plan and elevation views
 7. Shall include suppression system equipment locations
- C. 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.
- D. Commissioning Equipment List: The Suppression System Contractor shall provide a commissioning equipment list for each installed clean agent fire extinguishing system. The equipment list shall identify all installed equipment and configurations.
- E. Test Plan: The Suppression System Contractor 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.
- F. Installation Drawings
 1. The Suppression System Contractor shall submit the following to the end-user/owner
 - i. Four (4) sets of installation drawings for each installed clean agent fire extinguishing system,
 - ii. One (1) set of the calculation report,
 - iii. One (1) copy of the owner's manual
 - iv. One (1) set of the product data sheets.

2. Upon completion of installation and commissioning acceptance, the Suppression System Contractor shall submit the following to the end-user/owner
 - i. Two (2) sets of "As-Built" installation drawings
 - ii. One (1) set of the calculation report for each installed system.

G. Operation and Maintenance Manuals

1. Upon completion of installation and commissioning acceptance, the Suppression System Contractor shall provide two (2) copies of the Design, Installation, Operation and Maintenance Manual for the using Kidde ADS System using Novec 1230 to the end-user/owner.

H. Flow Calculation Reports

1. The Suppression System Contractor shall provide the following information in the flow calculation report.
 - i. Customer information and project data
 - ii. Hazard information including minimum and adjusted design concentrations, minimum and maximum enclosure ambient temperature, minimum agent required, volume of enclosures and any corresponding non-permeable volume.
 - iii. Cylinder information including 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 including pipe type, diameter, length, change in elevation, equivalent lengths of all added accessories as applicable.
 - v. Nozzle information including number of nozzles and identification of enclosure location, flow rate of associated nozzle, nozzle nominal pipe size, nozzle type and nozzle orifice area.
 - vi. Pipes and pipe fittings. A detailed list of pipe, by schedule, nominal diameter and length, and fittings, by nominal diameter and quantity.
 - vii. Agent software shall be listed and approved by UL and FM. The flow calculations software shall include the option of using the 3 Way Selector valve if needed.
 - viii. OPTIONAL: 3 Way Selector valves shall be used to protect multiple hazards with a common bank of cylinders. The fire suppression contractor shall submit a flow calculation for each hazard protected by directional valves. Modeling of the Three-Way Ball Valve shall be shown in the "open/thru" and "closed/to hazard" position

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

2.1 **SYSTEM DESCRIPTION**

- A. The system shall be a Kidde Advanced Delivery Fire Suppression System (ADS) Fire Suppression System using Novec 1230 agent and shall consist of Kidde agent cylinder(s) super pressurized with dry nitrogen to 360 psig (24.8 Bar) at 70°F (21°C), Kidde seamless nitrogen driver cylinder(s) pressurized to 1800-psig at 70°F (124 bar at 21°C), Kidde actuation hardware and Kidde ADS discharge nozzle(s) attached to a pipe network.
- B. The ADS system shall be engineered for total flooding of the hazard being protected.
- C. The design of this system shall be for Class A, B, and C fires as determined by the area being protected.
- D. OPTIONAL: Hazards requiring uninterrupted service shall be provided with a reserve bank of cylinders of the same capacity as the main bank and connected to the same manifold.
- E. Agent Concentration Requirements
 1. The system shall achieve a 4.5% (v/v) extinguishing concentration for Class A (Surface Type Fires) hazards.

2. The system shall achieve a 5.8% (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. The system shall achieve a 4.5% (v/v) extinguishing concentration for Class C (Energized Electrical Equipment) hazards per the latest UL listing by 3M.
4. The system Design Concentrations shall not exceed the agents Lowest Observed Adverse Effects Level (LOAEL) as published in NFPA 2001

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 shall be listed and approved to protect sub-floors of height 1 foot (0.31 m) above floor deck
 2. Nozzles shall be listed and approved to protect rooms of height 18.5 foot (5.64 m) without requiring the use of additional levels of nozzles. Nozzles listed for less than 18.5 foot (5.64 m) room height shall not be acceptable.
 3. Nozzle area coverage for both 360- and 180-degree nozzles shall be a maximum of 42.5 foot x 42.5 foot (12.95 m x 12.95 m).

2.3 AGENT CYLINDER LOCATIONS:

- A. In order to maximize the end-user/owner's available real estate and minimize any disruption during fire suppression system installation, testing and maintenance, agent storage cylinders shall be located in a designated area at a distance in excess of 180 feet from the core business / process space being protected.
- B. The suppression system contractor shall submit agent flow calculations to prove that the system performance is not impaired as a result of the remote cylinder placement.
- C. Cylinders shall be proven via the flow calculation program output report to deliver 95% of their contents within 10 seconds
- D. The inability to meet the design requirements by any system shall be considered as not meeting the intent of the specifications.

2.4 AGENT CYLINDER ASSEMBLIES

- A. The Novec 1230 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.
- B. 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.
- C. The system manufacturer shall be able to provide US DOT documentation that the registration number marked on the agent cylinder corresponds to a manufacturing location at a US address.
- D. The agent cylinders shall hold the agent at 360 psig @ 70°F (24.8 bar gauge @ 21°C).
- E. The agent cylinder assembly shall be provided with a safety relief disc.
- F. The agent cylinders shall be equipped with an integral liquid level indicator (LLI) so as to enable the agent cylinder to remain connected and secured in place while measuring the agent mass.
- G. The agent cylinder shall have a pressure gauge to provide a visual reading of actual container pressure.
- H. The external Nitrogen driver cylinders shall be equipped with a low-pressure switch wired to the system control panel supervisory circuit.

- I. OPTIONAL: The agent cylinders shall be equipped with a low-pressure switch wired to the system control panel supervisory circuit.

2.5 FIRE EXTINGUISHING AGENT

- A. The Fire Suppression Agent shall be Novec 1230 supplied by Kidde.
- B. The suppression agent properties shall meet the standards of quality as given below:
 - 1. Agent Purity, mole % minimum 99%
 - 2. Acidity, ppm (by weight HCL equivalent), maximum 3.0
 - 3. Water Content, weight %, maximum 0.001
 - 4. Non-volatile residues, g/100ml maximum 0.05

2.6 CYLINDER ACTUATION HARDWARE

- A. Kidde ADS Nitrogen drivers shall be actuated by Kidde Actuators 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. Kidde Actuators shall not require scheduled periodic replacement.
- D. Kidde Actuators shall be actuated by an UL listed and FM approved Kidde Suppression Control Unit compatible listed with the Kidde Actuators.

2.7 AGENT NOZZLES

- A. Kidde Total Flooding ADS style clean agent extinguishing system nozzles shall be utilized
- B. The nozzles shall be made of stainless steel.
- C. 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.
- D. Each nozzle discharge pattern shall be available in sizes ranging from 1/2-in NPT to 2-in NPT.
- E. Within each nozzle size and style, the manufacturer shall offer multiple different orifice areas.
- F. Nozzles shall be UL Listed and FM Approved for use with the manufacturer's clean agent extinguishing system employing Novec 1230.

2.8 MULTI-AREA PROTECTION

- A. Selector valves shall be used to protect multiple areas (identified elsewhere) with the same set of agent cylinders.
- B. The 3-way selector valves shall be UL listed or FM approved as components of the Kidde ADS system using Novec 1230.
- C. The 3-way selector valves shall be located and installed in the piping network in accordance with the manufacturer's guidelines and design manual.
- D. Sizes of the selector valves shall vary from 1/2" to 4".

2.9 PIPE AND FITTINGS

- A. Agent distribution piping and fittings shall be installed in accordance with NFPA 2001, approved piping standards and the suppression system manufacturer's requirements.
- B. Piping materials shall be Schedule 40 black iron, galvanized, stainless steel, or chrome plated conforming to (a) ASTM A106 Seamless Grades A, B or C or (b) Schedule 40, ASTM A53 ERW Grades A or B or (c) Schedule 40, ASTM A53 F Furnace Welded
- C. Ordinary cast iron pipe, A-120 steel pipe and non-metallic pipe shall not be used
- D. All fittings shall conform to Class 300 malleable or ductile iron for sizes up to 6 inch (152mm), Class 300 flanged joints for sizes up to 8 inch (203mm) and Class 500 lb. grooved for sizes 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. All piping shall be supported as close as possible to concentrated loads and each change in direction. Hanger spacing's shall be in accordance with pipe design practices and hanger manufacturers recommendation on spacing.
- I. All pipe shall be reamed and cleaned prior to assembly to remove burrs and cutting oils
- J. The use of Teflon tape or Joint Compound is acceptable, but should only be applied to the male threads

3. EXECUTION

3.1 CLEAN AGENT FIRE EXTINGUISHING SYSTEM INSTALLATION

- A. The system shall be supplied and installed by a factory-authorized, Kidde Suppression System Contractor. The Suppression System Contractor shall be trained and certified by Kidde Fire Systems to design, install and maintain the Kidde fire suppression system. The Suppression System Contractor 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.
- 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 Suppression System Contractor, in accordance with the most current version of NFPA 2001 and the manufacturer's installation, operation and maintenance manual.