Guideline No. F-11(201709)

F-11

PORTABLE FOAM NOZZLE DEVICE

Issued date: September 27, 2017

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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Main change: New Release

Contents

Portable Foam Nozzle Device

Scope of Application

It is applicable to portable foam nozzle devices which are provided for machinery spaces with internal combustion engine, roll-off spaces, helicopter decks, etc. as required by Chapter II-2 of SOLAS convention, 1974.

2 Normative References

2.1 *International Convention for Safety of Life at Sea in 1974* (SOLAS Convention) and chapter II-2 of its amendments

2.2 Chapter 4 of *International Code for Fire Safety Systems* amended by MSC.217(82)

3 Definitions

3.1 Mixing ratio: volume percentage of foam extinguishing agent in foam mixture.

3.2 Expansion ratio: the ratio of foam volume and the mixture which produces the foam.

3.3 25% precipitation time: the time for precipitating 25% (mass) foam mixture from the foam.

3.4 Foam range: horizontal distance from the nozzle of the foam nozzle to maximum density point in foam continuously scattering area.

4 Drawings and Documents

4.1 The following drawings and documents shall be submitted to CCS for approval

（1） General assembly drawing

（2） General drawing of the foam nozzle

（3） Product technical specifications

（4） Type test outline

4.2 The following drawings and documents shall be submitted for future reference

（1） Nameplate drawing

（2） Product instructions

5 Raw Materials and Spare Parts & Components

5.1 Raw materials and spare parts & components shall be regulated according to relevant requirements of current specifications of the Society.

6 Technical Requirements

6.1 Performance parameters

See Table 6.1 for performance parameters of the foam nozzle.

Table 6.1

<table>
<tr><th>Vessel volume (l)</th><th>Rated operating pressure (MPa)</th><th>Operating pressure range (MPa)</th><th>Rated mixture flow (l/S)</th><th>Range (m)</th><th colspan="2">Mixing ratio</th><th>Expansion ratio</th><th>25% precipitation time (min)</th></tr>
<tr><td rowspan="3">20</td><td rowspan="3">0.5</td><td rowspan="3">0.2～0.6</td><td rowspan="2">4（±8%）</td><td rowspan="2">≥6</td><td>1%</td><td>1.0%～1.3%</td><td rowspan="3">≥5</td><td rowspan="3">Aqueous film-forming extinguishing agent ≥1.5
Other extinguishing agents ≥2.0</td></tr>
<tr><td rowspan="2">3%</td><td rowspan="2">3.0%～3.9%</td></tr>
<tr><td>8 （±8%）</td><td>≥15</td><td>6%</td><td>6.0%～7.0%</td></tr>
</table>

6.2 Structure

The foam nozzle device is composed of one self-priming foam nozzle connecting with the fire hose, one portable foam vessel capable of retaining at least 20 liters foam concentrate, together with one identical spare vessel. One end of foam nozzle is connected with fire hose with the self-priming interface in the middle connecting with the foam concentrate vessel though the hose.

6.3 Service temperature

The service temperature range of the foam nozzle device is -20℃~55℃. After the high and low temperature test, each part such as foam nozzle, tube, and vessel shall operate normally without deformation and damage which affects its normal use.

6.4 Mixture flow

At the rated operating pressure, mixture flow shall be 0.92 - 1.08 times of the rated value.

6.5 Mixing ratio

Ejection test shall be performed for the foam nozzle at the rated operating pressure and its foam mixture mixing ratio shall meet the requirements of Table 1.

6.6 Expansion ratio

Expansion ratio of the foam nozzle shall meet the requirements of Table 1 at the rated operating pressure.

6.7 25% precipitation time

25% precipitation time of the foam nozzle shall meet the requirements of Table 1 at the rated operating pressure.

6.8 Range

The range of the foam nozzle shall not be less than the value of the manufacturer and shall meet the requirements of Table 1 at the rated operating pressure.

6.9 Drop

The foam nozzle device shall have no any damage or deformation and it can operate normally after the drop test.

6.10 Impact resistance

The foam nozzle device can operate normally without any damage of the foam nozzle and the foam concentrate vessel shall have no cracking after the impact test.

6.11 Salt-spray resistance

The foam nozzle device can operate normally and fasteners can be tightened normally after the salt spray test.

6.12 Vibration resistance

The appearance of the foam nozzle shall be intact without damage in the structure and fasteners can work normally without loosening after the vibration test.

7 Type Test

7.1 Selection of typical samples

Each model shall be sampled with six sets of samplings in the type test.

7.2 Items of type test

S/N	Items	Technical Requirements	Type Test	Factory test
1	Structure	6.2	×	×
2	Service temperature	6.3	×	
3	Mixture flow	6.4	×	×
4	Mixing ratio	6.5	×	×
5	Expansion ratio	6.6	×	×
6	25% precipitation time	6.7	×	×
7	Range	6.8	×	
8	Drop	6.9	×	
9	Impact resistance	6.10		
10	Salt-spray resistance	6.11	×	
11	Vibration resistance	6.12	×	

Note: test classification description: “×” indicates the applicable test items

7.3 Test Method

7.3.1 Structure inspection

The foam nozzle device shall meet the requirements of Article 6.2.

7.3.2 Service temperature test

Firstly place 3 sets of foam nozzle devices in the environment of -20 ± 2 ℃ for 24h, then place them in environment of 20 ±5 ℃ for 24h, and finally place in the environment of 55 ±2 ℃ for 24h. At least two sets of three sets of foam nozzle devices comply with the requirements of Article 6.3 after the termination of test, otherwise the test failed.

7.3.3 Mixture flow test

When the water pressure of inlet of the foam nozzle reaches rated operating pressure and is stable, use the foam receiving tank to receive the spraying foam for 10s. Measure the mixture mass M_0 after the standing of foam. The flow shall be calculated as per Equation (1) and the result shall meet requirements of Article 6.4.

$$q = M_0/10 \quad (1)$$

Wherein:

M_0-The foam mass after the spraying for 10s, kg;

q-Mixture flow of the foam nozzle, l/s

7.3.4 Mixing ratio

Adjust the water pressure at the inlet of the foam nozzle device to rated operating pressure and to be stable, firstly weigh the foam concentrate mass of the portable vessel (W_0), then use the foam receiving tank to receive the spraying foam for 10s, next weigh the foam concentrate mass of the portable vessel (W_1), finally measure the mixture mass (M_0) after the standing of the foam and calculate the mixing ratio (a) as per the Equation (2). The result shall comply with the requirements of Article 6.5.

$$a = \frac{W0 - W1}{\rho * M0} \times 100\% \qquad (2)$$

Wherein:

W_0 – The weight of portable vessel with the foam concentrate before the spraying, kg;

W_1– The weight of portable vessel with the foam concentrate after the spraying, kg;

M_0 – The weight of the foam concentrate, kg;

ρ – The density of the foam concentrate, kg/m^3;

a – Mixing ratio.

7.3.5 Expansion ratio and 25% precipitation time

(1) Adjust the pressure of the inlet of the foam nozzle and make it stable at rated operating pressure. Make sure the temperature of the foam concentrate and water in the range of 20±2℃. The foam shall spray to the board of foam collector and the foam receiving tank receives the foam after the weighing of the tank (M_1). Start the stopwatch for timing at the same time. After the filling of the foam receiving tank, wipe off the foam outside of the tank and weigh the tank (M_2). The 25% precipitation mass ($M_{3)}$ shall be calculated as per Equation (3).

$$M_3 = \frac{M2 - M1}{4} \qquad (3)$$

Wherein:

M_3 - 25% precipitation mass, g;

M_2 – the weight of foam receiving tank which is filled with foam, g;

M_1 – The weight of foam receiving tank, g.

(2) When the mass of precipitated foam concentrate reaches M_3, stop timing and the time of the stopwatch is the 25% precipitation time which shall comply with the requirement of Article 6.7.

(3) Expansion ratio shall be calculated as per Equation (4) and the result shall meet the requirement of Article 6.6.

$$N = \frac{V\rho}{M2 - M1} \qquad (4)$$

Wherein:

N - Expansion ratio;

V – volume of the foam receiving tank of precipitation measuring equipment, ml;

ρ – The density of the foam concentrate, g/ml. ρ=1.0 g/ml shall be taken.

7.3.6 Range test

Put the foam nozzle on the jetrig with the nozzle of foam nozzle 1m away from the ground, the axis is held at 30±2 ° to the horizontal plane and the wind speed not more than 2m/s and at downwind condition, adjust the pressure of the inlet of the foam nozzle and make it stable at rated operating pressure, then spay for at least 10s. Measure the range which is the horizontal distance from the foam concentration point to the nozzle. The result

shall meet the requirements of Article 6.8.

7.3.7 Drop test

(1) Drop the foam nozzle with the nozzle upwards, downwards and horizontal direction along the axis from the height of 1m respectively to the steel plate of 10mm. The test result shall comply with the requirement of Article 6.9.

(2) Drop the foam concentrate vessel with the nozzle upwards, downwards and horizontal direction along the axis of the foam nozzle from the height of 1m respectively to the steel plate of 10mm. The test result shall comply with the requirement of Article 6.9.

7.3.8 Impact test

(1) Place the foam nozzle in environment of -20±2℃ for 24h to conduct impact test. Place the cylindrical flat steel hammer with the diameter of 75mm and height of 4±0.1kg 1m above the tested device and drop the hammer freely to impact the flange of the foam nozzle. Test result shall meet the requirement of Article 6.9.

(2) Place the foam nozzle in environment of -20±2℃ for 24h to conduct impact test. Place the cylindrical flat steel hammer with the diameter of 75mm and height of 4±0.1kg 1m above the tested device and drop freely the hammer to impact the foam concentrate vessel. Test result shall meet the requirement of Article 6.9.

7.3.9 Salt-spray resistance performance test

(1) Clean the appearance of the foam nozzle device before the test to move away grease and dirt. Do not use abrasive or solvent during cleaning. Put the foam nozzle into salt-spray resistance test chamber in an upright state. The foam nozzle devices neither can contact with each other nor the test box.

(2) The test concentrate in the salt-spray test chamber is made of distilled water and edible sodium chloride with the concentration of 50±1g/L and the PH value in the range of 6.5~7.2 at the temperature of 25℃. The temperature in the test chamber shall be 35℃±5℃ and spray rate shall be (1~2)ml/h (the average rate tested by putting the collector with test concentrate whose effective area is 80cm^2 into the test chamber for 24h). Guide plate shall be installed in the rest box if necessary to avoid that the salt-spray concentrated directly impact the surface of the foam nozzle. The concentrate after the spraying shall not be used again.

(3) Put a set of foam nozzle into the salt-spray test chamber for the test period of 480h. Spray continuously during the test period. Do not open the test chamber except during inspection or other necessary operations for a short period of time and do not touch the surface of the foam nozzle.

(4) Take out the foam nozzles after the test and dry them at the room temperature for more than 24h, then clean them with warm water. Check carefully the conditions of surface and accessories of the foam nozzles. The result shall comply with the requirement of Article 6.10.

7.3.10 Vibration test

(1) Put the foam nozzle and fix them in the fixture of the vibration table in the upright state and change the vibration direction of the vibration table in turn to make the foam nozzle vibrate in three directions (vertical, horizontal and lateral).

7.3.10.1.1 The vibration shall be conducted as per the following parameters in the directions of vertical, horizontal and lateral

Frequency (Hz)	Amplitude (mm)
10～19	0.75±0.08
20～39	0.50±0.05
40～60	0.25±0.03

Vibrate for 5min per frequency and increase the frequency value and amplitude in the unit of 2Hz;

7.3.10.1.2 Vibrate for 2h in each direction according to the resonant frequency value produced in 7.3.10.1.1 if there is no resonance, vibration test shall be carried out as per the following requirements. And vibration test for each direction shall be conducted according to the following parameters:

7.3.10.1.3 Frequency: 40 Hz; amplitude: 0.25mm±0.03mm; time of duration: 2h.

(2) The foam nozzle device shall meet the requirement of Article 6.11 after the vibration test.

8 Inspection by Piece/Batch

8.1 According to 7.2, the factory test items for the inspection by Piece/Batch which are approved by type (B) shall include: structure inspection, mixture flow, mixing ratio, expansion ratio and 25% precipitation time. The sampling ratio is 2 %, at least 2 samples.

8.2 The inspection by Piece/Batch which are approved by type (A) shall be conducted in accordance with the quality control plan approved by the Society.

8.3 All test items shall be conducted for the inspection by Piece/Batch without the type approval in accordance with 7.2. And the sampling ratio shall be 100%.