INTERNATIONAL STANDARD

ISO 7076-1

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Fire protection — Foam fire extinguishing systems —

Part 1: Foam proportioning equipment

Protection contre l'incendie — Systèmes d'extinction d'incendie à mousse —

Partie 1: Équipement de dosage de la mousse

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Contents

Page

Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 7076-1 was prepared by Technical Committee ISO/TC 21, *Equipment for fire protection and fire fighting*, Subcommittee SC 6, *Foam and powder media and firefighting systems using foam and powder*.

ISO 7076 consists of the following parts, under the general title *Fire protection — Foam fire extinguishing systems*:

— *Part 1: Foam proportioning equipment*

— *Part 2: Low expansion foam equipment*

— *Part 5: Compressed air foam equipment*[1)]

1) To be published.

Fire protection — Foam fire extinguishing systems —

Part 1:
Foam proportioning equipment

1 Scope

This International Standard specifies requirements and test methods for foam proportioning equipment of fixed foam extinguishing systems for indoor or outdoor use or both.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 7-1, *Pipe threads where pressure-tight joints are made on the threads — Part 1: Dimensions, tolerances and designation*

ISO 175, *Plastics — Methods of test for the determination of the effects of immersion in liquid chemicals*

ISO 179-1, *Plastics — Determination of Charpy impact properties — Part 1: Non-instrumented impact test*

ISO 180, *Plastics — Determination of Izod impact strength*

ISO 228-1, *Pipe threads where pressure-tight joints are not made on the threads — Part 1: Dimensions, tolerances and designation*

ISO 272, *Fasteners — Hexagon products — Widths across flats*

ISO 527-1, *Plastics — Determination of tensile properties — Part 1: General principles*

ISO 885, *General purpose bolts and screws — Metric series — Radii under the head*

ISO 898-1, *Mechanical properties of fasteners made of carbon steel and alloy steel — Part 1: Bolts, screws and studs with specified property classes — Coarse thread and fine pitch thread*

ISO 898-2, *Mechanical properties of fasteners — Part 2: Nuts with specified proof load values — Coarse thread*

ISO 1179-1, *Connections for general use and fluid power — Ports and stud ends with ISO 228-1 threads with elastomeric or metal-to-metal sealing — Part 1: Threaded ports*

ISO 4633, *Rubber seals — Joint rings for water supply, drainage and sewerage pipelines — Specification for materials*

ISO 4759-1, *Tolerances for fasteners — Part 1: Bolts, screws, studs and nuts — Product grades A, B and C*

ISO 7005-1, *Pipe flanges — Part 1: Steel flanges for industrial and general service piping systems*

ISO 7005-2, *Metallic flanges — Part 2: Cast iron flanges*

ISO 9227, *Corrosion tests in artificial atmospheres — Salt spray tests*

ASTM D638, *Standard test method for tensile properties of plastics*

ASTM G155, *Standard practice for operating xenon arc light apparatus for exposure of non-metallic materials*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
proportioning ratio
volume percentage of foam concentrate in a foam solution

3.2
foam proportioning equipment
equipment which controls the mixing of foam concentrate into a water flow, at a predetermined ratio, to produce a foam solution

EXAMPLE Balanced pressure proportioner, bladder tank proportioner, inline eductor, pump proportioner.

3.3
working pressure
pressure at which the foam proportioning equipment is used in the system

4 Requirements

4.1 Connections

4.1.1 Permanent connections and joints

Permanent joints shall conform to ISO 7-1, ISO 228-1, ISO 1179-1, ISO 7005-1 or ISO 7005-2, as applicable, or shall conform to other technical specifications valid in the place of use where International Standards are not applicable.

4.1.2 Bolting of pressure-retaining parts

Bolts, nuts or studs or both used to fasten pressure-retaining parts shall conform to ISO 272, ISO 885 and ISO 4759-1, or shall conform to other technical specifications valid in the place of use where International Standards are not applicable.

4.2 Parts for removal during routine field maintenance

4.2.1 Removal

Parts intended for removal during routine field maintenance shall be accessible, removable and replaceable without damage using appropriate tools normally used by the trade, or special tools recommended by the component manufacturer.

4.2.2 Re-assembly

The design and construction of any part intended for removal during routine field maintenance shall be such that it cannot be re-assembled in a manner other than as intended.

4.3 Corrosion resistance of metal parts

Those parts of components that are exposed to foam concentrate or foam solution shall be resistant to corrosion from that exposure.

Those parts of components that are intended to freely move during operation or bear against, rotate within, or slide on stationary parts shall be of a corrosion-resistant material.

NOTE Bronze is a typical material that has corrosion-resistant properties when exposed to foam concentrate or foam solution.

4.4 Elastomeric joint rings

Elastomeric joint rings shall conform to the requirements of Type W of ISO 4633.

4.5 Plastics and reinforced resin materials

4.5.1 General

Plastic or reinforced resin components, which are essential to the operation or safety of the product, shall meet the relevant requirements of 4.5.2 and 4.5.3.

4.5.2 Resistance to ageing

After ageing in accordance with 5.2 and the appropriate sections of ISO 527-1, ISO 179-1 and ISO 180, specimens of plastics and reinforced resin materials used for components shall:

a) have a tensile strength of no less than 50 % of the value before exposure;

b) have an elongation at break of no less than 50 % of the value before exposure; or

c) have an impact strength of no less than 50 % of the value before exposure (this method is relevant to stiff plastics, i.e. flexible plastics shall be evaluated using the tensile test);

d) show no signs of cracking.

4.5.3 Resistance to exposure to liquids

Plastics and reinforced resin materials which come into contact with foam concentrate, foam solution or water after exposure to the particular liquid in accordance with 5.3 and the appropriate sections of ISO 527-1, ISO 179-1 and ISO 180, shall:

a) have a tensile strength of no less than 50 % of the value before exposure;

b) have an elongation at break of no less than 50 % of the value before exposure; or

c) have an impact strength of no less than 50 % of the value before exposure (this method is relevant to stiff plastics, i.e. flexible plastics shall be evaluated using the tensile test);

d) show no signs of cracking.

4.6 Strength

4.6.1 The pressure-retaining equipment shall withstand, without rupture, an internal hydrostatic pressure of four times the maximum working pressure for a period of 5 min when tested as specified in 5.4.

4.6.2 The calculated design load of any fastener, neglecting the force required to compress the gasket, shall not exceed the minimum tensile strength specified in ISO 898-1 and ISO 898-2 when the equipment is pressurized to four times the maximum working pressure. The area of the application of pressure shall be calculated as follows:

a) If a full-face gasket is used, the area of application of pressure is that extending out to a line defined by the inner edge of the bolts;

b) If an “O”-ring seal or ring gasket is used, the area of application of force is that extending out to the centre line of the “O”-ring or gasket.

4.7 Leak resistance

The pressure-retaining equipment, except atmospheric storage tanks and pressure vessels, shall withstand for 5 min without leakage, an internal hydrostatic pressure of 1,5 times the maximum working pressure specified by the manufacturer, when tested in accordance with 5.5.

4.8 Proportioning ratio

The measured proportioning ratio shall not be less than the rated concentration stated by the manufacturer and not more than 1,3 times the rated concentration or one percentage point above the rated concentration (whichever is less) when tested in accordance with 5.6.

4.9 Pressure loss

When tested in accordance with 5.7, the maximum deviation of pressure loss shall not be more than –10 % and 0 % of the value stated by the manufacturer.

4.10 Operation reliability

The spring, slider and other movable parts of foam proportioning equipment shall be tested individually in accordance with 5.8. After testing, the movable parts shall be reinstalled in the foam proportioning equipment, and the equipment shall operate properly. The proportioning ratio of the equipment shall meet the requirement of 4.8 when tested in accordance with 5.6.

4.11 Water flow

The foam proportioning equipment shall show no loose parts or leakage when tested in accordance with 5.9.

4.12 Stress corrosion

After being subjected to the conditions described in 5.10, a brass part containing greater than 15 % zinc shall comply with the following requirements:

a) show no evidence of cracking when examined using 25x magnification, or

b) if there is evidence of cracking of pressure-retaining equipment, comply with 4.6 at 2 times the maximum working pressure rather than 4 times the maximum working pressure, or

c) if there is evidence of cracking of equipment that is not pressure-retaining, comply with 4.11.

4.13 Salt-spray corrosion

After being subjected to the conditions described in 5.11, equipment constructed from metallic parts using combinations of brass, bronze, or ferrous metals shall show no destruction or damage which impairs function.

4.14 Light and water exposure

Following light and water exposure for 720 h, as specified in 5.12, an exterior polymeric or fibreglass component part or samples prepared from the same exterior polymeric or fibreglass component material:

a) shall show no evidence of cracking, and

b) a component part that need not be cut or altered in order to be subjected to the exposure shall function as intended when operated at its highest inlet pressure and highest flow rate for 2 min;

c) a component part that needs to be cut or altered in order to be subjected to the exposure shall have physical properties not less than 60 % of the original as-received physical properties when subjected to tensile tests described in ASTM D638.

5 Test methods

5.1 General

The following tests shall be carried out for each type of foam proportioning equipment.

Tests shall be carried out at ambient temperatures of 20 °C ± 10 °C, unless other temperatures are indicated. Unless otherwise stated, the tolerances given in Annex A shall apply.

5.2 Ageing test for plastics and reinforced resin materials

Place five specimens of the material under test in an air tolerance oven at 100 °C ± 2 °C for 90 d. Allow to cool in air at 23 °C ± 3 °C for 24 h ± 4 h before testing.

NOTE Certain plastics require a lower oven temperature. In such cases, if the acceleration factors are unknown, it is assumed that the lowering of the temperature by 10 °C implies a doubling of the ageing time.

5.3 Liquid exposure test

Immerse five samples in each of the liquids with which the material comes into contact, in accordance with ISO 175, for 210 d at 50 °C ± 2 °C. Use the appropriate test liquid, i.e. potable water, seawater or foam concentrate or foam solution, recommended by the supplier.

5.4 Equipment pressurization test

The foam proportioning equipment shall be fastened in the test device. Any materials or parts that are not capable of withstanding test pressure should be removed or replaced by suitable ones. Blank off or plug all orifices. Fill the foam proportioning equipment with water, close the air vent and pressurize the hydrostatic pressure four times the maximum working pressure and maintain this pressure for 5 min. The test results shall meet the requirements of 4.6.

5.5 Leak resistance test

The foam proportioning equipment shall be installed on the pipeline. Blank off or plug all orifices, leaving one connection for pressurization and an outlet fitted with a suitable valve for venting air. Fill the equipment with water, close the air vent and pressurize from zero, at a rate not exceeding 0.2 MPa /s (2 bar/s), to not less than 1,5 times the maximum working pressure and maintain for 5 min. The test results shall meet the requirements of 4.7.

5.6 Proportioning ratio test

The foam proportioning equipment shall be installed on the pipeline as its intended use.

The test shall be conducted with the minimum suction pressure at the concentrate inlet as specified by the manufacturer. Each proportioning ratio stated by the manufacturer shall be tested over the flow range specified by the manufacturer, including the maximum, minimum and intermediate flow rates. The foam concentrate having the lowest and highest value of viscosity specified by the manufacturer shall be used for this test, rather than a test liquid.

For each proportioning ratio and each flow rate, the flow rates of water inlet and foam inlet shall be recorded for 1 min after the water flow and pressure have been stabilized. The proportioning ratio shall meet the requirements of 4.8.

5.7 Pressure loss test

The foam proportioning equipment shall be installed as intended in the pipeline of the same nominal diameter as the equipment. Test pressure shall be in the range as specified by the manufacturer. Tests shall be conducted with water. At least five flow rates shall be chosen, including the minimum and maximum flow rates specified by the manufacturer and flow rates between the minimum and maximum flow rates specified by the manufacturer.

Both inlet pressure and outlet pressure shall be measured at each flow rate. Pressure loss shall be calculated using the formula below:

$$\Delta P = P_1 - P_2$$

where

ΔP = pressure loss, MPa;

P_1 = inlet pressure, MPa;

P_2 = outlet pressure, MPa.

A pressure loss curve shall be drawn, or a pressure loss value shall be calculated. The test results shall meet the requirements of 4.9.

The minimum flow rate may need to be increased to a velocity at least 3 m/s to provide a measurable inlet and outlet pressure.

The pressure loss may be measured directly with a differential pressure measuring device.

The inlet and outlet pressure measurement locations shall be at least ten pipe diameters from the equipment inlet and outlet, respectively.

The pressure loss for the pipeline between the inlet pressure measurement location and the inlet of the equipment and the outlet pressure measurement location and the outlet of the equipment can be subtracted from the pressure loss of the equipment. This typically requires an additional test with the pipeline coupled directly together without the equipment installed.

5.8 Operation reliability test

Subject the spring or slider in the normal mounting to 5 000 cycles of normal operation (such as stretch and slide). The components shall not be operated at a rate exceeding six cycles per minute. The test results shall meet the requirements of 4.10.

5.9 Water flow test

The foam proportioning equipment shall be installed in the pipeline as its intended use. The test sample shall be subject to continuous water flow:

a) for 10 min with the highest inlet pressure and flow rate as specified by the manufacturer;

b) for 5 min with 150 % of the highest flow rate as specified by the manufacturer.

The test results shall meet the requirements of 4.11.

5.10 Stress corrosion test

The openings of each sample shall be filled with deionized water and sealed with a non-reactive material (e.g. plastic cap) so as to prevent the introduction of the ammonia atmosphere into the interior of the component. The samples to be tested shall be free from any non-permanent protective coating and, if necessary, shall be degreased. The samples shall be tested in their intended orientation. Samples with threads intended for the purpose of installing the product in the field shall have the threads engaged and tightened to the torque specified in Table 1. There shall be provisions in the test chamber to prevent droplets of condensation from falling from the top of the enclosure directly onto the samples. Such shield or other means shall be constructed of glass or other non-reactive materials. The samples shall be exposed to the moist ammonia-air mixture maintained in a glass chamber with a known volume. Aqueous ammonia having a density of 0.94 g/cm^3 shall be maintained in the bottom of the chamber, 40 mm to 50 mm below the bottom of the samples.

A volume of aqueous ammonia equal to 10 L/m^3 of the test chamber volume, results in approximately the following atmospheric concentrations: 35 % ammonia, 5 % water vapour, and 60 % air. Prior to beginning the

exposure, the chamber shall be conditioned to a temperature of 34 °C ± 2 °C for a period of not less than 1 h, and shall be maintained as such throughout the exposure period. The moist ammonia-air mixture shall be maintained at essentially atmospheric pressure. Provision shall be made for venting the chamber, such as by the use of a capillary tube, to avoid pressure build-up.

The test exposure shall be 10 d. Upon removal, samples shall be rinsed in potable water and air-dried. After a 2 d to 4 d drying period, visual examination of the samples shall be made. After exposure, the equipment shall comply with the requirement of 4.12.

Table 1 — Torque requirements for threaded connections

Nominal thread size mm	Torque N-m
3	11
6	20
10	27
13	46
19	68
25	136
32	164
38	175
50	186
64	198
76	203
102	215

5.11 Salt-spray corrosion test

During the corrosive exposure, a metallic part is to be connected to a typical pipe fitting or hose coupling to simulate field installation, unless it is to be marked to specify fitting or coupling material or both.

The specimens shall be subjected to a salt spray using the equipment specified in ISO 9227 and a salt solution having a mass fraction of 20 % sodium chloride in distilled water. The pH of the collected salt solution shall be between 6,5 and 7,2 and the density shall be between 1,126 g/ml and 1,157 g/ml when atomized at 35 °C ± 2 °C. A suitable means of controlling the atmosphere in the chamber shall be provided.

Suspend the specimens in their normal operating position and expose them to the salt spray (fog) in a chamber having a volume of at least 0,4 m^3. Maintain the exposure zone at a temperature of 35 °C ± 2 °C. Record the temperature at least once per day. Salt solution shall be supplied from a recirculation reservoir through air-aspirating nozzles, at a pressure between 0,07 MPa (0,7 bar) and 0,17 MPa (1,7 bar). Collect salt solution run-off from exposed samples to make sure that it is not returned to the reservoir for recirculation. Shield specimens from condensate drippage. Collect fog from at least two points in the exposure zone to determine the rate of application and salt concentration.

Expose the specimens to the salt spray for a period of 10 d. After this period, remove the specimens from the fog chamber and allow them to dry for 2 d to 4 d at a temperature not exceeding 20 °C ± 5 °C in an atmosphere having a relative humidity no greater than 70 %. Tested samples shall remain fully functional and exhibit no corrosion, galvanic action, loss of legibility of markings, or separation of protective coatings, which impair functionality. Superficial discoloration with no substantial attack of the underlying material shall be acceptable. Test results shall meet the requirements of 4.13.

5.12 Light and water exposure test

The light and water exposure shall be conducted in accordance with Cycle 1 described in ASTM G155. Test results shall meet the requirements of 4.14.

6 Marking

The marking of the foam proportioning equipment shall be non-detachable, non-flammable, permanent and legible. The foam proportioning equipment shall be marked with:

a) name or trademark of the manufacturer;

b) name of product;

c) model;

d) working pressure(s);

e) direction of flow;

f) proportioning ratio;

g) date of production;

h) type of foam concentrate (newtonian or pseudoplastic or both).

7 Manufacturer's installation and operation instructions

Installation instructions, including any special dimensional, orientation or access requirements, shall be provided by the manufacturer. Instructions shall be provided in each shipping container or attached to each component.