Certificate No: LR2419056SF
Issue Date: 15/01/2024
Expiry Date: 14/01/2029

Certificate Of Fire Approval

This is to certify that the product detailed below will be accepted for compliance with the applicable Lloyd's Register Rules and Regulations and with the International Convention for the Safety of Life at Sea, (SOLAS), 1974, as amended, for use on ships and offshore installations classed with Lloyd's Register, and for use on ships and offshore installations when authorised by contracting governments to issue the relevant certificates, licences, permits etc.

Manufacturer	**Kidde-Fenwal Inc.**
Address	400 Main Street, Ashland, MA 01721, United States
Type	Fixed Gas Fire Extinguishing System
Description	Fixed Fire Extinguishing System – Type: "HFC-227ea ECS Marine Fire Suppression System" for Machinery Spaces of Category A and Cargo Pump Rooms equivalent to fire extinguishing systems required by SOLAS 1974 as amended, Chapter II-2/10.4 and 10.9
Trade Name	HFC-227ea ECS Marine Fire Suppression System
Specified Standard	IMO MSC/Circ. 848 as amended by MSC.1/Circ.1267

This certificate is not valid for equipment, the design or manufacture of which has been varied or modified from the specimen tested. The manufacturer should notify Lloyd's Register North America, Inc. of any modification or changes to the equipment in order to obtain a valid Certificate.

The Design Appraisal Document and its supplementary Type Approval Terms and Conditions form part of this Certificate.

This certificate remains valid unless cancelled or revoked, provided the conditions in the attached Design Appraisal Document are complied with and the equipment remains satisfactory in service.

Bruce McDonald

Global Fire & Safety Manager to Lloyd's Register North America, Inc.
A member of the Lloyd's Register group

1330 Enclave Parkway, Houston, Texas, 77077,
United States

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The undernoted documents have been appraised for compliance with the relevant requirements of International Conventions, and this Design Appraisal Document forms part of the Certificate.

This Certificate is an Amendment and a Renewal of Certificate Number: **LR2015571SF-03**

APPROVAL DOCUMENTATION

TEST REPORTS

U.S. Coast Guard Research and Development Center, Connecticut, United States of America, Test Report No. CG-D-02-99, "An Evaluation of the International Maritime Organization's Gaseous Agents Test Protocol with Halocarbon Agents and an Inert Gas, 180° Nozzles, and Low Temperature Conditioned Cylinders", dated December 1998.

Underwriters Laboratory of Canada, Test Report File. EX 4674 (Pages T 1-5) dated 3 March 2005 for Tell-tale tests conducted on 180° and 360° nozzles in accordance with IMO MSC/Circ.848 and File EX 4674 Test Record No.3 (on Page T3-1) dated 15 November 2002 and revised on 27 June 2012 confirming IMO MSC.1/Circ.1267 compliance.

CONDITIONS OF CERTIFICATION

1. This type approval is restricted to the fire extinguishing agent and arrangement of the nozzles only; approval of ancillary components is to be carried out at the design stage and suitable evidence of their approval such as Type Approval certificates are to be provided to the design Plan Approval authority and the attending surveyor.

2. The National Authorities of the vessel concerned are to accept the use of HFC-227ea as being acceptable for compliance with The International Code for Fire Safety Systems (Fire Safety Systems Code), Chapter 1, paragraph 4 and Chapter 5, paragraph 2.4 at the design stage. The manufacturers of the system are to advise, whoever they are contracted to, of this requirement at the earliest opportunity.

3. If the system is to be of the modular type, i.e., with the cylinders distributed within the machinery space, the National Authorities are to accept the arrangements with due reference to the Fire Safety Systems Code, Chapter 5, paragraph 2.1.2.2 and MSC/Circular 848, paragraph 11 of the Annex, as amended by MSC.1/Circ 1267.

4. The computation of the discharge time for each application is to be produced by Kidde ECS Series HFC-227ea Flow Calculation Program and is to be independently verified at the design stage. The system should be designed so that 95% of the extinguishing agent can be discharged in 10 seconds.

5. The quantity of HFC-227ea for the protected space is to be calculated at the minimum expected ambient temperature (which is to be no greater than zero degrees Celsius) with a minimum design concentration of 8.7%. In no case should the maximum concentration exceed 10.5% (LOAEL Limit) at the maximum expected ambient temperature, (not less than 50 degrees Celsius). Other temperature ranges may be considered on a project by project basis, subject to agreement by the National Authorities.

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6. The design concentration is to be based on the net volume of the protected space, including the casing, the bilge and the volume of free air contained in air receivers that in the event of a fire, is released into the protected space. All objects that occupy volume in the protected space should be subtracted from the gross volume of the space. They include, but are not necessarily limited to: auxiliary machinery, boilers, condensers, evaporators, main engines, reduction gears, tanks and trunks.

7. The discharge of HFC-227ea is to be evenly distributed over the protected space and the nozzle spacing is not to exceed 5 metres for a 360 degree nozzle or 5 metres for a 180 degree nozzle or equivalent nozzle coverage arrangement. The maximum nozzle vertical spacing is not to be greater than 5 metres.

8. The average minimum pressure at each nozzle is to be not less than 5.1 bar, at a maximum cylinder fill density of 1121 kg/m3, for nozzle types: 360 degrees (PART No. 90-19402X -XXX) and 180 degrees (PART No. 90-19401X-XXX). The drill sizes of each nozzle orifice and the quantity of agent to be discharged from each nozzle is to be determined by the software calculation program. Nozzles to be manufactured from ASTM B16 Brass.

9. The arrangements and parts used in the system are to be in accordance with the Kidde Fire Systems – Design, Installation, Operation and Maintenance Manual Document Number: 06-236225-001 Rev. BA dated October 2014, including Addendums as listed in the Appendix below. This manual also contains recommended procedures for the control of products of agent decomposition, including HF vapour generated from fluorocarbon extinguishing agents which could impair escape. Note: The Design Installation Manual is for reference only; system installation to be in accordance with the conditions of certification and general notes and to the satisfaction of the design plan approval authority and the attending surveyor. Additionally, where differences exist between the Installation Manual and the Certificate, the information in the Certificate must be considered correct and applied.

10. Arrangement drawings and calculations are to be submitted for acceptance in each case where it is proposed to install this system. Control panel schematics are also to be submitted. All principle components of the system are to be identified and their location indicated.

11. The means of control of the fixed gas fire-extinguishing system shall be readily accessible, simple to operate, and shall be grouped together in as few locations as possible at positions not likely to be cut off by a fire in a protected space. At each location there shall be clear instructions relating to the operation of the system having regard to the safety of personnel.

12. Where agent containers are stored within a protected space, the containers should be evenly distributed throughout the space and the arrangement of containers and the electrical circuits and piping essential for the release of any system should be such that in the event of damage to any one power release line or container valve through mechanical damage, fire or explosion in a protected space, i.e. a single fault concept, at least the amount of agent needed to achieve the minimum extinguishing concentration can still be discharged having regard to the requirement for uniform distribution of medium throughout the space; and the containers should be monitored for decrease in pressure due to leakage and discharge. Visual and audible alarms in the protected area and on the navigation bridge or in the space where the fire control equipment is centralised should be provided to indicate this condition.

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13. Production items are to be manufactured in accordance with a quality control system which shall be maintained to ensure that items are of the same standard as the approved prototype.

14. The certificate holder is solely responsible for the products supplied under this Certificate and to ensure that their products, whether manufactured by themselves or their licensee manufacturers, if agreed by Lloyd's Register, are fully compliant with the relevant statutory regulations and Lloyd's Register Class rules as applicable and designed, manufactured and installed to the same quality and specifications as the prototype tested, including components that are designed and manufactured by third parties.

NOTES

1. The system is to be designed in accordance with the Annex of IMO MSC/Circ. 848 as amended by MSC.1/Circ.1267. In particular, revised requirements apply where agent containers are stored within a protected space.

2. All systems should be designed to allow evacuation of the protected spaces prior to discharge. Means should also be provided for automatically giving audible and visual warning of the release of the fire-extinguishing medium into any space in which personnel normally work or to which they have access. The alarm should operate for the period of time necessary to evacuate the space, but not less than 20 seconds before the medium is released. Unnecessary exposure, even at concentrations below an adverse effect level, should be avoided.

3. Even at concentrations below an adverse effect level, exposure to gaseous fire extinguishing agents should not exceed 5 minutes. If a halocarbon agent is to be used above its NOAEL, means should be provided to limit exposure to no longer than the time specified according to a scientifically accepted physiologically based pharmacokinetic (PBPK) model or its equivalent which clearly establishes safe exposure limits both in terms of extinguishing media concentration and human exposure time.

4. The mechanical ventilation of the protected space(s) must be stopped before the activation of the fixed gas system and compartment closure arrangements should be designed to provide an agent hold time of at least 15 minutes. The release of an extinguishing agent may produce significant over and under pressurisation in the protected space. Measures to limit the induced pressures to acceptable limits should be provided.

5. The system should be supplied by both main and emergency sources of power, with the emergency power supply being provided from outside the protected machinery space.

6. The system pipework including: flexible hoses, pipes, valves and fittings are to be approved by Lloyd’s Register, in accordance with Lloyd’s Register Rules, Part 5.

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7. 10% of the distribution piping is to be tested to 1.25 times the maximum pressure likely to be experienced in service. For the KIDDE-FENWAL HFC-227ea system, this equates to 1.25 x 34.5 bar (at 50 deg. C) = 43.5 bar. The manifold pipework is to be tested to at least 1.5 times the setting of the manifold relief valve. The manifold relief valve is to be set at a minimum pressure of 52 bar and the minimum manifold test pressure is to be 78 bar. All pipework including manifold and fittings should be of suitable galvanised steel or stainless steel construction. Threaded joints in fixed gas systems shall be allowed only inside protected spaces and in cylinder storage spaces.

8. The storage system containers and associated pressure components, in particular, valves and fittings exceeding 7 bar, are to be designed and tested to codes of practice recognised by Lloyd's Register, indicating that they can withstand the pressure expected in service, having regard to their installed location and that they are suitable for the agent identified.

9. For cylinder head valves or actuators or other components of marine safety critical systems, which use retainer screws or similar arrangements for torque setting or other critical applications that are likely to change from its set position due to vibration, thus adversely affecting system functionality:
   - Screwed fastenings that are subject to vibration require a locking device to prevent them working loose.
   - If stroke length is determined by external stroke end stops, means shall be provided for locking the adjustable end stops.
   - For critical operations, positive locking arrangements are to be utilised.

10. Recommended procedures for the control of products of agent decomposition are to be provided. In particular, on passenger ships, the decomposition products should not be discharged in the vicinity of muster (assembly) stations.

11. Provisions should be made to ensure that escape routes which are exposed to leakage from the protected space are not rendered hazardous during or after discharge of the agent in the event of fire. In particular, HF vapour can be produced in fires as a breakdown product of the fire extinguishing agent and can cause health effects such as upper respiratory tract and eye irritation to the point of impairing escape. Control Stations and other locations that require manning during a fire situation should have provisions to keep HF and HCl below 5 ppm at that location. The concentrations of other products should be kept below concentrations considered hazardous for the required duration of exposure.

12. As longer exposure of the agent to high temperatures would produce greater concentrations of HF and HCl gases, the type and sensitivity of detection, coupled with the rate of discharge, should be selected to minimise the exposure time of the agent to the elevated temperature. The performance of fire-extinguishing arrangements on passenger ships should not present health hazards from decomposed extinguishing agents, for example on passenger ships, the decomposition products should not be discharged in the vicinity of muster (assembly) stations. Other mitigating steps include evacuation and donning masks.

13. Warning signs and audible and visual alarms should be located outside each entry to the protected space(s).

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14. The quantity and design concentration of the fire extinguishing agent and the nozzle configuration to be used onboard for each application must be in accordance with this certificate. The approval of all other system components and the final system installation onboard must be to the satisfaction of the of the design plan approval authority and the attending surveyors. On completion of the installation final acceptance of the system is dependent on satisfactory survey.

APPENDIX

List of Addendums to Kidde Fire Systems – Design, Installation, Operation and Maintenance Manual Document Number: 06-236225-001 Rev. BA dated October 2014.

1. Addendum 06-237553-001 Rev AA, August 2016 on “2 Inch valve and safety burst disc information”
2. Addendum 06-237784-001 on 2” and 3” Valve Burst Disc Harmonization
3. Addendum 06-236225-007 on new Liquid Level Indicator
4. Addendum 06-236225-008 on new 450 lb Cylinder
5. Addendum 06-236225-009 Rev AA, Safety Data Sheet Addendum
6. Addendum 06-237798-001 on 2” El-Check Valve
7. Addendum 06-237577-001 on Control Head & Remediation
8. Addendum 06-237761-001 on 3” Valve
9. Addendum 06-237766-001 on Flexible discharge hose
10. Addendum 06-237775-001 on Manifold Y Fitting
11. Addendum 06-237670-001 on Clean Agent Sign
12. Addendum 06-237834-001 Rev AA, on modified 1.5" and 3" El-Check Valves
13. Addendum 06-237826-001 Rev AA on modified Pressure switch port on cylinder valve for optional pressure switch installation

1. The Design Installation Manual and Addendums are for reference only; system installation is to be in accordance with the conditions of certification and general notes and to the satisfaction of the design plan approval authority and the attending surveyor. Additionally, where differences exist between the Installation Manual and the Certificate, the information in the Certificate must be considered correct and applied.

2. This type approval certificate is restricted to the fire extinguishing agent and the arrangement of nozzles only; approval of all ancillary components, including those in manufacturer documents listed above, are to be carried out at the design stage and suitable evidence of their approval such as Type Approval certificates are to be provided to the design Plan Approval authority and the attending surveyor.

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Supplementary Type Approval Terms and Conditions

This certificate and Design Appraisal Document relates to type approval, it certifies that the prototype(s) of the product(s) referred to herein has/have been found to meet the applicable design criteria for the use specified herein, it does not mean or imply approval for any other use, nor approval of any products designed or manufactured otherwise than in strict conformity with the said prototype(s)