

1. GENERAL

1.1 INTENT OF SPECIFICATIONS

- A. This specification details the requirements for an engineered clean agent / waterless fire suppression system for marine applications, Model Kidde ECS with HFC-227ea (ECS-HFC227ea). These requirements, combined with good engineering practices must be followed in order to produce a safe and effective fire protection and suppression system.
- B. All system components shall be manufactured and/or supplied by Kidde Fire Systems, 400 Main Street, Ashland, MA 01721, USA; Phone (508) 881-2000; URL: [http:// www.kiddefiresystems.com](http://www.kiddefiresystems.com)
- C. All materials and equipment shall be new and unused. Recycled products shall not be acceptable

1.2 System Description

- A. The clean agent suppression system shall be a total flooding type Kidde ECS with HFC-227ea certified and approved for Marine applications.
- B. The system hardware shall consist of HFC-227ea Agent in Cylinder(s) super-pressurized with Nitrogen to 360 psig at 70F (25 bar at 21C) and discharged into the affected area using discharge nozzle(s) attached to a pipe network.

1.3 CODES AND COMPLIANCE

- A. The design, installation, testing and maintenance of the clean agent fire suppression system shall be in accordance with the following applicable codes, standards and regulatory bodies:
 1. NFPA 2001: Clean Agent Fire Extinguishing Systems
 2. UL 2166: Halocarbon Clean Agent Extinguishing System Units
 3. FM5600: Approval Standard for Clean Agent Extinguishing System
 4. ANSI B1.20.1: Standard for Pipe Threads, General Purpose
 5. Applicable Ship Classification Society
 - i. American Bureau of Shipping (ABS)
 - ii. Det Norske Veritas (DNV)
 - iii. Lloyds Register of shipping (LRS)
 - iv. Transport of Canada (TC_LOA)
 6. International Maritime Organization – Safety Of Life At Sea
 7. Requirements of the Local Authority Having Jurisdiction
 8. Manufacturer's Design, Installation, Operation & Maintenance Manual
- B. The complete system shall have the applicable following listings and approvals:
 1. USCG Certificate of Approval
 2. UL 2166 Listed for marine use – Underwriters Laboratories, Inc. (UL)
 3. Underwriters Laboratories, Inc of Canada (ULC)
 4. Factory Mutual Global (FM)

1.4 QUALIFICATIONS

- 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. The manufacturer/supplier name and part number shall appear on all major components.
 4. All equipment shall be provided by the same manufacturer / supplier.
- B. Contractor
 1. The system shall be supplied and installed by a factory authorized, Kidde Fire Systems distributor. The Contractor shall be trained by the manufacturer to calculate/design, install, test and maintain the system and shall be able to produce a certificate stating such on request.
 2. The Contractor shall employ a person who can show proficiency at least equal to a NICET level III or IV certification in special hazards design.
 3. The Contractor shall confirm in writing that they stock a full complement of spare parts and offer 24-hour emergency service for all equipment being furnished.

4. The Contractor shall maintain or have access to a recharging station capable of recharging the suppression system within 48hrs after discharge.

1.5 WARRANTY

- A. The manufacturer shall warrant the system equipment for 36-months from the date of shipment from the factory
- B. The contractor shall warrant the installation for 12-months from time of customer acceptance or commissioning

1.6 SUBMITTALS

- A. 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.
- B. The contractor shall submit the manufacturers' product technical data and catalog cut sheets for each component or device used in the system.
- C. Engineered Design Drawings: The Contractor's NICET III or IV certified designer shall design the system and provide documents that shall include but are not limited to the following details:
 1. Plan, elevation and isometric drawings showing the location, installation and mounting details of the agent cylinders, valves, nozzles and other accessories.
 2. Design calculations for enclosure volume, agent quantity based on required design concentration for each hazard area.
 3. Dimensions, weights and loads of equipment assemblies, components, method of field assembly, clearance requirements, mounting and bracing practices, etc
 4. Flow Calculation Reports showing the following:
 - i. Customer information and project data
 - ii. 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.
 - iii. 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 shall include pipe type, pipe diameter, pipe length, change in elevation, pipe equivalent length and the equivalent length of any added accessory.
 - v. Nozzle information shall include the number of nozzles, flow rate per nozzle, nozzle nominal pipe size, nozzle type and nozzle orifice area.
 - vi. Pipe fittings information shall include a detailed list by nominal diameter and quantity.
 5. Any other requirements of NFPA-2001 latest edition.
- D. Commissioning Equipment List: The Contractor shall provide a commissioning equipment list for each installed system. The equipment list shall identify all installed equipment and configurations.
- E. Test Plan: The 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 or end users representative approves the test plan.
- F. The Contractor shall submit the following 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 for each installed system shall be submitted to the owner/end-user.
- G. The Contractor shall submit the following Manuals after complete installation

1. Two (2) copies of the ECS HFC-227ea Design, Installation, Operation and Maintenance Manual.

2. PRODUCT/SYSTEM REQUIREMENTS

2.1 System Exclusions

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

2.2 Agent Concentration Requirements

- A. The system shall be designed to suppress Class A / B / C (select option) fires.
- B. The agent design concentration achieved shall be 6.7% (v/v) for Class A Surface Type Fires / as required by the system manufacturer for Class B Flammable Liquids / 7.0% (v/v) for Class C Energized Electrical Equipment (select one option).
- C. In no case shall the design concentrations exceed the Lowest Observed Adverse Effects Level (LOAEL) for the agent as published in NFPA 2001

2.3 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. Nozzle performance

1. Both 180-degree and 360-degree nozzles shall be listed to be mounted at heights up to 15.5 feet (4.72 m) from the floor.
2. Both 180-degree and 360-degree nozzles shall be listed to cover an area of 16.4 ft x 32.8 ft (5.0 m x 10.0 m).

2.4 Cylinder Locations:

- A. The agent cylinders shall be located in or in close proximity of the protected area.
- B. Where subject to moisture, cylinders shall be installed to provide a space of 2.0 in. (~51 mm) between the deck and the bottom of the container is required.
- C. The system shall deliver 95% of its contents within 10 seconds of the start of the discharge.
- D. The flow calculation report submitted shall verify this performance requirement.
- E. The inability to meet the design requirements and selected cylinder locations by any system will be considered as not meeting the intent of the specification.

2.5 Cylinder Assemblies

- A. The HFC-227ea agent 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 be conditioned to 360 psig @ 70°F (24.8 bar gauge @ 21°C).
- B. The system manufacturer shall provide US DOT documentation proving that the registration number marked on the agent cylinders corresponds to a USA based manufacturing location.
- C. The HFC-227ea agent cylinders shall comply with the following:
 1. Cylinders of capacity 100 lbs and above shall be equipped with a permanent integral liquid level indicator (LLI) to enable the owners representative measure the weight of agent in each individual cylinder without having to physically move or lift the cylinders. Systems without integral LLIs shall not be considered as equal.
 2. The cylinders shall have a pressure gauge to indicate the actual container pressure.
- D. Cylinders shall be secured with a two bracket system.

2.6 Fire Suppression Agent

- A. The Fire Suppression Agent shall be HFC-227ea
- B. The agent shall be UL listed and FM approved
- C. The agent shall comply with requirements stipulated in NFPA 2001 and specifically the following:
 1. The Agent Purity by mole shall be greater than or equal to 99.0%
 2. The Acidity by weight of HCL equivalent shall be less than or equal to 3.0ppm
 3. The maximum Water Content shall be less than or equal to 0.001%

4. The maximum Non-volatile residue shall be less than or equal to 0.05 g/100mL
5. The maximum allowed PFIB shall be less than or equal to 100ppb
- D. The manufacturer shall be able to produce a certificate from a recognized laboratory confirming the above qualifications on request.
- E. Agents obtained from re-claiming or re-cycling shall not be acceptable.
- F. The cylinders shall be filled with agent at a UL-listed first fill facility
- G. **[Optional]** Since the protected vessel is required to comply with International Maritime Organization (IMO) High speed Craft (HSC) code requirements and since multiple hazards are protected with individual systems for each hazard, cylinders shall be arranged with cross-over valves such that agent intended for one hazard can be discharged into another and vice-versa.

2.7 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.

2.8 ACTUATION HARDWARE

- A. The agent cylinders shall be mechanically actuated with two distinctive physical actions in compliance with USCG requirements.
- B. For evacuation and safety purposes, agent discharge shall be preceded by the sounding of a Pneumatic Siren and delayed by a Pneumatic Time Delay.
- C. It shall be possible to remotely actuate the system from a distance of up to 300 feet from the cylinder storage location.

2.9 Nozzles

- A. System nozzles shall be made of brass.
- B. Nozzles shall be spaced in the protected area to achieve uniform distribution of the agent.
- C. Nozzles shall have either a 180-degree and 360-degree discharge patterns.

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 SYSTEM CHECKOUT

- A. The 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

3.3 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 USCG and the manufacturer's installation, operation and maintenance manual. The routine maintenance shall include the following:
 1. Visual check of pipe network and distribution nozzles per the operation and maintenance manual.
 2. Weight and pressure of the cylinders per the operation and maintenance manual.
 3. Inspect all cylinders and equipment for damage per the operation and maintenance manual.
 4. Routine maintenance on the suppression system as a whole shall be performed as recommended by NFPA 2001, current edition.