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F-01

FIXED PRESSURE WATER-SPRAYING AND WATER MIST FIRE-EXTINGUISHING SYSTEM

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Foreword:

CCS Product Inspection and Testing Guideline (hereinafter referred to as this Guideline) contains the technical requirements, inspection and testing criteria related to classification and statutory survey of marine products to be applied for CCS approval/inspection.

This Guideline frees the users to adopt other test methods and requirements which are equivalent to or are stricter than this Guideline.

This Guideline is published and updated by CCS, and is released at http://www.ccs.org.cn. Your comments or suggestions are welcomed and may be sent to our email addressed mp@ccs.org.cn.

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FIXED PRESSURE WATER-SPRAYING AND WATER MIST FIRE-EXTINGUISHING SYSTEM

1 Application

1.1 This Guideline applies to the type approval and products inspection of fixed pressure water-spraying and water mist fire-extinguishing system within machinery spaces of category A and cargo pump rooms as specified in SOLAS Regulation II-2/10.

2 Classification of fixed pressure water-spraying and water mist fire-extinguishing system

2.1 To be classified by fire-extinguishing medium:

(1) uniflow system: means a fire-extinguishing system applying single pipe to each nozzle;

(2) two-way flow system: means a water spraying fire-extinguishing system separately supplied with water and atomized medium which are mixed at the water-spraying nozzle.

2.2 To be classified by working mode:

(1) open system (deluge system);

(2) close system (wet pipe system, dry pipe system and preaction system).

2.3 To be classified by water supply mode:

(1) pump group system: means the water-spraying system using pump group to supply water;

(2) container system: means the water-spraying system applying water and gas receivers to pressure and supply water.

3 Normative references

3.1 The approval and inspection of fixed pressure water-spraying and water mist fire-extinguishing system are to be carried out based on the following documents and amendments:

(1) Chapter II-2 of International Convention for the Safety of Life at Sea, 1974, as amended;

(2) IMO International Code for Fire Safety Systems (FSS Code);

(3)MSC/Circ.1165–Revised Guidelines for the Approval of Equivalent Water-Based

Fire-extinguishing Systems for Machinery Spaces and Cargo Pump-rooms.

4 Definitions

4.1 For the purpose of this Guideline:

(1) Water-based extinguishing medium means fresh water or seawater with or without additives mixed to enhance fire-extinguishing capability.

(2) Preaction system means a system employing automatic nozzles attached to a piping system containing air that mayor may not be under pressure, with a supplemental detection system installed in the same area as the nozzles. Actuation of the detection system opens a valve that permits water to flow into the piping system and to be discharged from any nozzles that may be open.

(3) Wet pipe system means a system employing nozzles attached to a piping system containing water and connected to a water supply so that water discharges immediately from the nozzles upon system activation.

(4) Dry pipe system means a system employing nozzles attached to a piping system containing air or nitrogen under pressure, the release of which (as from the opening of a nozzle) permits the water pressure to open a valve known as a dry pipe valve. The water then flows into the piping system and out of the opened nozzle.

(5) Deluge system means a system employing open nozzles attached to a piping system connected to a water supply through a valve that is opened by the operation of a detection system installed in the same areas as the nozzles or opened manually. When this valve opens, water flows into the piping system and discharges from all nozzles attached thereto.

(6) Antifreeze system means a wet pipe system containing an antifreeze solution and connected to a water supply. The antifreeze solution is discharged, followed by water, immediately upon operation of nozzles.

5 Plans and documents

5.1 The following documents are to be submitted to CCS for approval when applying for type approval:

(1) main performance specification table;

(2) general assembly plan;

(3) main parts plan;

(4) schematic diagram of the system;

(5) calculations;

(6) a list of physicochemical properties of main parts materials;

(7) technical conditions of delivery and acceptance;

(8) the type test program.

5.2 The following documents are to be submitted to CCS for information when applying for type approval:

(1) product specifications, including the maximum spacing and height for installation of nozzles, the distance below the ceilings, the maximum protecting capacity and the maximum ventilation, etc.

5.3 The applicant is to submit to CCS the following plans and technical documents as approved by ship plan approval units when applying for products inspection by CCS:

(1) schematic diagram of the system;

(2) piping arrangement of full-scale ship, including nozzles arrangement, protection areas, release station and pump group;

(3) piping hydraulic calculations;

(4) arrangement of fire detection and fire alarm system.

6 Materials and components

6.1 Materials and components are to comply with relevant requirements of CCS Rules.

7 Design and technical requirements

7.1 Arrangement and installation

7.1.1 Nozzles are to be fitted above bilges, tank tops and other areas over which oil fuel is liable to spread and also above other specific fire hazards in the machinery spaces.

7.1.2 The system may be divided into sections, the distribution valves of which are to be operated from easily accessible positions outside the spaces to be protected so as not to be readily cut off by a fire in the protected space.

7.1.3 The system operation controls are to be available at easily accessible positions outside the spaces to be protected and are not to be liable to be cut off by a fire in the protected spaces.

7.1.4 Pressure source components of the system are to be located outside the protected spaces.

7.1.5 A means for testing the operation of the system for assuring the required pressure and flow is to be provided.

7.2 Function and control

7.2.1 The system is to be capable of manual release.

7.2.2 The activation of the fire-fighting system is not to result in loss of electrical power or reduction of the maneuverability of the ship.

7.2.3 The system is to be available for immediate use and capable of continuously supplying water for at least 30 min in order to prevent re-ignition or fire spread within that period of time. Systems which operate at a reduced discharge rate after the initial extinguishing period are to have a second full fire-extinguishing capability available within a 5-minute period of initial activation. Where the minimum water supply volume equals to the design standard as specified in (10) plus that of the filled pipes, a pressure water tank is to be arranged to comply with the functional requirements provided in Chapter II-2/12.4.1 of SOLAS.

7.2.4 The system and its components are to be suitably designed to withstand ambient temperature changes, vibration, humidity, shock, impact, clogging and corrosion normally encountered in machinery spaces or cargo pump-rooms in ships. Components within the protected spaces are to be designed to withstand the elevated temperatures which could occur during a fire.

7.2.5 The electrical components of the pressure source for the system are to have a minimum rating of IP 54. The system is to be supplied by both main and emergency sources of power and should be provided with an automatic change-over switch. The emergency power supply is to be provided from outside the protected machinery space.

7.2.6 The piping system is to be sized in accordance with a hydraulic calculation technique, to ensure the pressure and flow necessary for normal operation of the system.

7.2.7 The system is to be provided with a redundant means of pumping. The capacity of the redundant

means is to be sufficient to compensate for the loss of any single supply pump. The system is to be fitted with a permanent sea inlet and be capable of continuous operation using seawater.

7.2.8 The system is to be kept under required pressure and be automatically supplied with water from pumps when the system pressure is lower.

7.2.9 Systems capable of supplying water at the full discharge rate for 30 min may be grouped into separate sections within a protected space. The sectioning of the system within such spaces is to be approved by the Administration in each case.

7.2.10 In all cases, the capacity and design of the system are to be based on the complete protection of the space demanding the greatest volume of water.

7.2.11 The system is to be capable of fire extinction, and tested to the satisfaction of the Administration in accordance with Appendix B of MSC/Circ.1165.

7.3 Nozzles and pumps

7.3.1 The water-mist nozzles used in machinery spaces are subject to approval by CCS.

7.3.2 The number and arrangement of the nozzles are to be to the satisfaction of the Administration and are to be such as to ensure an effective average distribution of water of at least 5 l/m2 /min in the spaces to be protected. Where increased application rates are considered necessary, these are to be to the satisfaction of the Administration.

7.3.3 Precautions are to be taken to prevent the nozzles from becoming clogged by impurities in the water or corrosion of piping, nozzles, valves and pump.

7.3.4 The pump is to be capable of simultaneously supplying at the necessary pressure all sections of the system in any one compartment to be protected.

7.3.5 The pump may be driven by an independent internal combustion machinery, but, if it is dependent upon power being supplied from the emergency generator fitted in compliance with the provisions of regulation II-1/42 or regulation II-1/43 of SOLAS, as appropriate, that generator is to be so arranged as to start automatically in case of main power failure so that power for the pump required by 7.3.4 is immediately available. The independent internal combustion machinery for driving the pump is to be so situated that a fire in the protected space or spaces will not affect the air supply to the machinery.

7.4 Fire detection and alarm

7.4.1 In periodically unattended or unmanned machinery spaces of category A, the fixed pressure water-spraying and water mist fire-extinguishing system are to be able to automatically release and alarm in addition to manual release. To avoid false release, a combination of smoke detection and flame detection is recommended. The smoke detector is to give out alarm signal first when detecting smoke at the protected space to notify the crew to go on patrol as necessary. While the flame detector starts, the relief valves in the protected area will be released to discharge pressure water-spraying and to alarm. The manufacturer is to provide the instructions for detector performance, operation and arrangement.

7.4.2 Activation of any water distribution valve is to give a visual and audible alarm in the protected space and at a continuously manned central control station. An alarm in the central control station is to indicate the specific valve activated.

8 Calculation of strength and performance

8.1 Piping system measurement is to be determined by hydraulic calculation. Where the Hazen-Williams Method is used, the formula is:

$$h = \frac{10.667l}{C^{1.852}d^{4.87}}q^{1.852}$$

where: d – pipe diameter (m);

q – flow quantity (m^3/s);

l – length of pipe section (m);

h – head loss (m).

The friction factor C may be obtained in the following Table for different types of pipes:

Type of pipe	***C* value**
Black or galvanized mild steel	100
Copper and copper alloys	150
Stainless steel	150

9 Type test

9.1 Selection of typical samples

(1) The manufacturer is to provide test samples, and the typical samples are to be randomly selected on site.

(2) A type test is to be carried out on each model of water-mist nozzle.

9.2 Type test items

The type tests are to include water-mist nozzle test and fire-extinguishing test.

(1) For water-mist nozzle, the test items and methods are to be conducted in accordance with MSC/Circ.1165, Appendix A – Component Manufacturing Standards of Equivalent Water-based Fire-extinguishing Systems.

(2) For open water-mist nozzle, the type test items may be referred to in Table 9.2 (2).

Open-type water-spraying test item **Table 9.2 (2)**

Serial No.	Test item	MSC/Circ.1165 paragraphs of Appendix A	Remark
1	Visual examination	4.2	
2	Functional test	4.5	
3	Water flow test	4.10	
4	Corrosion test	4.11	
5	Heat-resistance test	4.13	
6	Vibration test	4.15	①
7	Impact test	4.16	
8	Clogging test	4.20	②
9	Water-mist nozzle markings	5.1	

Notes: ① The purpose of vibration test is to detect the tightness of nozzles (paragraph 3.8.1 of MSC/Circ.1165) and the release function of the nozzle's heat responsive element (paragraph 3.5.1 of MSC/Cir.1165) after the test, therefore, for open nozzle, the vibration test time may be reduced to 8 h.

② The open water-mist nozzles without strainer or filter, using fresh water as the fire-extinguishing medium, or using water-spraying system applying high-pressure as the water-supplying pump, may be exempt from clogging test.

(3) For close nozzles, type tests, such as strength test for release elements, heat exposure test, thermal shock test, 30-day leakage test, etc. according to different types of nozzles.

(4) For fire-extinguishing test, the test items and methods are to be conducted in accordance with MSC/Circ.1165, Appendix B – Test Method for Fire Testing Equivalent Water-based Fire-extinguishing Systems for Machinery Spaces of Category A and Cargo Pump-rooms.

10 Unit/batch inspection

10.1 The inspection is to at least include:

(1) inspection of the main components (fire detection and fire alarms) compliance with design

requirements;

(2) no visible defects for the water-mist nozzle exterior appearance. The manufacturer brands, models and numbers of nozzles are to be permanently marked on the nozzles;

(3) system tightness test: the test pressure being 1.25 times the rated working pressure with no leakage;

(4) piping system strength test: the test pressure being not less than 1.5 times the rated working pressure with no leakage during the 5 min test period;

(5) nozzle tightness test (only for close nozzle), the test pressure being 2 times the rated working pressure with no leak;

(6) nozzle strength test:

① for close nozzles, the test pressure being 4 times the rated working pressure with no fracture, movement or loose component occurred during 1min test period;

② for open nozzles, hydrostatic strength test with the test pressure being 1.5 times the rated working pressure, no leakage occurred for the nozzle itself during 5 min hydrostatic test.

(7) The flow rate and atomizing angle test of the nozzle are not to be out of the tolerance required by drawings.

(8) System operation tests are to include:

① system manual and automatic start and stop;

② alarm and display system;

③ spraying test.

(9) In unit/batch inspection, 10% or at least 2 water-mist nozzles of the same batch are to be randomly selected for the above-mentioned tests.