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**REVISED GUIDELINES FOR THE APPROVAL OF FIXED WATER-BASED LOCAL  
APPLICATION FIRE-FIGHTING SYSTEMS FOR USE IN CATEGORY A  
MACHINERY SPACES (MSC/CIRC.913)**

1 The Maritime Safety Committee, at its seventy-first session (19 to 28 May 1999), approved Guidelines for the approval of fixed water-based local application fire-fighting systems for use in category A machinery spaces (MSC/Circ.913).

2 The Committee, at its eighty-eighth session (24 November to 3 December 2010), having considered the proposal of the Sub-Committee on Fire Protection, at its fifty-fourth session, approved the Revised Guidelines for the approval of fixed water-based local application fire-fighting systems for use in category A machinery spaces, set out in the annex.

3 Member Governments are invited to apply the annexed Revised Guidelines when approving fixed water-based local application fire-fighting systems for use in category A machinery spaces, and bring them to the attention of ship designers, shipowners, equipment manufacturers, test laboratories and other parties concerned.

4 This circular supersedes MSC/Circ.913, except that fire and component tests previously conducted in accordance with MSC/Circ.913 remain valid for the approval of new systems. Existing fixed water-based local application fire-fighting systems approved and installed based on MSC/Circ.913 should be permitted to remain in service as long as they are serviceable.

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## ANNEX

### REVISED GUIDELINES FOR THE APPROVAL OF FIXED WATER-BASED LOCAL APPLICATION FIRE-FIGHTING SYSTEMS FOR USE IN CATEGORY A MACHINERY SPACES

#### 1 General

Fixed water-based local application fire-fighting systems should provide localized fire suppression in areas, as specified in SOLAS regulation II-2/10.5, for category A machinery spaces, without the necessity of engine shut-down, personnel evacuation, shutting down of forced ventilation fans, or sealing of the space.

#### 2 Definitions

2.1 *Fire suppression* is 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.

2.2 *Protected space* is a machinery space where a local application fire-fighting system (hereinafter, referred to as "the system") is installed.

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

2.4 *Water-based extinguishing medium* is freshwater or seawater with or without additives mixed to enhance fire-extinguishing capability.

#### 3 Principal requirements for the system

##### 3.1 System operation

.1 The system should be capable of manual release.

.2 The activation of the system should not require engine shutdown, closing fuel oil tank outlet valves, evacuation of personnel or sealing of the space, which could lead to loss of electrical power or reduction of manoeuvrability. This is not intended to place requirements on the electrical equipment in the protected area when the system is discharging freshwater.

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\* For internal combustion machinery, typical protected areas are hot surfaces such as exhaust pipes without insulation, or with insulation fitted in accordance with SOLAS regulation II-2/4.2.2.6.1 that is likely to be removed frequently for maintenance, and high-pressure fuel oil systems installed near hot surfaces. For typical diesel engines, such areas would include the area on top of the engine, the fuel injection pumps and turbochargers, unless the fuel injection pumps are installed in a sheltered location beneath the steel platform.

For boiler fronts and oil-fired inert gas generators, typical protected areas are hot surfaces around the burners without insulation, or with insulation fitted in accordance with SOLAS regulation II-2/4.2.2.6.1 that is likely to be removed frequently for maintenance. Boiler fronts should be interpreted as the boiler burner location irrespective of the boiler design.

For incinerators, typical protected areas are hot surfaces around the burners without insulation, or with insulation fitted in accordance with SOLAS regulation II-2/4.2.2.6.1 that is likely to be removed frequently for maintenance.

- .3 The operation controls should be located at easily accessible positions inside and outside the protected space. The controls inside the space should not be liable to be cut off by a fire in the protected areas.
- .4 Pressure source components of the system should be located outside the protected areas.
- .5 Where automatically operated fire-fighting systems are installed:
  - .1 a warning notice should be displayed outside each entry point stating the type of medium used and the possibility of automatic release;
  - .2 the detection system should ensure rapid operation while consideration should also be given to preventing accidental release. The area of coverage of the detection system sections should correspond to the area of coverage of the extinguishing system sections. The following arrangements are acceptable:
    - .1 set-up of two approved flame detectors; or
    - .2 set-up of one approved flame detector and one approved smoke detector.

Other arrangements can be accepted by the Administration. However, use of heat detectors should in general be avoided for these systems;
  - .3 the discharge of water should be controlled by the detection system. The detection system should provide an alarm upon activation of any single detector and discharge if two or more detectors activate. The Administration may accept other arrangements; and
  - .4 visual and audible indication of the activated section should be provided in the engine control room and the navigation bridge or continuously manned central control station. Audible alarms may use a single tone.
- .6 Operating instructions for the system should be displayed at each operating position.
- .7 Appropriate operational measures or interlocks should be provided if the engine-room is fitted with a fixed high-expansion foam or aerosol fire-fighting system, to prevent the local application system from interfering with the effectiveness of these systems.

### **3.2 Arrangement of nozzles and water supply**

- .1 The system should be capable of fire suppression based on testing conducted in accordance with the appendix to these Guidelines. Any installation of nozzles on board should reflect the arrangement successfully tested in accordance with the appendix to these Guidelines. If a specific arrangement of the nozzles is foreseen on board, deviating from the one tested, it can be accepted provided such arrangement additionally passes fire tests based on the scenarios of these Guidelines.

- .2 The location, type and characteristics of the nozzles should be within the limits tested in accordance with the appendix to these Guidelines. Nozzle positioning should take into account obstructions to the spray of the fire-fighting system. The use of a single row of nozzles or single nozzles may be accepted for installation where this gives adequate protection according to paragraph 3.4.2.4 of the appendix.
- .3 The piping system should be sized in accordance with a hydraulic calculation technique such as the Hazen-Williams hydraulic calculation technique\* and the Darcy-Weisbach hydraulic calculation technique, to ensure availability of flows and pressures required for correct performance of the system.
- .4 The system may be grouped into separate sections within a protected space. The capacity and design of the system should be based on the section demanding the greatest volume of water. In any case the minimum capacity should be adequate for a single section protecting the largest single engine, diesel generator or piece of machinery. In multi-engine installations, at least two sections should be arranged.
- .5 Nozzles and piping should not prevent access to engine or machinery for routine maintenance. In ships fitted with overhead hoists or other moving equipment, nozzles and piping should not be located to prevent operation of such equipment.

### 3.3 System components

- .1 The system should 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.
- .2 The system and its components should be suitably designed to withstand ambient temperature changes, vibration, humidity, shock, impact, clogging and corrosion normally encountered in machinery spaces. Components within the protected spaces should be designed to withstand the elevated temperatures which could occur during a fire. Components should be tested in accordance with the listed sections of appendix A of MSC/Circ.1165, as amended by MSC.1/Circ.1269, as modified below:

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\* Where the Hazen-Williams Method is used, the following values of the friction factor "C" for different pipe types which may be considered should apply:

Pipe type	C
Black or galvanized mild steel	100
Copper and copper alloys	150
Stainless steel	150

<b>MSC/Circ.1165, as amended by MSC.1/Circ.1269 Appendix A paragraph no.</b>	<b>Modifications</b>
3.1 Dimensions	
3.4.1 Flow constant	
3.11.1 Stress corrosion	
3.11.2 Sulphur dioxide corrosion	Open nozzles should be subject to post test visual examination. The requirements of paragraph 3.14.2 are not applicable
3.11.3 Salt spray corrosion	The NaCl concentration used for the test should be 20%. Following exposure, open nozzles should meet the flow constant requirements of paragraph 3.4.1. The requirements of paragraphs 3.14.2 and 4.11.4.2 are not applicable
3.12 Integrity of nozzle coating	Applicable only if the nozzles have wax or bitumen coatings
3.15 Resistance to heat	
3.16 Resistance to vibration	Open nozzles should be subject to post test visual examination. The requirements of paragraphs 3.5 and 3.8 are not applicable
3.17 Impact test	
3.22 Clogging test	

- .3 The system and its components should be designed and installed based on international standards acceptable to the Organization\*, and manufactured and tested in accordance with the appropriate elements of the appendix to these Guidelines.
- .4 The electrical components of the pressure source for the system should have a minimum rating of IPX4\*\* if located in the protected space. Systems requiring an external power source need only be supplied by the main power source.
- .5 The water supply for local application systems may be fed from the supply to a water-based main fire-fighting 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-2/10.5, these Guidelines, and MSC/Circ.1165, as amended by MSC.1/Circ.1237 and MSC.1/Circ.1269, are met, and the systems are capable of being isolated from the other sections of the main system.
- .6 A means for testing the operation of the system for assuring the required pressure and flow should be provided.
- .7 Spare parts and operating and maintenance instructions for the system should be provided as recommended by the manufacturer.
- .8 A fitting should be installed on the discharge piping of open head systems to permit blowing air through the system during testing to check for possible obstructions.

\* Pending the development of international standards acceptable to the Organization national standards as prescribed by the Administration should be applied.

\*\* X 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 0.1 to 6.

## APPENDIX

### TEST METHOD FOR FIXED WATER-BASED LOCAL APPLICATION FIRE-FIGHTING SYSTEMS

#### 1 SCOPE

This test method is for evaluating the effectiveness of fixed water-based local application fire-fighting systems. The test method verifies the design criteria for vertical and horizontal grids of nozzles. The test method is intended to evaluate maximum nozzle spacing, minimum and maximum distance from the nozzle to the hazard, minimum nozzle flow rate and nozzle angle, if any, in addition to minimum operating pressure.

#### 2 SAMPLING

2.1 The nozzles and other system components should be supplied by the manufacturer with design and installation criteria, operating instructions, drawings, and technical data sufficient for the identification of the components.

2.2 The flow rate for each type and size of nozzle should be determined at the minimum nozzle operating pressure.

#### 3 FIRE TESTS

##### 3.1 Test principles

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

3.1.2 The tests also define the following design and installation criteria:

- .1 maximum spacing between nozzles;
- .2 minimum and maximum distance between the nozzles and the protected area;
- .3 the need for nozzles to be positioned outside of the protected area; and
- .4 minimum operating pressure.

##### 3.2 Test description

###### 3.2.1 Test enclosure

3.2.1.1 The test enclosure, if any, should be sufficiently large and provided with adequate natural or forced ventilation during the fire test to ensure that the oxygen concentration throughout the fire test remains above 20% (by volume) for 5 min after ignition at the locations specified in paragraph 4.2.2.

3.2.1.2 The test enclosure, if any, should be at least 100 m<sup>2</sup> in area. The height of the test enclosure should be at least 5 m.

### 3.2.2 *Fire scenarios*

3.2.2.1 The fire scenarios should consist of nominal 1 and 6 MW spray fires. These fires should be produced using light diesel oil as the fuel as described in table 3.2.2.1 below.

**Table 3.2.2.1 – Spray fire parameters**

<b>Spray nozzle</b>	<b>Wide spray angle (120° to 125°) full cone type</b>	<b>Wide spray angle (80°) full cone type</b>
Nominal oil pressure	8 bar	8.5 bar
Oil flow	0.16 ± 0.01 kg/s	0.03 ± 0.005 kg/s
Oil temperature	20 ± 5°C	20 ± 5°C
Nominal heat release rate	6 MW	1 MW

3.2.2.2 The fuel spray nozzles should be installed horizontally and directed toward the centre of the nozzle grid as shown in figure 3.3.2.

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

### 3.2.3 *Installation requirements for tests*

3.2.3.1 The local application system should 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 paragraphs 3.3 and 3.4.

3.2.3.2 The system should consist of either a 2 x 2 or 3 x 3-nozzle grid in general.

3.2.3.3 The nozzles should be installed at least 1 m below the ceiling of the enclosure.

3.2.3.4 The maximum spacing of the nozzles should be in accordance with the manufacturer's system design and installation manual.

3.2.3.5 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.

## 3.3 *Test programme*

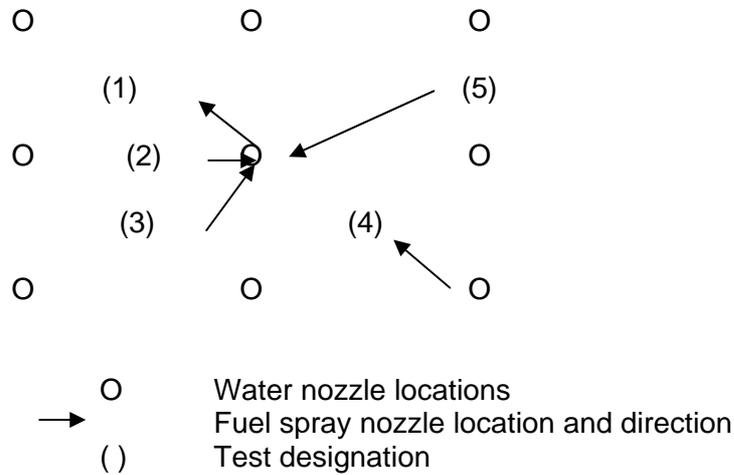
3.3.1 The fire-extinguishing capabilities of the system should be evaluated for the minimum and maximum separation distances (the distance between the nozzle grid and the fuel spray nozzle). These distances should be as defined in the manufacturer's system design and installation manual.

3.3.2 Each separation distance should be evaluated against the two fire scenarios (1 and 6 MW spray fires). Tests should 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 (corner); and
- .5 between two nozzles at the edge of the grid.

These fire locations are shown in figures 3.3.2, and 3.4.2.1 to 3.4.2.3 below.



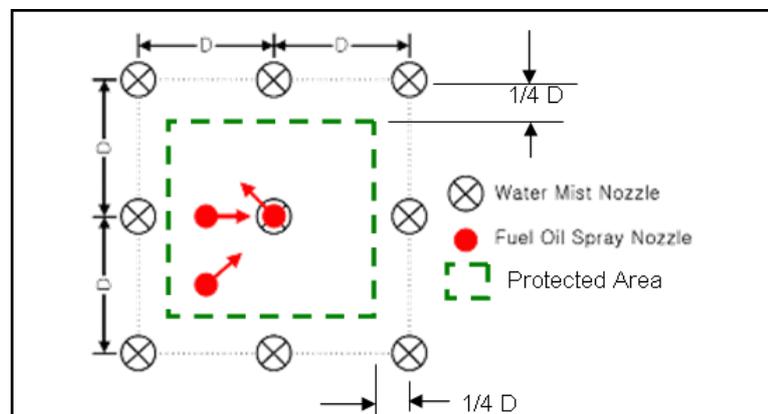
**Figure 3.3.2 – Fuel spray nozzle locations**

### 3.4 Test results and interpretation

3.4.1 The local application fire-fighting system is required to extinguish the test fires within 5 min of the start of water discharge. The fuel oil spray and water spray are required to continue in operation after this, as specified in paragraph 4.3. If the fire re-ignites after this five-minute water discharge period the test is considered to be a failure.

3.4.2 The results of the tests should be interpreted as follows:

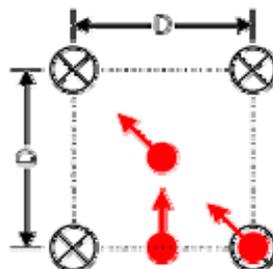
- .1 Systems (utilizing a 3 x 3 nozzle grid) that extinguish fires referred to in paragraphs 3.3.2.1 to 3.3.2.3 are considered to have successfully completed the protocol with the condition that the outer nozzles should be installed outside of the protected area a distance of at least 1/4 of the maximum nozzle spacing as shown in figure 3.4.2.1.



**Figure 3.4.2.1**

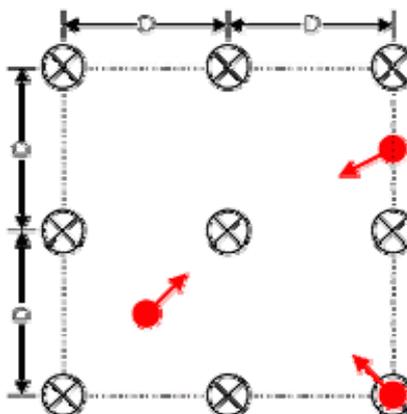
For this system, the outer nozzles should be installed outside of the protected area a distance of at least 1/4 of the maximum nozzle spacing.

- .2 Systems (utilizing either a 2 x 2 or 3 x 3 nozzle grid) that extinguish fires referred to in paragraphs 3.3.2.3 to 3.3.2.5 are considered to have successfully completed the protocol and can be designed with the outer nozzles located at the edge of the protected area as shown in figures 3.4.2.2 and 3.4.2.3. This does not prohibit the location of the nozzles outside of the protected area.



**Figure 3.4.2.2 – 2 x 2 nozzle grid**

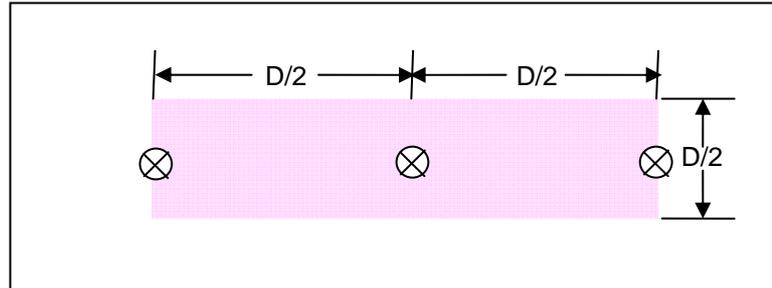
For systems which utilize a 2 x 2 nozzle grid, the outer nozzles can be located either at the edge of the protected area or outside of the protected area.



**Figure 3.4.2.3 – 3 x 3 nozzle grid**

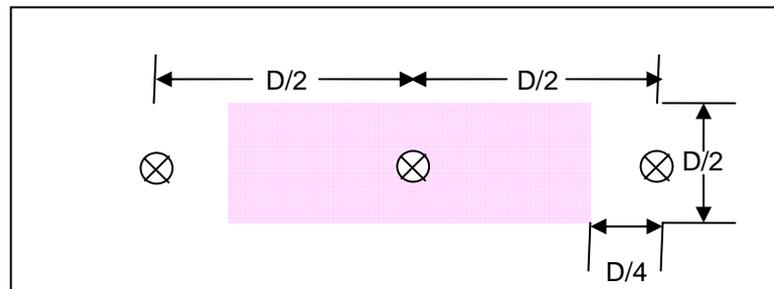
For systems which utilize a 3 x 3 nozzle grid, the outer nozzles can be located either at the edge of the protected area or outside the protected area.

- .3 The requirements stated in either paragraph 3.4.2.1 or 3.4.2.2 should be met for both the minimum and maximum separation distances as well as the minimum operating pressure.
- .4 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 as shown in figures 3.4.2.4 to 3.4.2.6. **Note:** the fuel spray nozzle locations shown in figures 3.4.2.4 to 3.4.2.6 are shown for information only.



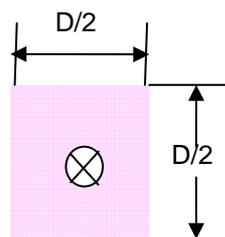
**Figure 3.4.2.4**

For systems with a single row of nozzles that extinguishes fires referred to in paragraphs 3.3.2.3 to 3.3.2.5, the outer nozzles should be placed at least at the edge of the protected area.



**Figure 3.4.2.5**

For systems with a single row of nozzles that extinguishes fires referred to in paragraphs 3.3.2.1 to 3.3.2.3, the outer nozzles should be placed outside the protected area a distance of at least 1/4 of the maximum nozzle spacing.



**Figure 3.4.2.6**

For a single nozzle installation, the spacing should be as shown in figure 3.4.2.6.

- .5 For installations where the protected area is next to a bulkhead or similar vertical obstruction, the first row of nozzles should be located at 1/2 the maximum nozzle spacing away from the bulkhead for either of the conditions described in paragraph 3.4.2.1 or 3.4.2.2.

## **4 TEST PROCEDURE**

### **4.1 Pre-burn time**

Each fuel oil spray should be ignited and allowed to burn from 10 s to 15 s prior to system operation.

### **4.2 Measurements**

#### **4.2.1 *Fuel oil spray system***

4.2.1.1 The fuel oil flow rate and pressure in the fuel oil spray system should be verified prior to the test.

4.2.1.2 The fuel oil spray system pressure should be measured during the test.

#### **4.2.2 *Oxygen concentration at the fire location***

Oxygen concentration should be measured at 100 mm below and 500 mm behind the fuel oil spray nozzle.

#### **4.2.3 *Water spray system pressure and flow rate***

The system water pressure and flow rate should be measured using suitable equipment.

### **4.3 Operation of the fire-fighting system**

4.3.1 The water spray system should be activated within the pre-burn time specified in section 4.1.

4.3.2 The fires should be extinguished within 5 min of water application.

4.3.3 The fuel oil spray should be operated for at least 15 s after fire extinguishment.

4.3.4 The water spray system should be operated for a minimum of 1 min after fire extinguishment.

### **4.4 Observations during the fire test**

During the test, the following observations should be recorded:

- .1 start of the ignition procedure;
- .2 start of the test (ignition);
- .3 time when the extinguishing system is activated;
- .4 time when the extinguishing system is shut off;
- .5 time of re-ignition;
- .6 time when the fuel supply to the nozzle is stopped;
- .7 time when the fire is extinguished; and
- .8 time when the test is terminated.

## 5 TEST REPORT

The test report should, as a minimum, include the following information:

- .1 name and address of the test laboratory;
- .2 date of issue and identification number of the test report;
- .3 name and address of applicant;
- .4 name and address of manufacturer or supplier of the product;
- .5 test method and purpose;
- .6 product identification;
- .7 description of the tested product:
  - .1 assembly drawings;
  - .2 descriptions;
  - .3 assembly of included materials and components;
  - .4 specification of included materials and components;
  - .5 installation specification; and
  - .6 detailed drawings of the test set-up;
- .8 date of tests;
- .9 drawing of each fire test configuration;
- .10 measured water spray nozzle flow characteristics;
- .11 identification of the test equipment and used instruments;
- .12 test results including observations and measurements made during and after the test:
  - .1 maximum nozzle spacing;
  - .2 minimum and maximum separation distances and angles; and
  - .3 minimum operating pressures;
- .13 deviations from the test method;
- .14 conclusions; and
- .15 date of the report and signature.