FOAM CONCENTRATES, PROPORTIONER: PERFORMANCE TEST

Key word: Foam concentrates, proportioner, test method

1 SCOPE AND FIELD OF APPLICATION

This NORDTEST method is intended to provide a basis for testing of proportioners for foam concentrates intended for use together with manual foam generation equipment. This test method includes both general requirements as well as performance tests.

As there are many different types of constructions, the method has to be used in applicable parts. In general there are, however, two basic working principles:

- the foam concentrate is injected into the water by generating a pressure drop over the proportioner,
- the proportion of foam concentrate is depending on the flow rate passing the proportioner.

In order to evaluate these two basic principles the test procedure and the parameters that are variated during the test programme are somewhat different. Two test procedures are therefore described in paragraphs 2.5.2.1 and 2.5.2.2, respectively.

The test method can be used as a separate test of any specific proportion equipment for e.g. some basic approval. Preferably it should be used to provide information about the complete foam extinguishing system that will be used by the fire brigades. This is possible by combining tests and test results from the following NORDTEST methods.

- NT FIRE 023, Fire extinguishing foam concentrates: Performance.
- NT FIRE 041, Foam branches, portable: Performance test.

2 TESTING

2.1 Documentation

The client shall provide the testing institute with the following documents before the tests are started.

- Design drawings and general assembly drawing with dimensioned flow paths.
- Material description also including information about surface treatment and coating thickness.
- Technical data and limits for proper function of the proportioner, e.g. nominal, minimum and maximum working pressure, minimum required pressure drop over the proportioner, minimum and maximum flow rate and intended proportion rates.

2.2 Test specimen

The client shall provide the testing institute with at least one proportioner.

2.3 Test equipment

The test equipment should in principle be arranged as shown in Fig 1. The following equipment and performance is required.

Flow meter with an accuracy within ±2% of the measured value \(Q_1\).

Pressure gauge, two pieces, with an accuracy within ±2% of the measured value \(P_1, P_2\).
Delivery pipe and outlet pipe with at least 100 mm bore and at least 1 - 200 mm length. Pressure gauges connections (P₁ and P₂) shall be fitted 200 mm from the outlet ends of the pipes.

Load cell equipment shall permit measurements at least twice a second with an accuracy of ± 1% (Q₂). (Density of the foam concentrate must be known or determined).

2.4 Foam concentrate

The foam concentrate used should preferably have been tested according to NT FIRE 023 and should fulfill the requirements described in Annex E dated January 1, 1987.

As there are many different foam concentrates with e.g. various flow characteristics, the manufacturer or supplier of the proportioner may freely choose foam concentrate. However, the name and composition of the used foam concentrates shall be reported.

As a recommendation at least two types of foams should be tested, one with Newtonian flow characteristics, e.g. protein or detergent foam or AFFF at 3%, and one with non-Newtonian (pseudoplastic) flow characteristics, e.g. most alcohol resistant foam concentrates at 3% and 6%, respectively.

The tests are normally performed with foam concentrate having a temperature of 15 °C - 20 °C, but other temperatures can be tested on request.

2.5 Test procedure

2.5.1 General

The test shall be performed at an air temperature of 10 – 20 °C, the water temperature shall be 5 - 15 °C and the foam concentrate shall have a temperature of 15 - 20 °C.

2.5.2 Functional test

Depending on type or principle of construction, the proportion equipment should be tested according to paragraph 2.5.2.1 or 2.5.2.2 or, if necessary, according to both paragraphs.

The proportioners and test equipment should be mounted as in Fig 1. Each separate induction test should continue for at least 30 s, or at high flow rates until at least 10 l of concentrate (or water) have been consumed.

2.5.2.1 Proportioners dependent on pressure drop (e.g. inline injectors)

2.5.2.1 a) The proportion rate as a function of pressure drop over the proportioner (P₁ - P₂/P₁ x 100) is measured.

Pressure drops of 25%, 30%, 35%, 40% and 60% should be tested. The tests should be performed at stated nominal working pressure (or flow rate) and at lowest and highest recommended working pressures (or flow rate) stated by the manufacturer. If no recommendations are given by the manufacturer, these tests should be performed at 75% and 125% of stated nominal working pressure.

Water should be used as test media instead of foam concentrate.

2.5.2.1 b) If the proportion rate can be varied, tests according to 2.5.2.1 a) should be repeated on all proportion rates. If the proportion rate can be regulated steplessly, e.g. 1 - 6%, the test should be performed on three different rates, preferably 1%, 3% and 6%.

Fig. 1
2.5.2.1 c) The proportion rate with one or several foam concentrates should be tested. Choice of foam and proportion rates should be made according to paragraph 2.4. The tests should be performed with minimum pressure drop recommended by the manufacturer or minimum acceptable pressure drop according to the test results of paragraph 2.5.2.1 a). Used foam concentrates should be reported.

2.5.2.1 d) The results should be presented as follows, preferably both in tabulated form and in a graph.
- Flow rate (Q₁) as a function of inlet pressure (P₁).
- Measured proportion rate(s) (%) as a function of total flow rate (Q₃) and various pressure drop over the proportioner.
- Measured proportion rate(s) (%) using foam(s).

2.5.2.2 Proportioners depending on flow rate

2.5.2.2 a) The proportion rate as a function of flow rate and working pressure is measured within the ranges specified by the manufacturer.

Tests should be performed on at least three different flow rates, or if the working range is very wide, at steps of approximately 200 l/min. The influence of working pressure should also be tested at a minimum of three different levels.

During the tests, the pressure drop over the proportioner should be recorded.

Water should be used as test media instead of foam concentrate.

2.5.2.2 b) If the proportion rate can be varied, tests according to 2.5.2.2 a) should be repeated on all proportion rates. If the proportion rate can be regulated steplessly, eg 1 - 6 %, the tests should be performed on three different rates, preferably 1 %, 3 % and 6 %.

2.5.2.2 c) The proportion rate with one or several foam concentrates should be tested. Choice of foam and proportion rates should be made according to paragraph 2.4. The tests should be performed at maximum recommended working pressure or maximum acceptable working pressure according to the test results of paragraph 2.5.2.2 a).

Used foam concentrates should be reported.

2.5.2.2 d) The results should be presented as follows, preferably both in tabulated form and in a graph.
- Pressure drop (P₁ - P₂) as a function of flow rate (Q₁).
- Measured proportion rate(s) (%) as a function of total flow rate (Q₃) and working pressure (P₁).
- Measured proportion rate(s) (%) using foam(s).

2.5.3 Pressure test

The foam solution outlet of the proportioner shall be plugged.

The proportioner shall be subject to a hydrostatic pressure test of 1.6 MPa during 1 min and any water leaking through the foam concentrate inlet shall be reported.

Afterwards the proportioner shall be examined with respect to damages that could have an influence on the function.

3 TEST REPORT

The test report shall include the following information.

a) Name and address of the testing laboratory.
b) Date and identification number of the report on each page of the report.
c) Name and address of the client.
d) Purpose of the test.
e) Method of sampling.
f) Name of manufacturer or supplier of the product.
g) Name or other identification marks and description of the product.
h) Identification of drawings, material description, technical data and labels.
i) Date of supply of the product.
j) Description of the specimens.
k) Date of test.
l) Test method.
m) Signature and title of person(s) accepting technical responsibility for the test report and date of issue.
n) A statement that the report must not be reproduced in its entirety without the approval of the testing laboratory.
o) Test results.

o:1 Results of functional tests with water and foam concentrate. The results should be presented according to paragraph 2.5.2.1 d) or 2.5.2.2 d). The type of used foam concentrate should be reported.
o:2 Results of pressure test.
PROPORTIONER FOR FOAM CONCENTRATES:
REQUIREMENTS (PROPOSAL)

A.1 General requirements

The proportioner shall be constructed of non-corrosive material or a combination of materials, which do not give galvanic corrosion. The material shall resist influence from the foam concentrate.

The last requirements are considered as fulfilled if the proportioner has been treated with protective painting.

A.1.1 The proportioner shall be equipped with fixed connections for the water inlet and foam solution outlet as well as for the inlet of the foam concentrate.

A.1.2 An inline injector shall be equipped with a sieve at the water inlet, hole size ≤ 6 mm.

A.1.3 The direction of the water flow through the proportioner shall be permanently marked with an arrow.

A.1.4 Proportioner with a fixed mixing device

This type of proportioner may be constructed for a certain mixing ratio. The marking of the mixing ratio in question must, however, be done in an obvious way.

A.1.5 Proportioner with an adjustable mixing unit

The scale shall show the mixing ratio in a clear and unambiguous way.

A.2 Test requirements

A.2.1 Functional test

After testing the following requirements shall be fulfilled for the various types.

A.2.1.1 Proportioning accuracy

When tested according to paragraph 2.5.2.1 a) - c) or 2.5.2.2 a) - c), the accuracy of the proportion rate should be within the following limits.

<table>
<thead>
<tr>
<th>Adjusted proportion rate (%)</th>
<th>Allowed tolerances on measured proportion rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 2</td>
<td>≤ 2 ± 0.25 %</td>
</tr>
<tr>
<td>3</td>
<td>3 ± 0.35 %</td>
</tr>
<tr>
<td>4</td>
<td>4 ± 0.50 %</td>
</tr>
<tr>
<td>5</td>
<td>5 ± 0.60 %</td>
</tr>
<tr>
<td>≥ 6</td>
<td>≥ 6 ± 0.75 %</td>
</tr>
</tbody>
</table>

If these tolerances are exceeded, e.g. due to increase in the viscosity of foam at low temperatures, proportioners with stepless regulation of induction rate might be adjusted to achieve proper proportion rate. Such adjustments should be presented in tabulated or graphical form as a function of temperature or viscosity and be verified with tests according to paragraph 2.5.2.1 or 2.5.2.2.

A.2.1.2 Pressure drop

The required pressure drop for proper function may not exceed 38 %, when using a Newtonian foam concentrate at 6 % admixture and at normal temperature. Non-Newtonian foam concentrate, low temperature or higher mixing rate etc, might require higher pressure drop.

A.2.2 Pressure test

Water may not leak into the foam concentrate up to 1.6 MPa with the foam solution outlet closed.

A.3 Marking

The proportioner shall be marked with at least the following.

- Water flow arrow (see paragraph A.1.3).
- Manufacturer and supplier.
- Year of manufacturing.
- Proportioning rate(s).
- Minimum and maximum flow rate.
- Minimum and maximum pressures on the foam solution outlet.