CEA 4102
Sprinkler Systems

Requirements and test methods for Foam Proportioners for Sprinkler Systems according to CEA 4001
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FOREWORD

It has been assumed in the preparation of these CEA-Specifications that the execution of its provisions is entrusted to appropriately qualified and experienced organisations.

NOTE: All pressure data in these CEA-Specifications are given as gauge pressures in bar\(^1\).

\(^1\) bar = 10\(^5\) Pa

1 SCOPE

These CEA-Specifications specify requirements and test methods for Foam Proportioners used in automatic sprinkler systems (wet pipe systems and dry pipe systems) conforming to the CEA Rules for Sprinkler Systems - Planning and Installation - (CEA 4001) or foam enhanced systems to EN 12845.

These CEA-Specifications specify requirements and test methods for these foam proportioners – by reference to the European Standard for Foam Systems (EN 13565-1) or

– detailed description of additional requirements and test methods in these CEA-Specifications.

NOTE: The requirements and test methods ensure that the foam proportioner is reliable and provides a stable function (proportion rate). The requirements and test methods do not ensure that the foam proportioner is compatible with a specific foam concentrate chosen for a specific sprinkler system and that the foam proportioner in each case provides the intended proportion rate. According to CEA 4001, the compatibility has to be ensured by the installer and the proportion rate has to be tested and verified in each installed system.

3 DEFINITIONS

For the purpose of these CEA-Specifications the definitions of EN 13565-1 and the following definitions apply.

Flow rate Q1:
Flow rate of extinguishing water into and through the proportioner, in l/min.

Flow rate Q2:
Flow rate of foam concentrate induced into the extinguishing water by the proportioner, in l/min.

Flow rate Q3:
Total flow rate at the outlet of the proportioner (Q1 + Q2), in l/min.

Proportion rate:
Volume-% foam concentrate in the total flow = (Q2/Q3) \(\times\) 100, in %.
4 REQUIREMENTS AND TEST METHODS

4.1 Manufacturer Specifications

The manufacturer shall specify:

– the maximum working pressure PS: at least 10 bar and not exceeding 16 bar; and
– the permitted maximum water flow rate \( Q_{1\text{max wet}} \) for use in wet pipe systems; and
– the permitted maximum water flow rate \( Q_{1\text{max dry}} \) for use in dry pipe systems: either 70% or 100% of \( Q_{1\text{max wet}} \); and

*Note: The manufacturer may, by specification, limit the use in dry pipe systems to systems requiring not more than 70% of the specified maximum flow rate \( Q_1 \) for wet pipe systems.*

– the nominal proportion rate(s); and
– the pressure drop; and
– the required/permissible conditions at the foam concentrate inlet (including permissible dry run time, if clause 4.9 is applicable).

4.2 Technical documentation

The following documentation shall be submitted:

a) Manufacturing documents:
   – Assembly drawing and parts list; and
   – Drawings of all individual parts; and
   – Data sheets of all purchased parts.

The marking according to 4.3 shall be documented in the drawings. If the marking is applied in coded form the meaning of the codes must be documented in the drawings.

b) User documentation:
   – Data sheet; and
   – Mounting/installation instructions.

c) List of documents:
   – A list (with the manufacturer’s designations, drawing No., revision’s state, date) containing all above mentioned documents (providing designation, drawing No., revision’s state and date).

4.3 Marking

The foam proportioner must be marked with the following information:

– Manufacturer’s/supplier’s name or trade mark; and
– Type designation; and
– Maximum working pressure; and
– Direction of flow (water flow); and
– Nominal proportion rate; and
– Maximum water flow rate \( Q_{1\text{max wet}} \); and
– some mark(s) or code(s) (e.g. serial number or batch number), by which at least the date or batch and the place of manufacture (if several places of manufacture) can be identified by the manufacturer.

This marking shall be non-detachable, permanent, non-combustible, and well legible in installed position of the foam proportioner.

4.4 Requirements and test methods of EN 13565-1

4.4.1 Foam proportioners shall fulfil the applicable requirements for foam proportioners of EN 13565-1, except when otherwise stated in these CEA-Specifications.

4.4.2 Foam proportioners shall be tested in accordance with the applicable test methods for foam proportioners of EN 13565-1, except when otherwise stated in these CEA-Specifications.

4.4.3 The test pressure in the hydrostatic pressure test (see EN 13565-1, clause 4.3.2 and Annex A) shall be 4 times the specified maximum working pressure instead of 3 times the specified maximum working pressure and
in a subsequent verificational function test according to 4.5.2 the requirements of 4.5.1 shall be met.

4.4.4 The requirements of EN 13565-1 regarding accuracy of proportioning and flow/pressure loss characteristics (see EN 13565-1, clause 7) are covered by the function requirements and test method specified in 4.5.

4.4.6 Additional requirements and test methods (in addition to EN 13565-1) are specified in 4.6 to 4.9.

4.5 Function

NOTE: This clause covers the requirements of EN 13565-1, clause 7. In addition, requirements for high water flow rates (upto 150% of specified Q_{1 \text{max wet}}) and requirements for small water flow rates (below flow rates used in foam systems) are specified.

4.5.1 Requirements

The requirements for the accuracy of proportioning as shown in figure 1 shall be met when tested in accordance with 4.5.2.

The pressure drop figures specified by the manufacturer shall be within ± 10 % of the value(s) determined in accordance with 4.5.2.

4.5.2 Test method

The test shall generally be done as described in section 2 of Nordtest Method NT Fire 042. Water should be used as test media instead of foam concentrate for Q2.

Water flow Q1 through the proportioner is established as shown in table 1.

At increasing and decreasing pressure the following is measured:

- Q1;
- Q2;
- pressure upstream the proportioner;
- pressure downstream the proportioner;
- the required/ permissible conditions at the foam concentrate inlet, as applicable.

The proportion rate is calculated.

![Figure 1](image.png)

*Figure 1  Requirements on accuracy of proportioning depending on flow rate Q1.*
4. REQUIREMENTS AND TEST METHODS

4.6 Water hammer

The proportioner (parts and accessories exposed to extinguishing water pressure) is filled with water and shock-pressurised (test medium water) as follows:
- Number of water hammer cycles: 3000
- Test pressure: (maximum working pressure + 25) bar

Before each water hammer cycle the pressure in the proportioner shall not exceed 3.5 bar.

During and after the test the proportioner shall show no signs of damage or deterioration.

In a subsequent verificational function test according to 4.5.2 the requirements of 4.5.1 shall be met.

4.7 Overload 110%

4.7.1 Applicability

These requirements (clause 4.7.2) do not apply to proportioners which by design ensure
- that overload can by no means modify the characteristics and operational safety of the proportioner temporarily or permanently; and
- that an obstruction of the extinguishing water flow Q1 as a result of overload conditioning is not possible.

These conditions may be met when no parts of the proportioner are located in the extinguishing water flow Q1 and no parts of the proportioner can extend into it and no movable parts inside the proportioner are exposed to the flow.

4.7.2 Requirements and test method

Water flow 110% of $Q_{1\text{ max wet}}$ through the proportioner is established for 60 min at an upstream pressure of $(5.5 \pm 0.5)$ bar.

The following is measured:
- $Q_1$;
- $Q_2$;
- pressure upstream the proportioner;
- pressure downstream the proportioner;
- the required/permissible conditions at the foam concentrate inlet, as applicable.

The proportion rate is calculated.

During the test the requirements of 4.5.1 shall be met.

NOTE: Maximum allowed proportion rate at 110% of $Q_{1\text{ max wet}}$: 1.3 times the nominal proportion rate (subject to a maximum of nominal proportion rate +1%). Minimum allowed proportion rate at 110% of $Q_{1\text{ max wet}}$: 0.95 times nominal proportion rate.

During and after the test the proportioner shall show no signs of damage or deterioration.

In a subsequent verificational function test according to 4.5.2 the requirements of 4.5.1 shall be met.

<table>
<thead>
<tr>
<th>Each function test (Input and verificational)</th>
<th>Input function test only</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1 [l/min]</td>
<td>200, 500, 20% of $Q_{1\text{ max wet}}$, 50% of $Q_{1\text{ max wet}}$, $Q_{1\text{ max wet}}$</td>
</tr>
<tr>
<td>Upstream pressure [bar]</td>
<td>5, 10, 12.5 (*), 16</td>
</tr>
<tr>
<td>(but not exceeding the specified maximum working pressure PS) (*) is done in case the proportioning does not meet the requirements at 16 bar</td>
<td></td>
</tr>
<tr>
<td>Duration</td>
<td>At each point: for a time period sufficient to reach stable flow conditions Q1 and Q2 to get proper measurements for the calculation of the proportion rate (as a rule 2 to 5 min)</td>
</tr>
</tbody>
</table>

Table T 1: Function test parameters
4.8 Overload 150%

4.8.1 Applicability

4.8.1.1 These requirements (clause 4.8.2) do not apply if the permitted maximum water flow rate $Q_{1 \text{max } \text{dry}}$ for use in dry pipe systems is limited to 70% of $Q_{1 \text{max } \text{wet}}$ (see clause 4.1).

4.8.1.2 These requirements do not apply to proportioners which by design ensure

- that overload can by no means modify the characteristics and operational safety of the proportioner temporarily or permanently; and

- that an obstruction of the extinguishing water flow $Q_1$ as a result of overload conditioning is not possible.

These conditions may be met when no parts of the proportioner are located in the extinguishing water flow $Q_1$ and no parts of the proportioner can extend into it and no movable parts inside the proportioner are exposed to the flow.

4.8.2 Requirements and test method

According to 4.7.2 with the following changes:

- Water flow: 150% of $Q_{1 \text{max } \text{wet}}$ instead of 110% of $Q_{1 \text{max } \text{wet}}$.
- Duration of flow: 4 min instead of 60 min.

4.9 Suction-side dry run (operation without foam concentrate supply)

4.9.1 Applicability

4.9.1.1 These requirements (clauses 4.9.2 and 4.9.3) do not apply to proportioners which by design ensure

- that a dry run of the proportioner (operation without foam supply) can by no means modify the characteristics and operational safety of the proportioner temporarily or permanently; and

- that an obstruction of the extinguishing water flow $Q_1$ as a result of dry run is not possible.

4.9.1.2 Clause 4.9.2 needs to be applied to 1 proportioner of a design series only (i.e. 1 size of a series of proportioners with several sizes of similar design).

4.9.2 Requirements and test method for long test

Water flow $Q_{1 \text{max } \text{wet}}$ through the proportioner is established for 90 min at an upstream pressure corresponding to the maximum working pressure PS.

During these 90 min the foam concentrate inlet is open to atmosphere.

Subsequently (with the water flow $Q_1$ continuously in place), the foam concentrate inlet is quickly connected to the foam supply (containing test medium water), thus starting $Q_2$. The proportioner is operated for a further short time period to allow for cooling by $Q_2$.

During and after the test there shall be no effect on the extinguishing water flow $Q_1$.

4.9.3 Requirements and test method for short test

According to 4.9.2 with the following changes:

- Duration of dry run: specified permissible dry run time (see 4.1) instead of 90 min.
- During and after the test the proportioner shall show no signs of damage or deterioration.
- In a subsequent verificational function test according to 4.5.2 the requirements of 4.5.1 shall be met.

4.10 Other tests

Where special designs or new manufacturing methods make it necessary to conduct additional testing, this will be carried out in coordination with the manufacturer.