Guideline No.: F-02(201610)

F-02 FIXED WATER-BASED LOCAL APPLICATION FIRE-EXTINGUISHING SYSTEM

Issued date: October 28, 2016

Foreword:

This Guide is a part of CCS Rules, which contains technical requirements, inspection and testing criteria related to classification and statutory survey of marine products.

This Guide is published and updated by CCS and can be found through http://www.ccs.org.cn . Comments or suggestions can be sent by email to ps@ccs.org.cn .

Historical versions and release date : F-02(201510) October 20,2015

Main changes and effective date:

The “5 material and components” is amended to coordinate with the rules.

CONTENTS

FIXED WATER-BASED LOCAL APPLICATION FIRE-EXTINGUISHING SYSTEM

1 Application

1.1 This Guideline applies to the fixed local application fire-extinguishing systems as required in Regulation II-2/10.5.6 of SOLAS.

1.2 Fixed local application fire-extinguishing systems applies to passenger ships of 500 gross tonnages and upwards, cargo ships of 2,000 gross tonnage and above and machinery spaces of category A with more than 500 m3 in volume.

1.3 Fixed local application fire-extinguishing systems are to protect areas such as the following without the necessity of engine shutdown, personnel evacuation, or sealing of the spaces:

(1) the fire hazard portions of internal combustion machinery used for the ship's main propulsion and power generation;

(2) boiler fronts;

(3) the fire hazard portions of incinerators;

(4) heated fuel oil separators;

(5) oil fired inert gas generators; and

(6) oil heaters.

2 Normative references

2.1 Regulation II-2/10.5.6 of the International Convention for the Safety of Life at Sea, 1974 (1974 SOLAS Convention) and the amendments thereof.

2.2 Chapter 7 of the International Code for Fire Safety Systems.

2.3 MSC.1/Circ.1387 Revised Guidelines for the Approval of Fixed Water-based Local Application Fire-fighting Systems for Use in Category A Machinery Spaces.

3 Terms and definitions

3.1 This Guideline adopts the following terms and definitions as given in MSC.1/Circ.1387 and

MSC/Circ.1082.

3.1.1 Fire suppression means a reduction in heat output from the fire and control of the fire to restrict its spread from its seat and reduce the flame area.

3.1.2 Protected space is a machinery space where a local application fire-fighting system is installed.

3.1.3 Protected area is an area (an installation or a part of installation) within a protected space which is required to be protected by the system.

3.1.4 The effective nozzle coverage is determined by the results of fire-extinguishing test.

① For a 3 × 3 nozzle grid, the fire-extinguishing test is to comply with the requirements in 3.3.2.1 to 3.3.2.3 of Appendix of MSC/Circ.1387. See Figure 1 for the effective nozzle coverage area.

② For a 3 × 3 or 2 × 2 nozzle grid, the fire-extinguishing test is to comply with the requirements in 3.3.2.3 to 3.3.2.5 of Appendix of MSC/Circ.1387. See Figure 2-1 or 2-2 for the effective nozzle coverage area.

③ For a single row of nozzles, the fire-extinguishing test is to comply with the requirements in 3.3.2.1 to 3.3.2.3 of Appendix of MSC/Circ.1387. See Figure 3 for the effective nozzle coverage area.

④ For a single row of nozzles, the fire-extinguishing test is to comply with the requirements in 3.3.2.3 to 3.3.2.5 of Appendix of MSC/Circ.1387. See Figure 4 for the effective nozzle coverage area.

⑤ For individual nozzles, the effective nozzle coverage (width and length) is defined as 1/2 the maximum nozzle spacing. See Figure 5.

Note: the fuel spray nozzle locations shown in Figures 3 to 5 are shown for information only.

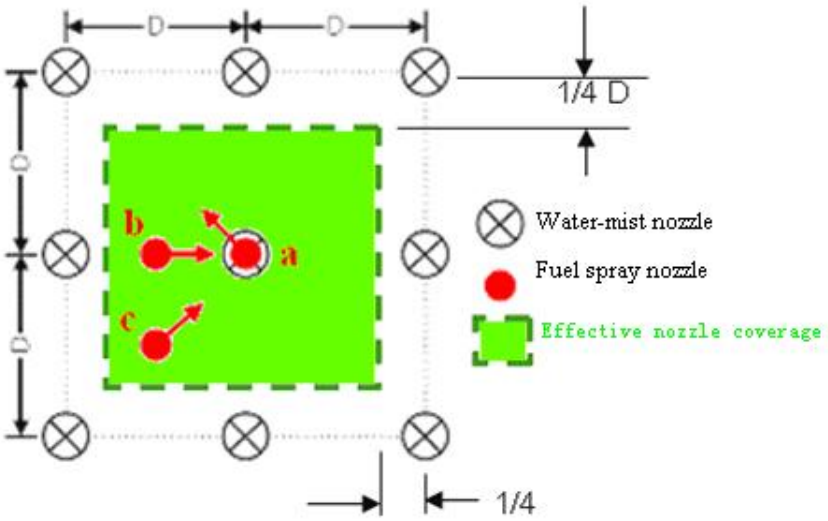

Figure 1

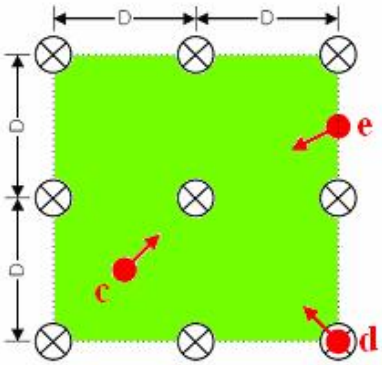

Figure 2-1

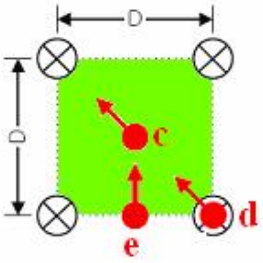

Figure 2-2

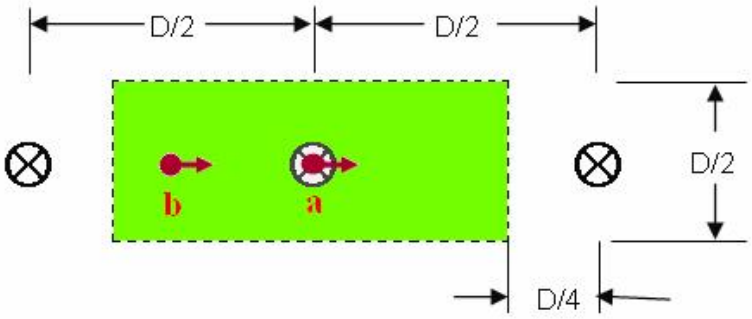

Figure 3

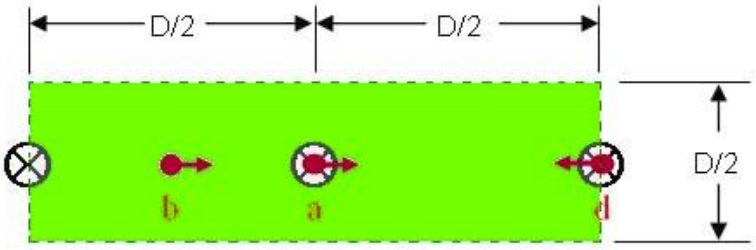

Figure 4

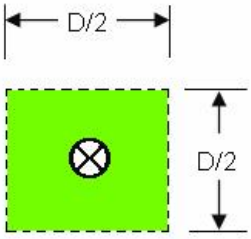

Figure 5

4 Plans and documents

4.1 The following documents are to be submitted to CCS for approval when applying for products approval:

(1) system design principles;

(2) specification of product primary performance;

(3) general assembly drawing;

(4) main components and parts;

(5) schematic diagram of the system;

(6) calculations;

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

(8) technical specification of delivery and acceptance;

(9) the type test program.

4.2 The following documents are to be submitted to CCS for information when applying for products approval:

(1) product instruction;

(2) maintenance manual.

4.3 The applicant is to submit to CCS the following approved plans and technical documents when applying for products inspection by CCS:

(1) schematic diagram of the fixed water-based local application fire-extinguishing 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.

5 Materials and components

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

6 Design and technical requirements

6.1 Arrangement

6.1.1 Water-mist nozzles are to be vertically arranged. Where the installation with an inclination away from the vertical direction is adopted, the protected section is to be verified and defined by fire-extinguishing test. The joints used in piping system are to comply with the requirements provided in 2.5.3 “Mechanical Joints”, PART THREE of Rules for Classification of Sea-going Steel Ships.

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

6.1.3 Pressure source components of the system are to be located outside the protected area.

6.1.4 The identification of effective coverage within the protected areas:

(1) The length of effective coverage for diesel engines used for main propulsion and power generation is the distance between two cylinders at the top two ends of diesel engine. In case an exhaust gas turbine supercharger is fitted on one end, it is to be considered in the protected length. The width of the protected area is measured from the outer surface of the high-pressure oil pump to the outlet outer edge of the exhaust gas turbine supercharger. Where the fuel oil nozzle is arranged with an inclination from the vertical, the protected section are to cover to the direction of height, which indicates the distance from high-pressure oil pump outlet to the top of diesel engine cylinders. The arrangement for multi-engines is required for at least two sections.

(2) The effective coverage for boiler, incinerator and oil fired inert gas generator refers to the entire burner.

(3) The effective coverage for heated fuel oil separator refers to the entire oil separator but not necessarily including the heater.

6.2 Function

6.2.1 The system is to be capable of manual release.

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

6.2.3 The system is to be available for immediate use and capable of continuously supplying water-based medium for at least 20 min in order to suppress or extinguish the fire and to prepare for the discharge of the main fixed fire-extinguishing system within that period of time.

6.2.4 The system is to be capable of fire suppression with forced ventilation fans running and supplying air to the protected area, or a method of automatically shutting air supply fans upon release of the system is to be provided to ensure that the fire-fighting medium is not dispersed.

6.2.5 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.

6.2.6 The electrical elements of the pressure source for the system are to have a minimum rating of

IP× 4. Systems requiring an external power source need only be supplied by the main power source.

× means the characteristic numeral used to mark the degree of protection against access to hazardous parts and ingress of solid foreign objects, which could be 0 to 6.

6.2.7 The piping system is to be sized in accordance with a hydraulic calculation technique to ensure availability of flows and pressures required for correct performance of the system.

6.2.8 The water supply for local application systems may be fed from the supply to a water-based main fire-extinguishing system providing that adequate water quantity and pressure are available to operate both systems for the required period of time. Local application systems may form a section(s) of a water-based main fire-extinguishing system provided that all requirements of SOLAS regulation II-2/10, MSC/Circ.1387, and MSC/Circ.1165 and its amendments, as amended by MSC.1/Circ.1237 and MSC.1/Circ.1269 are met, and the systems are capable of being isolated from the main system.

6.2.9 The capacity and design of the system are to be based on the protected area demanding the greatest volume of water.

6.2.10 Components within the protected spaces are to be designed to withstand the elevated temperatures which could occur during a fire. Components are to be tested in accordance with the relevant sections of Appendix A of MSC/Circ.1165, as amended by MSC/Circ.1269.

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

6.2.12 A fitting is to be installed on the discharge piping of open head systems to permit blowing air through the system during testing to check for possible obstructions.

6.3 Fire detection and alarm

6.3.1 Activation of any local water-based fire-extinguishing system is to give a visual and distinct audible alarm in the protected space and at continuously manned stations. The alarm is to indicate the specific system activated.

6.3.2 Irrespective of the detection system of either conventional type (multi-wire system) or zone address coding type (main wire system), the detection system of the local water-based

fire-extinguishing system are usually to be independent of the ship's fire detection and alarm system. In particular, special attention is to be paid to the system of conventional type that each area to be protected by local water-based fire-extinguishing system is to have an independent detection branch.

6.3.3 Where the detection system of zone address coding type complies with 2.1.4, Chapter 9 of International Code for Fire Safety Systems, the detection system of local water-based fire-extinguishing system will be allowed to share with the detection part of the ship's fire detection and alarm system, namely, the detector of "fire detection and alarm system" may replace that of "local water-based fire-extinguishing system", whose corresponding requirements, however, are to be compliable with by the detectors in terms of types and arrangements. In addition, such combination is not to impact the original functions of the ship's fire detection and alarm system and local water-based fire-extinguishing system. Any alarm released by the local water-based fire-extinguishing system is to be distinct from that of the ship's fire detection and alarm system.

6.3.4 Fire detectors are to be positioned adjacent to the protected areas. The detection system of any type to be used is to be functioned to identify fire in the protected areas and the detection units in one area are not to actuate the action of those in other areas.

6.3.5 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 in the protected area 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.

6.4 Miscellaneous

6.4.1 Where automatic starting local water-based fire-extinguishing system is fitted, a notice indicating the medium type adopting and the possibility of automatic release is to be displayed at the entrance of the protected spaces.

6.4.2 Operating instructions for the system are to be displayed at each operating position. Spare parts and operating and maintenance instructions for the system are to be provided as recommended by the manufacturer.

7 Selection of typical samples

7.1 In a type approval, a type test is to be carried out for each model of system. For different types of water-mist nozzles, each water-mist nozzle is to be type tested. For different types of water-mist nozzles made of the same material, only one type of nozzle may be selected for corrosion test. The samples are to be randomly selected on site.

7.2 In a re-approval, one type is to be selected from the water-mist nozzles of which type tests have been completed for type test again.

7.3 In product inspection, 10% or at least 2 water-mist nozzles of the same batch are to be randomly selected for water flow measurement.

8 Type test

8.1 The type test items and requirements for open water-mist nozzle are given in Table 1.

Open water-mist nozzle test item **Table 1**

Serial No.	Test item	Test requirements	Remark
1	Visual examination	4.2	
2	Functional test	4.5	
3	Water flow test	4.10	
4	Corrosion test	4.11	Sulfur dioxide corrosion test: 3.14.2 is inapplicable Salt mist corrosion test: 3.14.2 and 4.11.4.2 are inapplicable

Continued Table 1

Serial	Test item	Test requirements	Remark

No.			
5	Heat-resistance test	4.13	
6	Vibration test	4.15	For open water-mist nozzle, the vibration test period may be reduced to 8 h; 3.5 and 3.8 are inapplicable
7	Impact test	4.16	
8	Clogging test	4.20	It is considered that for open spray nozzle without strainer or filter, serving for a local water-spraying system applying fresh water as medium or a high-pressure plunger pump to supply water may be exempt from the clogging test
9	Water-mist nozzle markings	5.1	

Note: The numbers in the test requirements column correspond to the paragraphs in Appendix A of MSC/Circ.1165, as amended by MSC.1/Circ.1269.

8.2 Fire-extinguishing test

8.2.1 Test objective

(1) These tests are intended to evaluate the fire-extinguishing capabilities of individual water-mist nozzles and grids of water-mist nozzles used as local application fire-fighting systems on light diesel oil fuel spray fires.

(2) The tests also define the following design and installation criteria:

① the maximum spacing between water-mist nozzles;

② the minimum and maximum distance between the water-mist nozzles and the protected hazard;

③ the need for water-mist nozzles to be positioned outside of the protected hazard; and

④ the minimum and maximum operating pressure of water-mist nozzles.

8.2.2 Test conditions

(1) The test enclosure, if any, is to be at least 100 m2 in area, and the height of the test enclosure is to be at least 5 m., above which a canopy is fitted and the casing wall around need not be

enclosed.

(2) The test enclosure, if any, is to be sufficiently large and provided with adequate natural or forced ventilation during the fire test to ensure that the oxygen concentration at 500 mm after and 100 mm below the fuel oil nozzle during the fire test (5 min after ignition) remains above 20% (by volume) without activation of the local application fire-fighting system.

(3) Fire scenarios

① The fire scenarios are to consist of nominal 1 MW and 6 MW spray fires. These fires are to be produced using light diesel oil as the fuel as described in Table 2.

② The fuel spray nozzles are to be installed horizontally and directed toward the centre of the nozzle glide.

③ The fuel spray nozzle is to be located 1 m above the floor and at least 4 m away from the walls of the enclosure, if any.

Table 2

Spray nozzle	Wide spray angle (120° to 125°) full cone type	Wide spray angle (80°) full cone type
Nominal oil pressure	8.0 Bar	8.5 Bar
0il flow	0.16± 0.01 kg/s	0.03± 0.005 kg/s
0il temperature	20 ± 5℃	20 ±5.℃
Nominal heat release rate	6MW	1MW

(4) Installation of water-mist nozzles

① The local application system is to consist of uniformly spaced nozzles directed vertically downward or to the side, or installed at an inclined angle, if any, and tested in accordance with 8.2.3 and 8.2.6.

② The maximum spacing of the nozzles is to be in accordance with the manufacturer’s system design and installation manual.

③ The nozzles are to be installed at least 1 m below the ceiling of the enclosure, if any.

④ The system is to consist of either a 2 ×2 or 3 × 3 nozzle grid, as required.

⑤ Additional nozzles may be installed at the test in accordance with manufacturer's instruction. In this case, details for additional nozzles should be included in the test report and reflected in the individual ship's design.

8.2.3 Test items

1) The fire-extinguishing capabilities of the system are to be evaluated for the minimum and maximum separation distances (the distance between the nozzle grid and the fuel spray

nozzle). These distances are to be as defined in the manufacturer's system design and installation manual.

2) The fire-extinguishing capabilities of the system are to be evaluated for the working conditions with the lowest pressures. These working pressures are to be as defined in the manufacturer's system design and installation manual.

3) Each separation distance is to be evaluated against the two fire scenarios (1 MW and 6 MW spray fires). Tests are to be conducted with the fuel spray nozzles horizontally positioned in the following locations:

① under one nozzle in the centre of the grid;

② between two nozzles in the centre of the grid;

③ between four nozzles;

④ under one nozzle at the edge of the grid (comer); and

⑤ between two nozzles at the edge of the grid.

8.2.4 Test procedure

(1) Pre-burn. Each fuel oil spray is to be ignited and allowed to bum for 10 to 15 seconds prior to system operation.

(2) The water spray system is to be activated within the pre-bum time, and to extinguish fires in 5 min.

(3) The fuel oil spray is to be operated for at least 15 seconds after fire extinguishments.

(4) The water spray system is to be operated for a minimum of 1 min after fire extinguishments.

8.2.5 Test measurements and records

(1) The following data are to be measured and recorded before test:

① the type, number, flow coefficient of the water-mist nozzles;

② the installation height of and horizontal space between the water-mist nozzles;

③ the installation height, flow rate, working pressure and spray atomizing angle of the fuel spray nozzles.

(2) During the test, the following observations are to be recorded:

① start of the ignition procedure;

② ignition of fuel oil nozzle;

③ time when the extinguishing system is activated;

④ time when the fire is extinguished;

⑤ time when the extinguishing system is shut off;

⑥ time of re-ignition;

⑦ time when the fuel supply to the nozzle is stopped;

⑧ time when the test is terminated.

8.2.6 Test results and interpretation

(1) The local application fire-extinguishing system is required to extinguish the test fires within 5 min from the start of water discharge. If the fire re-ignites after this five minute water discharge period the test is considered to be a failure.

(2) The results of the tests are to be interpreted as follows:

① Systems (utilizing a 3 × 3 nozzle grid) that extinguish fires referred to in 8.2.3.3(1) to 8.2.3.3(3) are considered to have successfully completed the protocol with the condition that the outer nozzles are to be installed outside of the protected area a distance of at least 1/4 of the maximum nozzle spacing.

② Systems (utilizing either a 2 × 2 or 3 × 3 nozzle grid) that extinguish fires referred to in 8.2.3.3(3) to 8.2.3.3(5) are considered to have successfully completed the protocol and can be designed with the outer nozzles located at the edge of the protected area. This does not prohibit the location of the nozzles outside of the protected area.

③ For installations which may be adequately protected using individual nozzles or a single row of nozzles, the effective nozzle coverage (width and length) is defined as 1/2 the maximum nozzle spacing.

④ For installations where the protected area is next to a bulkhead or similar vertical obstruction, the first row of nozzles is to be located at 1/2 the maximum nozzle spacing away from the bulkhead for either of the conditions.

9 Unit/batch inspection

9.1 For main components: marine certificates of water-mist nozzle, water pump, motor, electric control box, fire detection and alarm system (fire detector, alarm controls, displays, etc.).

9.2 Piping hydraulic pressure test: the test pressure is not to be less than 1.5 times the maximum working pressure.

9.3 The water-mist nozzle water flow rate test: 10% or at least 2 water-mist nozzles of the same

batch are to be randomly selected for water flow measurement. The results are to be within the ±5％ range of the specified value.

9.4 The exterior appearance of the water-mist nozzle: no appearance defect is visible for the water-mist nozzles. The manufacturer, water-mist nozzle type and number are to be permanently marked on the nozzles.

9.5 Water-mist nozzle function test: 3 water-mist nozzles of the same batch are to be randomly select for hydraulic pressure strength test under the pressure 1.25 times the rated working pressure for 15 min.

9.6 System operation test:

(1) test on system starting or stopping automatically and manually;

(2) test on alarms and displays;

(3) at least one protected area to be selected for test, operating for not less than 30 seconds. It is recommended that a protected area further away from water supply pump be chosen for the test.

9.7 After installation onboard ship, in addition to testing the operation (pumping and closing) of the system as required in 3.3.6 of Annex of MSC/Circ.1387, at least two protected areas are to be selected for a 30-second effectiveness test, to inspect the flow condition of the system and observe the operation performance of the nozzle, which at this time are to be covered with a transparent plastic shroud to collect the spraying water. Alarm and automatic activation tests are to be conducted for the automatic water-spraying system.