

Guideline No.F-04 (201510)



# **F-04 Fixed Deck Foam System**

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## **Foreword**

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

This Guideline 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](mailto:ps@ccs.org.cn).

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## Contents

1 Application.....	4
2 Basis for approval and inspection .....	4
3 Terms and definitions.....	4
4 Plans and documents.....	5
5 Materials and components.....	5
6 Design and technical requirement on the fixed deck foam fire-fighting system of the liquid cargo ship specified in R10.8.1 of Chapter II-2 of the SOLAS convention.....	6
7 Design and technical requirement on the deck foam fire-fighting system of the helicopter specified in R18.5 of Chapter II-2 of the SOLAS convention .....	7
8 Design and Technical Requirement on the Deck Foam Fire-fighting System of the Ship Used for Bulk Transportation of Hazardous Chemicals .....	7
9 The electrical equipment and control system should meet relevant requirements in Parts Four And Seven of CCS Rules for Classification of Sea-Going Steel Ships. ....	9
10 Inspection and test.....	9

## **Fixed Deck Foam System**

### **1 Application**

1.1 The Guideline applies to the following fixed deck foam fire-fighting systems:

- (1) The fixed deck foam fire-fighting system of the liquid cargo ship specified in R10.8.1 of Chapter II-2 of the SOLAS convention
- (2) The deck foam fire-fighting system of the helicopter specified in R18.5 of Chapter II-2 of the SOLAS convention
- (3) The deck foam fire-fighting system of the ship used for bulk transportation of hazardous chemicals

1.2 The basic structure of the fixed deck foam fire-fighting systems applied to the Guideline is as follows:

It consists of the fire monitor, fire monitor tower, foam nozzle, power source, control device, foam thickening agent tank, mixing unit, and fire pump set.

### **2 Basis for approval and inspection**

2.1 The approval and inspection bases adopted by the Guideline are as follows:

- (1) Chapter II-2 of Amendment (2000) of *Convention on the Safety of Life at Sea (SOLAS Convention) (1974)* (International Maritime Organization)
- (2) Chapter 14 of *International Fire Safety Rules* and its applicable Amendment (International Maritime Organization)
- (3) Chapter 11 of *International Rules on the Structure and Equipment of the Ship Used for Bulk Transportation of Hazardous Chemicals*
- (4) Part Three "Pipeline and Pressure Vessel" of *CCS Rules for Classification of Sea-Going Steel Ships*

For contents not covered by the Guideline, please refer to the above-mentioned documents.

### **3 Terms and definitions**

For the purpose of the Guideline, the following terms and definitions provided in the above-mentioned regulations and standards apply:

3.1 Foam thickening agent: The substance that can generate foam, which is a type of concentrated liquid usually.

3.2 Foam solution: The mixture of foam thickening agent and thinner (such as the water and

seawater).

3.3 Foam: The gas-liquid mixtures formed by foam solution via spraying, expansion and inflation.

3.4 Expansion ratio (foam expansion ratio): The volume ratio of the foam and foam solution.

#### **4 Plans and documents**

4.1 The applicant should submit the following plan and documents (if applicable) of the deck foam fire-fighting system to the CCS:

- (1) Main product performance specification table.
- (2) Schematic diagram of piping system, electric control schematic diagram and relevant remote control schematic diagram.
- (3) Flow and capacity calculation book, including the deck fire monitor arrangement plan,
- (4) Strength calculation book of the parts under pressure.
- (5) General assembly diagram of all components, such as the foam monitor, foam nozzle, mixing unit, tank, and valve.
- (6) Parts diagram indicating the structure, material, size and welding method of the components, such as the gun barrel, elbow, nozzle, turret, tank, valve body, and operating mechanism.
- (7) Relevant certificates, charts and parameter descriptions of supporting products, such as the fire monitor, pump, proportioner, motor, and valve.
- (8) Release procedure (in both Chinese and English).
- (9) Product factory test/inspection program
- (10) Product operation instructions (in both Chinese and English).

#### **5 Materials and components**

5.1 The materials and components of the product should be controlled as per relevant requirement of current regulations of CCS.

5.2 The following purchased parts of the deck foam fire-fighting system should be provided with the product inspection certificate of CCS or equivalent document:

- (1) Pump and control valve
- (2) Motor (which should be provided with product certificate and type approval certificate for the power of not less than 50kW and less than 50kW respectively) and electric

control box.

**6 Design and technical requirement on the fixed deck foam fire-fighting system of the liquid cargo ship specified in R10.8.1 of Chapter II-2 of the SOLAS convention**

6.1 The foam supplying device should be able to transport the foam to the whole deck area of the cargo oil tank, and into any cargo oil tank with broken deck.

6.2 At the time of operation of the deck foam system as per the required output quantity, a minimum number of water columns should be sprayed from the fire main pipe as per the pressure required.

6.3 The supply rate of the foam solution should not be less than the max. value among the following:

- (1) 0.6 L/min per square meter based on the deck area of the cargo oil tank (the deck area of the cargo oil tank refers to the value obtained by multiplying the max. ship width by the total longitudinal length of the place where all the cargo oil tanks are located);
- (2) 6 L/min per square meter based on the horizontal section area of single cargo oil tank (with the max. horizontal section area); or
- (3) 3 L/min per square meter based on the max. area protected by the foam monitor that lies in front of such monitor, but at least 1250 L/min..

6.4 The foam thickening agent should be sufficient, so that foam can be generated for at least 20 min or 30 min when the max. foam solution supply rate specified in Article 6.3 above is adopted for the oil tanker with or without inert gas installation respectively, and the foam expansion ratio (namely, the volume ratio of the foam volume generated and the volume of the mixture of the water and the foam thickening agent) should not exceed 12:1 generally. If the system generates low-expansion foam basically, but the expansion ratio exceeds 12:1 a little, the quantity of foam solution required should be calculated via the system with the expansion ratio of 12:1. If the medium-expansion foam (with expansion ratio at 50:1-150:1) is adopted, the foam usage rate and capacity of the foam monitor device should satisfy the competent authorities.

6.5 The foam of fixed foam system should be supplied by multiple foam monitors and foam guns. Each foam monitor should supply at least 50% of the foam solution required in Articles 6.3(1) and 6.3(2). For oil tanker with carrying capacity of less than 4,000 deadweight tons, the competent authorities may require only foam gun rather than foam monitor to be installed on such tanker. In this case, however, the capacity of each foam gun should be at least 25% of the foam solution supply rate required in Articles 6.3(1) and 6.3(2).

6.6 The capacity of each foam monitor should guarantee that at least 3 L/min per square meter of foam solution spraying can be reached in the deck area protected by the gun and completely in front of it. Such capacity should be at least 1,250 L/min.

6.7 The distance between the foam and the far end of the protected area in front of it should not exceed 75% of the range of the foam monitor in dead air.

6.8 Hose connection of the gun. For oil tanker with carrying capacity of less than 4,000 deadweight tons, one hose connection used by the foam gun should be provided respectively at right/left side of the poop or the place in front of the accommodation space facing the deck of the cargo oil tank.

6.9 Four foam guns should be provided at least. The quantity and arrangement of the exits of the foam gun main should be provided in such a way that at least 2 foam guns can spray the foam to any part of the deck area of the cargo oil tank.

6.10 The gun foam should be installed in such a way that it can be operated flexibly during fire fighting, and cover the area that cannot be protected by the foam monitor.

6.11 Valve should be provided at the foam main and fire fighting main (if the latter is part of the deck foam system) closely in front of the foam monitor, so as to isolate the damaged part of the main.

6.12 The fire monitor and other components of the system should be made with corrosion-resistant materials or those with antiseptic treatment.

6.13 The mechanical property and chemical composition of the casting material should comply with relevant provisions of GB/T1173, GB/T1176, GB/T1348 and GB/T9439.

**7 Design and technical requirement on the deck foam fire-fighting system of the helicopter specified in R18.5 of Chapter II-2 of the SOLAS convention**

7.1 For foam fire-fighting of the helicopter deck, proper foam spraying system should be provided at the place close to the helicopter deck that consists of foam monitor or foam generation branch duct and can spray foam to all parts of the helicopter deck under any operational weather condition of the helicopter. Such equipment should be placed near the hatchway of the helicopter deck, and capable of working for at least 5 min. as per the spraying rate required in the table below:

Type	Overall length of the helicopter	Foam concentrates spraying rate (l/min)
H1	Less than 15 m (excluding 15 m)	250
H2	15 m - 24 m (excluding 24 m)	500
H3	24 m -35 m (excluding 35 m)	800

The foam fire extinguishing agent should be of seawater-resistance type, and meet the requirement of the *International Civil Aviation Organization Airport Service Manual*.

**8 Design and technical requirement on the deck foam fire-fighting system of the ship used for bulk transportation of hazardous chemicals**

8.1 Each ship should be provided with the fixed deck foam system required in 4.8.2 - 4.8.12.

8.2 Only one type of foam stock solution should be provided, which should be effective for the max. quantity of the cargo probably to be carried. For other cargo ineffective or incompatible with the foam, additional fire-fighting arrangement should be provided to the satisfaction of competent authorities. Common protein foam should not be used.

8.3 The foam supplying device should be able to transport the foam to the whole deck area of the liquid cargo tank, and into any liquid cargo tank with assumed broken deck.

8.4 The deck foam system should feature simple and quick operation, and the main control station of the system should be provided at a proper position outside the cargo area and close to the accommodation space, so as to guarantee the easy access and operation in case of any fire occurring in the protected area.

8.5 The supply rate of the foam solution should not be less than the max. value among the following:

8.5.1 2 l/min per square meter based on the deck area of the liquid cargo tank. The deck area of the liquid cargo tank refers to the value obtained by multiplying the max. ship width by the longitudinal length of the place where the cargo oil tank is located;

8.5.2 20 L/min per square meter based on the horizontal section area of single liquid cargo tank (with the max. horizontal section area); or

8.5.3 10 L/min per square meter based on the max. area protected by the foam monitor that lies completely in front of such monitor, but at least 1250 L/min. For ships with carrying capacity of less than 4,000 deadweight tons, the min. delivery capacity of the foam monitor should be 1000 l/min.

8.6 The foam stock solution should be sufficient, so that foam solution can be generated continuously for at least 30 min when the max. foam solution supply rate specified in 4.8.5.1, 4.8.5.2 and 4.8.5.3 is adopted.

8.7 The fixed foam system should provide foam solution that is to be sprayed by the foam monitor and foam gun. The delivery capacity of each foam monitor should at least guarantee 50% of the foam solution supply rate required in 8.5.1 or 8.5.2. The delivery capacity of any foam monitor should cover the protected deck area in front of the foam monitor (at least 10 l/min per square meter), which should not be less than 1250 l/min. For ships with carrying capacity of less than 4,000 deadweight tons, the min. delivery capacity of the foam monitor should be 1000 l/min, with delivery rate of at least 10 l/min per square meter.

8.8 The distance between the foam and the far end of the protected area in the front of it should not exceed 75% of the range of the foam monitor in dead air.

8.9 One hose connection of the foam monitor and foam gun should be provided respectively at the left/right side of the poop or the place in front of the accommodation space facing the liquid cargo tank area.

8.10 The foam gun should be operated flexibly during fire fighting, and cover the shielding area protected by the foam monitor. The delivery capacity of any foam gun should not be less than 400

l/min, and its range should be not less than 15 m in dead air. Four foam guns should be provided at least for each ship. The quantity and arrangement of the exits of the foam gun main should be provided in such a way that at least 2 foam guns can spray the foam to any part of the deck area of the liquid cargo tank.

8.11 Stop valve should be provided on the foam main in front of any foam monitor, so as to isolate the damage pipe of the main. If the fire-fighting main is part of the deck foam system, such stop valve should also be provided on the fire-fighting main.

8.12 At the time of operation of the deck foam system as per the required output quantity, a minimum number of water guns should be connected from the fire main pipe as per the pressure required. (The minimum number of water guns should be able to be used at the accommodation space, service space, control room and machinery room on the deck in the range of the total ship length at the same time.)

8.13 Alternative facilities to the satisfaction of CCS should be adopted for ships used especially to carry cargo with limited quantity for protection, but the efficiency level of such facilities on the cargo on the ship should reach that of the deck foam system that is effective to most inflammable cargo.

8.14 Portable fire extinguisher applicable to the cargo to be carried should be provided and kept in good operating status. The delivery capacity of the portable fire extinguisher should comply with relevant provisions of the SOLAS 74.

8.15 In case of any inflammable cargo carried, all ignition sources should be eliminated in the hazardous locations specified in the International Rules on the Structure and Equipment of the Ship Used for Bulk Transportation of Hazardous Chemicals, unless such ignition source complies with the provision of 10.1.4 of the Guideline.

8.16 For the ship with handling device at the stem or stern, one foam monitor meeting the requirement of 8.7 and one foam gun meeting the requirement of 8.10 should be provided. The additional foam monitor should be provided at the place that facilitates the protection of the handling device at the stem or stern. The cargo piping area in front or at the rear of the cargo area should be protected by the foam gun mentioned above.

**9 The electrical equipment and control system should meet relevant requirements in Parts Four and Seven of CCS Rules for Classification of Sea-Going Steel Ships.**

## **10 Inspection and test**

10.1 The casting surface should be smooth and clean, and free of such defects affecting the strength and performance as the crack, pore, shrinkage, or sand hole.

10.2 The weld seam should be level and even, and free of such defects as the insufficient penetration, burning through, scar, or other defect affecting the strength and appearance quality.

10.3 The certificates of main components mentioned in Article 5 of the Guideline should be checked, which should comply with the expected application of the product. For self-made products, they should be subject to approval as per relevant requirement of CCS.

10.4 The parts under pressure should be subject to hydraulic intensity test, or provided with approved test certificate. The test pressure is 1.5 times the max. working pressure, and the parts should be free of such defects as sweating, crack or permanent deformation after pressure maintaining for 3 min.

10.5 For water pressure tightness test of the system, the test pressure should be 1.1 times the max. working pressure, and the parts should be free of leakage after pressure maintaining for 3 min.

10.6 Each foam monitor and foam gun should be subject to spraying test, so as to check whether the supply water pressure, flow and controllability are normal.

10.7 For the first ship, 10% (at least 1 set) of the foam monitors and foam guns should be selected randomly for foam spraying effectiveness test, so as to check if the range meets the design requirement.