
**Fire protection — Fire extinguishing
media — Powder**

Protection contre l'incendie — Agents extincteurs — Poudres

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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 7202 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*.

This second edition cancels and replaces the first edition (ISO 7202:1987), which has been technically revised.

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Introduction

This International Standard is one of a series giving specifications for fire extinguishing media in common use and which are in need of specification for fire fighting purposes. These specifications are designed to establish that the medium in question has at least a minimum useful fire extinguishing capability and can therefore be reasonably sold for fire extinguishing purposes.

Requirements for media used in particular equipment will form the subject of future International Standards.

Annexes A to D provide important information on, and give recommendations relating to, the use of extinguishing powders, and they should be read carefully by all concerned with the use of extinguishing powders. They do not, however, form part of the specification.

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Fire protection — Fire extinguishing media — Powder

1 Scope

This International Standard specifies requirements for the chemical and physical properties, and for minimum performance in defined test methods, of fire extinguishing powders suitable for use against fires of classes A, B, C and D. Requirements are also given for the information and data to be declared by the manufacturer.

NOTE The classification of fires is given in ISO 3941.

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 3310-1, *Test sieves — Technical requirements and testing — Part 1: Test sieves of metal wire cloth*

ISO 4788, *Laboratory glassware — Graduated measuring cylinders*

ISO 7165, *Fire fighting — Portable fire extinguishers — Performance and construction*

3 Terms and definitions

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

3.1

batch

single charge of material in the processing equipment that has been made homogeneous by subsection to the same unit and physical processing

NOTE This is for the purposes of acceptance and verification testing by an inspecting authority.

3.2

characterization statement

information and data declared by the manufacturer regarding the chemical and physical properties of the powder

3.3

extinguishing powder

extinguishing medium composed of finely divided solid chemical products consisting of one or more principal components, which are combined with additives to improve its characteristics

NOTE 1 The term “dry powder” is sometimes used to denote special metal fire extinguishing agents and the term “dry chemical extinguishing agent” refers to the extinguishing medium covered by this International Standard.

NOTE 2 When it is useful to indicate the class of fire for which a particular powder is designed, capital letters may be added before the term. The letters used in this International Standard are those defined in ISO 3941.

EXAMPLE “BC” powder is designed to extinguish class B (liquids or liquefiable solids) and class C (gases) fires; “ABC” powder is designed to extinguish class A (solids that normally form glowing embers), class B and class C fires; “D” powder is designed to extinguish metal fires.

3.4 lot

one or more batches but not more than 25 t of powder, manufactured to the same formulation by the same manufacturing process and under the same environmental conditions

NOTE Any substantial change in production personnel, manufacturing process, source of raw materials, or change in environmental conditions may justify identifying the material as a different lot.

4 Sampling

Samples for testing in accordance with this International Standard shall be taken using a method which will provide a sample which is as representative as possible. In order to avoid any risk of condensation, it is essential that the temperature of the powder in its original container is not lower than the ambient air temperature when the sample is being taken. Sample containers should not be opened until temperature equilibrium with the laboratory air has been reached.

When sampling a lot, not less than 12 kg of material shall be taken at random from a batch. For batch testing, not less than 2,5 kg selected from a container shall be taken at random. Suitably identified samples shall be stored in individual, clean, dry, airtight, non-reactive containers.

In addition to these samples, an inspecting authority may require additional samples for verification testing.

NOTE One suitable method of sampling is suggested in Annex C.

5 Characterization statement and requirements

5.1 General

The manufacturer shall declare, on demand, the information and data specified in 5.2 to 5.5. The manufacturer should conduct statistical measurements to ensure that the values declared correspond to the mean values of the range of values inherent to the manufacturing process.

NOTE The characterization statement is primarily for identification and information purposes and to provide the reference values for the tolerance requirements of 5.2, 5.3 and 5.4, but particular attention is drawn to 5.5.

5.2 Bulk density

The bulk density of the powder shall be determined in accordance with 13.1. The bulk density shall be within $\pm 0,07$ g/ml of the value declared by the manufacturer.

5.3 Sieve analysis

When tested using the method specified in 13.2.2 or 13.2.3, the quantity retained on the 40 μm sieve and on the 63 μm sieve shall not differ from the declared value by more than ± 8 % of the total mass of the sample, and the quantity retained on the 125 μm sieve shall not differ from the declared value by more than ± 5 % of the total mass of the sample. The test method shall be declared with the results.

5.4 Chemical content

Characteristic values for chemical content shall be expressed as percentages (mass fraction) of the total content.

The characteristic values for chemical content shall include all constituents present in the powder at a concentration representing 10 % or more of the total content. The sum of the characteristic values for chemical content shall be 90 % or more of the total content. Each constituent given a characteristic value shall be identified by its chemical name, or as the reaction product of a chemical process between reactants identified by their chemical names.

In the latter case, the chemical process shall be specified, for example by reference to a published patent. The content of a declared constituent shall be as follows:

- within $\pm 1,0$ % of the total chemical content for constituents of characteristic value more than 10 % but not more than 15 %;
- within $\pm 1,5$ % of the total chemical content for constituents of characteristic value more than 15 % but not more than 25 %;
- within $\pm 2,0$ % of the total chemical content for constituents of characteristic value more than 25 % but not more than 65 %;
- within $\pm 3,0$ % of the total chemical content for constituents of characteristic value more than 65 % and above.

NOTE 1 For example, a constituent with a characteristic value of 20 % has tolerance limits of 18,5 % and 21,5 % and a constituent with a characteristic value of 80 % has tolerance limits of 77 % and 83 %.

NOTE 2 The compatibility of the powder with foam depends on the powder's chemical content. The test described in Annex A may allow a determination of foam/powder compatibility to be made.

WARNING — It is important that under normal conditions of use the various materials and additives used to produce powders be generally recognized as being non-toxic to humans. In some countries there may be a legal obligation to disclose to designated authorities the complete chemical content, and any proposed changes of chemical content, with documented details of non-toxicity.

WARNING — The mixing of different types of powders (e.g. ABC and BC) consisting of certain compounds (e.g. $\text{NH}_4\text{H}_2\text{PO}_4$, NaHCO_3 or CaCO_3) and/or the mixing of these compounds as raw materials into one powder may result in caking, and the production of gas which will increase pressure in the container to an unsafe level. Such increases in pressure have been known to cause containers to rupture, and to cause bodily injury and damage.

WARNING — Recovered powder may have been previously contaminated, and may have absorbed moisture. If it is then recycled, the powder may eventually become lumpy and interrupt the flow of powder when used on a fire.

5.5 Toxicity

It is important that, under normal conditions of use, the various materials and additives used to produce extinguishing powders shall be generally recognized as being non-toxic to humans.

6 Fire test performance

The fire performance of extinguishing powders shall be evaluated following the procedures given in ISO 7165.

6.1 Class A

When tested using the method specified in 13.3.1.1, extinguishing powders claimed by the manufacturer to be suitable for class A fires shall comply with ISO 7165 for one of the minimum class A ratings, specified therein.

6.2 Class B

When tested using the method specified in 13.3.1.2, extinguishing powders claimed by the manufacturer to be suitable for class B fires shall comply with ISO 7165 for one of the minimum class B ratings, specified therein.

6.3 Class C

Extinguishing powders claimed by the manufacturer to be suitable for class C fires shall comply with 6.2.

NOTE There are no fire test requirements for the performance of extinguishing powders against class C fires included in this International Standard. Suitability for use against class C may be claimed for class B or class AB extinguishing powders only.

6.4 Class D

When tested using the method specified in 13.3.1.3, extinguishing powders claimed by the manufacturer to be suitable for class D fires shall comply with ISO 7165.

Extinguishing powders suitable for class D fires are typically not suitable for use on fires of other classes. Specialized media and applicators are typically used.

7 Fluidity testing

When tested using the method specified in 13.4, extinguishing powders shall not exceed an average flow time of 8 s taken as an average of 20 single measurements.

8 Resistance to caking and lumping

Any lumps formed shall not be retained on the 425 μm sieve when the powder is tested in accordance with 13.5.

9 Water repellence

There shall be no complete absorption of the water droplets when the powder is tested in accordance with 13.6.

10 Moisture content

The moisture content shall not exceed a mass fraction of 0,25 % when determined in accordance with 13.7.

NOTE 1 An alternative method is to analyse the moisture by use of an infrared moisture meter which has been adjusted to provide results equal to the method described in 13.7.

NOTE 2 A second alternative testing method is described in Annex D.

11 Electrical insulation value

The powder shall have a dielectric strength of not less than 5 kV, when measured using the method specified in 13.8.

This requirement shall not apply to class D powders.

12 Moisture absorbance

The rate of weight increase of a saturated dry powder agent attained by exposing it to an environment with a temperature of 30 °C and 60 % relative humidity for 48 h shall be less than 2 % upon exposure to an environment with a temperature of 30 °C and 80 % relative humidity for 48 h when tested in accordance with 13.9.

13 Test methods

13.1 Bulk density

13.1.1 Apparatus

13.1.1.1 250 ml stoppered glass measuring cylinder, conforming to ISO 4788, having an approximate height of 320 mm and an approximate internal diameter of 40 mm.

13.1.1.2 Scale, accurate to 0,001 g.

NOTE 1 See 5.2.

13.1.2 Procedure

Place $100 \text{ g} \pm 0,1 \text{ g}$ of the powder in a clean, dry, 250 ml stoppered glass measuring cylinder, conforming to ISO 4788, having an approximate height of 320 mm and an approximate internal diameter of 40 mm. Secure the stopper in the cylinder. Rotate the cylinder end over end for ten complete revolutions, at approximately one revolution every 2 s. Immediately after the ten revolutions have been completed, set the cylinder upright on a level surface and allow the powder to settle for 180 s. Read off the volume occupied by the powder. Calculate the bulk density, ρ_b , from the following equation:

$$\rho = \frac{m}{V}$$

where

m is the mass of the powder (i.e. 100 g);

V is the volume occupied by the powder.

NOTE 2 Electrostatic phenomena can cause difficulty in testing powders containing stearates. The problem is reduced by prior testing of a siliconized powder.

NOTE 3 After long-term storage, the bulk density can increase.

13.2 Sieve analysis

13.2.1 General

The two methods specified below (Method 1 and Method 2) can give slightly differing results.

NOTE 1 See 5.3.

13.2.2 Method 1

It is recommended to use sieve balls or –cubes on every deck when applying the rotap-sieve method.

13.2.2.1 Apparatus

The apparatus shall comprise the following items:

13.2.2.1.1 Nest of sieves, having a nominal diameter of 200 mm and nominal sizes of $125 \mu\text{m}$, $63 \mu\text{m}$ and $40 \mu\text{m}$, conforming to ISO 3310-1, a lid and a collecting pan with the $125 \mu\text{m}$ sieve as the top sieve with the lid placed on top and the $40 \mu\text{m}$ sieve as the bottom sieve with the collecting pan placed underneath.

13.2.2.1.2 Sieve-shaking device, capable of moving the nest in a horizontal ellipse with an impact from the bottom to the top of the nest at every ninth pass.

13.2.2.2 Procedure

Accurately weigh to $\pm 0,02 \text{ g}$ approximately 20 g of the powder into the top sieve. Assemble on the shaking device and shake for 10 min. Weigh the quantity of powder retained on each sieve and report as cumulative percentage of the original sample mass retained.

13.2.3 Method 2

13.2.3.1 Apparatus

The apparatus shall comprise the following items:

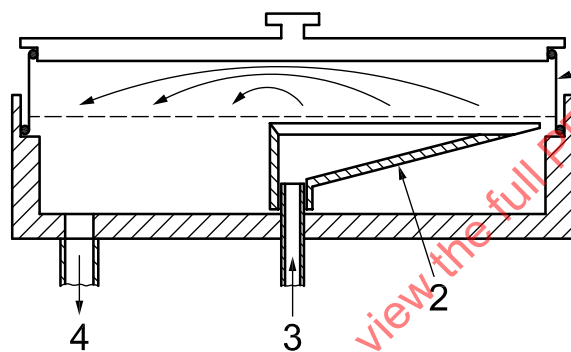
13.2.3.1.1 Three sieves, as described in 13.2.2.1.1.

13.2.3.1.2 Air-jet sieving device¹⁾, which provides an air flow from above to below the sieve with a reverse air-jet from a rotating arm beneath the sieve (see Figure 1).

13.2.3.2 Procedure

Carry out three tests using the 125 μm , 63 μm and the 40 μm sieves in turn.

Follow the air-jet sieving device manufacturer's instructions. Use a 20 g sample of powder and sieve for 5 min. Report as percentage retained on each sieve.



Key

- 1 sieve
- 2 rotating radial arm with top slot
- 3 air flow in
- 4 air flow and fine particles out

Figure 1 — Air-jet sieving device

13.3 Performance methods for test fires

The qualification test of extinguishing powders shall be carried out in accordance with ISO 7165.

13.3.1 Rating suitability for the various classes of fire

13.3.1.1 Class A

Extinguishing powders shall be evaluated in accordance with ISO 7165 for one of the minimum class A ratings, specified therein. The powder charge shall be within the range specified in ISO 7165 for the corresponding class A rating.

NOTE A charge of 3 kg for an extinguisher having a class A rating of 2A is typically used for testing.

1) A suitable apparatus, available commercially, is Model A200 LS manufactured by Alpine AG, 89 Augsburg, P.O. Box 101109, Germany. This information is given for the convenience of the users of this International Standard and does not constitute an endorsement of this apparatus by ISO.

13.3.1.2 Class B

Extinguishing powders shall be evaluated in accordance with ISO 7165 for one of the minimum class B ratings, specified therein. The powder charge shall be within the range specified in ISO 7165 for the corresponding class B rating.

NOTE A charge of 3 kg for an extinguisher having a class B rating of 55B is typically used for testing.

13.3.1.3 Class D

Extinguishing powders shall be evaluated in accordance with ISO 7165 for class D use.

Extinguishing powders suitable for class D fires are typically not suitable for use on fires of other classes. Specialized media and applicators are typically used.

13.4 Fluidity testing

13.4.1 Apparatus

13.4.1.1 **Fluidity test device** (see Figure 2).

13.4.1.2 **Glass container** (see Figure 3) **and reversible bracket**

13.4.1.3 **Scale**, accurate to 0,001 g.

13.4.1.4 **Stopwatch**, scale 0,1 s.

13.4.2 Procedure

Prepare 300 g powder sample, accurate to 0,5 g, and put in the glass container.

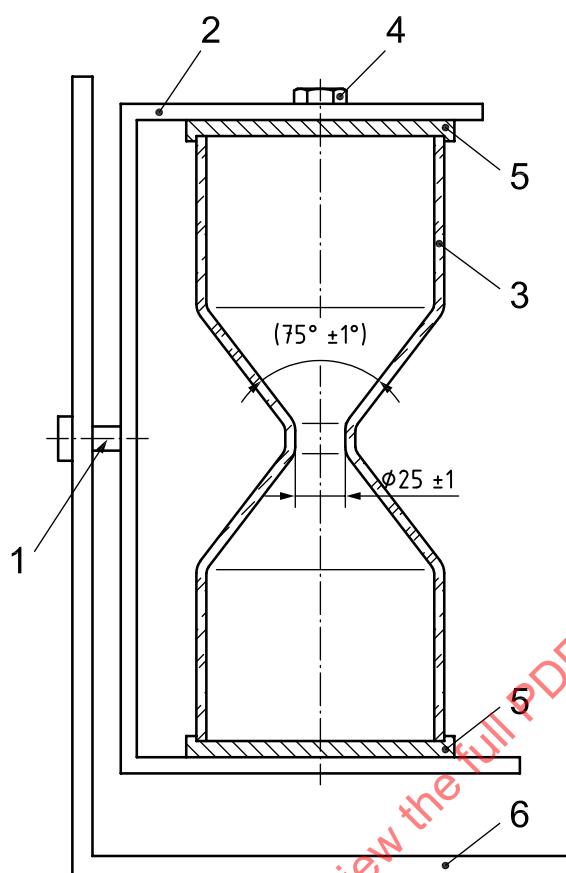
Fix the glass container on the bracket, and turn over the glass container repeatedly for 30 s.

After the sample is suspended in the container in boiling condition, record the time of sample flowing into the middle neck of the container. The test should be repeated 20 times, and 20 values recorded.

13.4.3 Result

The test result is the mean value of the 20 test values.

Dimensions in millimetres



Key

- 1 axis
- 2 bracket
- 3 glass container
- 4 fixing nut
- 5 glass container lid
- 6 bottom

Figure 2 — Fluidity test device

Dimensions in millimetres

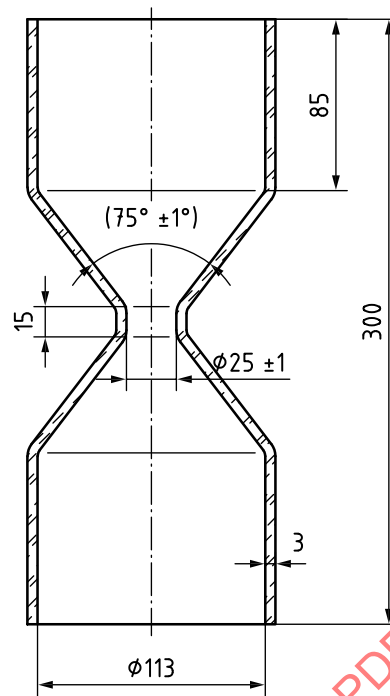


Figure 3 — Structure of glass container

13.5 Test for resistance to caking and lumping

NOTE See Clause 8.

13.5.1 Apparatus

13.5.1.1 Petri dish, approximately 70 mm diameter and a rim height > 10 mm.

13.5.1.2 Pallet knife.

13.5.1.3 Desiccator, with saturated sodium chloride solution giving approximately 75 % relative humidity.

13.5.1.4 Oven, controlled to $(48 \pm 3) ^\circ\text{C}$.

13.5.1.5 425 μm sieve, conforming to ISO 3310-1.

13.5.1.6 Spatula.

13.5.1.7 Clean sheet of paper.

13.5.1.8 Scale, accurate to 0,001 g.

13.5.1.9 Stopwatch, scale 0,1 s.

13.5.2 Procedure

Place an excess of powder in the Petri dish and smooth the surface flush with the rim using the pallet knife. Place the Petri dish in the desiccator at $(20 \pm 5) ^\circ\text{C}$ for (24 ± 1) h, then place the Petri dish in the oven for

(24 ± 1) h. Cover the Petri dish and allow to cool at (20 ± 5) °C for (60 ± 10) min, then remove the cover and overturn the Petri dish on to a clean sheet of paper.

Let the powder slide into sieve in a way that formed lumps are not crushed.

Shake the sieve with revolving movements horizontally to separate the formed lumps from free flowing powder without crushing the lumps.

Using a spatula to lift the lumps, drop them from a height of (200 ± 10) mm onto a clean sheet of paper which is placed on a hard surface. Let the powder slide onto the sieve again and shake with revolving movements horizontally to separate the formed lumps from free flowing powder as described before. No lumps shall be left on the sieve after this step.

13.6 Water repellence test

NOTE See Clause 9.

13.6.1 Apparatus

13.6.1.1 Petri dish.

13.6.1.2 Pallet knife.

13.6.1.3 Desiccator, as described in 13.5.1.3.

13.6.2 Procedure

Place an excess of powder in the Petri dish and smooth the surface flush with the rim using the pallet knife.

On three different areas of the powder surface, place a drop (approximately 0,3 ml) of distilled water. Place the Petri dish in the desiccator for (120 ± 5) min at (20 ± 5) °C. Remove the Petri dish from the desiccator and examine the drops. The drops shall not have been completely absorbed by the powder.

13.7 Test method for moisture content — Absorbance by sulfuric acid

13.7.1 Apparatus

13.7.1.1 Petri dish, as described in 13.5.1.1.

13.7.1.2 Desiccator, with concentrated sulfuric acid.

13.7.1.3 Scale, accurate to 0,001 g.

13.7.2 Procedure

Accurately weigh to $\pm 0,001$ g approximately 20 g of the powder into the Petri dish. Store the uncovered dish for (48 ± 2) h at a temperature of (20 ± 3) °C in the desiccator. Reweigh and calculate weight loss. Report the weight loss as a percentage of original sample weight.

13.8 Electrical insulation test

NOTE See Clause 11.

13.8.1 Apparatus

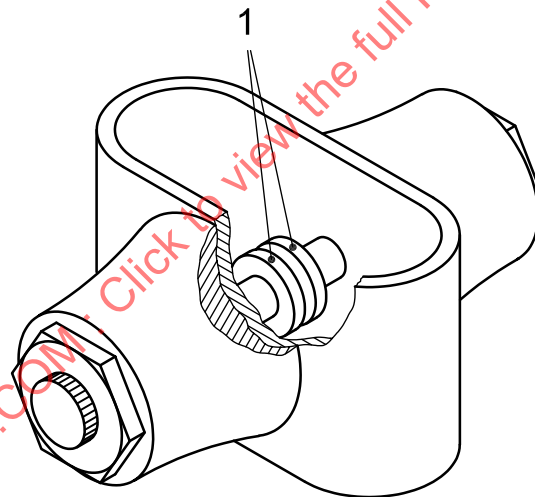
13.8.1.1 Test cup, generally as illustrated in Figure 4, fitted with rigidly mounted electrodes with parallel faces, and with axes in a coincident horizontal line constructed so that no part of it shall be less than 13 mm from any part of the test electrode discs, and made of a material of high dielectric strength resistant to the absorption of moisture.

The top end of the cup shall be not less than 32 mm above the top of the electrodes. The cup shall be designed to permit easy removal of the electrodes for cleaning and polishing, to withstand the test procedure of 13.8.2 and to permit easy adjustment of the gap spacing. The electrodes shall be polished brass discs, 25 mm in diameter and at least 3 mm thick, with square edges. The spacing between the electrodes shall be $2,5 \text{ mm} \pm 0,01 \text{ mm}$.

13.8.1.2 Step-up transformer, energized from a suitable low voltage source with output voltage continuously variable to more than 5 kV.

13.8.2 Procedure

Fill the test cup with extinguishing powder and compact it by dropping the cup 500 times at a frequency of 1 Hz through a height of 15 mm using an impact machine. The impact machine submits the cup to repetitive shock pulses by dropping it from the above given height onto a solid surface. The dropping operation shall be guided and have acceleration approaching free fall. The cup may, if desired, be clamped in a suitable protective casing during this procedure. Using the transformer, apply an electrical potential to the electrodes, increasing the potential at a uniform rate until breakdown occurs as indicated by a continuous discharge across the gap between the electrodes. Record the voltage as the dielectric breakdown strength.



Key

1 brass electrode separated by 2,5 mm gap

Figure 4 — Electrical conductivity test cup

13.9 Moisture absorption testing

13.9.1 Apparatus

13.9.1.1 Petri dish, approximately 70 mm diameter and a rim height $> 10 \text{ mm}$.

13.9.1.2 Pallet knife.

13.9.1.3 Environmental chamber, controlled to $(30 \pm 2) ^\circ\text{C}$ and (60 ± 2) and $(80 \pm 2) \%$ relative humidity.

13.9.1.4 Scale, accurate to 0,001 g.

Alternative:

13.9.1.5 Oven, controlled to $(30 \pm 2) ^\circ\text{C}$.

13.9.1.6 Desiccator, containing $(38,12 \pm 0,1) \%$ of sulfuric acid (H_2SO_4).

13.9.1.7 Desiccator, containing a concentrated aqueous solution of ammonium chloride (NH_4Cl).

13.9.2 Procedure

Weigh accurately 10 g of test sample and place it in a Petri dish. Spread the sample out so that it has a smooth surface and an even layer. Place the sample in an environmental chamber at a temperature of $30 ^\circ\text{C}$ and 60 % relative humidity. Alternatively, place in a desiccator containing 38,12 % of sulphuric acid (H_2SO_4) at a temperature of $30 ^\circ\text{C}$ for 48 h. Upon completion of the 48 h exposure, remove the sample from the environmental chamber and place the Petri dish cover on immediately. Take an accurate weight measurement of the sample (reference weight A).

After the measurement, place the sample in an environmental chamber at a temperature of $30 ^\circ\text{C}$ and 80 % relative humidity. Alternatively, place the test sample in a desiccator containing a saturated ammonium chloride solution at a temperature of $30 ^\circ\text{C}$ for 48 h. Upon completion of the exposure for 48 h, remove the sample from the environmental chamber and place the Petri dish cover on immediately. Take an accurate weight measurement of the sample removed as before (reference weight B).

The rate of weight increase shall be calculated with the mathematical formula below and shall be within the tolerance value specified the regulation.

$$\frac{\text{Weight B}_{(80\% \text{ rel. humidity})} [\text{g}] - \text{Weight A}_{(60\% \text{ rel. humidity})} [\text{g}]}{\text{Weight A}_{(60\% \text{ rel. humidity})} [\text{g}]} = \text{moisture absorption} [\% \text{ w/w}]$$

14 Marking and packaging

Whenever possible, the manufacturer or supplier shall provide, marked on each separate package (or on a label firmly attached to the package), the following information:

- the commercial name of the product followed by the words "Fire extinguishing powder";
- a brief statement, e.g. "Conforms to ISO 7202:2012, suitable for class A, B, C and D fires", to indicate the manufacturer's claim that the product complies with this International Standard and the classes of fire for which the product is suitable;
- the year of manufacture;
- any essential recommendations regarding conditions of storage;
- the name and address of the person or body who accepts to endorse full responsibility of the product's conformity to this International Standard (this may be the manufacturer, distributor or other supplier);
- the warning statement "Ensure compatibility between this product and the equipment in use".

NOTE Extinguishing powders should be packaged in containers which are essentially moisture- and impact-resistant. The supplier should ensure that every consignment is packed in such a way as to preserve its essential characteristics when stored and handled in accordance with the manufacturer's recommendations.

Annex A (informative)

Compatibility between extinguishing powders and foams

WARNING Under some circumstances, incompatibility between extinguishing powders and foams can exist. The user should ensure that any combination of extinguishing powder and foam which may be used does not lead to an unacceptable loss of efficiency caused by an unfavourable interaction of the chosen media, when applied simultaneously or successively.

NOTE A suggested method of evaluation is the following test method for testing the compatibility of powder with foam.

A.1 General

The following small-scale fire test can be used to show whether incompatibility between extinguishing powders and foams may exist.

NOTE The small-scale fire test is described in EN 1568-3:2008, Annex D.

This test is carried out on the foam in question, and then repeated after the fuel has been covered in powder. If the increase in extinction time is equal to or greater than 25 % longer than the result without powder, then the combination of powder and foam may be considered to lead to an unacceptable loss in efficiency.

Likewise, a reduction in burn back time by 25 % or more when powder is used would indicate that the foam and powder are incompatible. (500 ± 1) g powder is weighed into a 180 µm sieve, placed on a sheet of paper or cardboard. The sieve is held over the fuel, and the cardboard or paper removed. The powder is then evenly distributed over the surface of the fuel from a height of (150 ± 10) mm. The fuel is lit not more than 60 s after the powder has been spread over the surface of the fuel.

A.2 Apparatus

A.2.1 Circular fire tray of brass

The apparatus is shown in Figure A.1 with dimensions as follows:

- a) internal diameter at rim (565 ± 5) mm;
- b) height of vertical wall (150 ± 5) mm;
- c) height of conical base (30 ± 5) mm;
- d) thickness of vertical wall (1,2 ± 0,2) mm,

It has a turned over rim, and a drain point with valve at the centre of the conical base.

NOTE The tray has an area of approximately 0,25 m². The fire tray is supported approximately 1 m above the ground on a steel frame with four legs. The tray is normally placed beneath a suitable fume extraction hood which will extract the smoke without interfering with the fire.

A.2.2 Burn-back pot of brass

The apparatus has dimensions as follows:

- a) internal diameter at rim (120 ± 2) mm;
- b) internal depth (80 ± 2) mm;

- c) thickness of wall ($1,2 \pm 0,2$) mm, with a turned over rim, and fitted with four studs at the base to give an overall height of (96 ± 2) mm. A chain fitted to the rim allows the burn-back pot to be lifted using a metal rod.

A.2.3 Foam-making nozzle

The nozzle, shown in Figure A.2, has a nominal flow rate of 5,0 l/min at 7 bar when tested with water. It is fitted with an adjustable collar to allow foam to be ejected from the side of the nozzle and thus vary the foam flow rate through the outlet. The foam flow rate can also be controlled by adjusting the pressure applied to the foam solution.

A.2.4 Fuel

An aliphatic hydrocarbon mixture according to the following specification:

- a) distillation range: 84 °C to 105 °C;
- b) maximum difference between initial and final boiling points: 10 °C;
- c) maximum aromatic content: a mass fraction of 1 %;
- d) density at 15 °C: (700 ± 20) kg/m³.

NOTE 1 The normal value of surface tension of the aliphatic hydrocarbon mixture measured in accordance with ISO 304 at (20 ± 1) °C is 21 mN/m to 22 mN/m.

NOTE 2 Typical fuels meeting this specification are certain solvent fractions sometimes referred to as commercial Heptane.

A.3 Test procedure

A.3.1 Test conditions

Carry out the test under the following conditions:

- a) air temperature (15 ± 5) °C;
- b) fuel temperature ($17,5 \pm 2,5$) °C;
- c) foam solution temperature ($17,5 \pm 2,5$) °C.

A.3.2 Set up

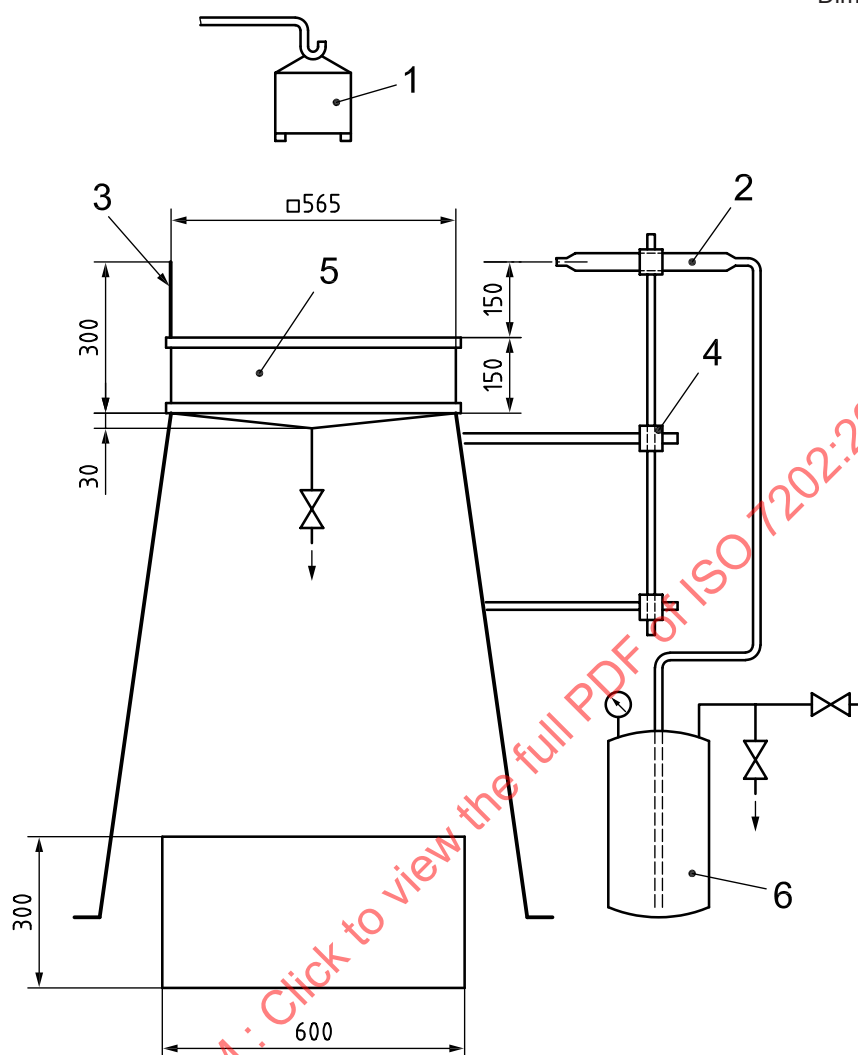
Position the foam nozzle horizontally with the by-pass holes in the adjustable collar facing downwards at a height of (150 ± 5) mm above the rim of the fire tray (see Figure A.1). Prepare the foam solution following the recommendations of the supplier for concentration, maximum premix time, compatibility with test equipment, avoiding contamination by other types of foam, etc. Set the nozzle pressure to 7 bar and the foam flow rate to ($0,75 \pm 0,025$) kg/min by adjusting the collar and, if necessary, reducing the nozzle pressure. It is convenient to collect the foam in a tarred vessel for 6 s and to weigh it to calculate the flow rate. Position the nozzle while keeping it horizontal so that the foam strikes the centre of the fire tray. Shut off the foam discharge. Clean the tray and close the drain valve.

A.3.3 Fire test

Place ($9 \pm 0,1$) l of fuel in the tray, and ($0,3 \pm 0,01$) l of fuel in the burn-back pot. (120 ± 2) s after fuelling ignite the fuel and allow to burn for (60 ± 2) s before starting foam application. Apply foam for (120 ± 2) s to the centre of the tray and record the times from the start of foam application to 90 % control, 99 % control, and complete extinction.

At the end of foam application ignite the fuel in the burn-back pot, and (60 ± 2) s after the end of foam application, lower the pot into the centre of the tray with a metal rod, taking care not to allow foam to enter the pot. Record the time taken from positioning of the burn-back pot to permanent full re-involvement of the fire tray surface in flames as the burn-back time.

Dimensions in millimetres

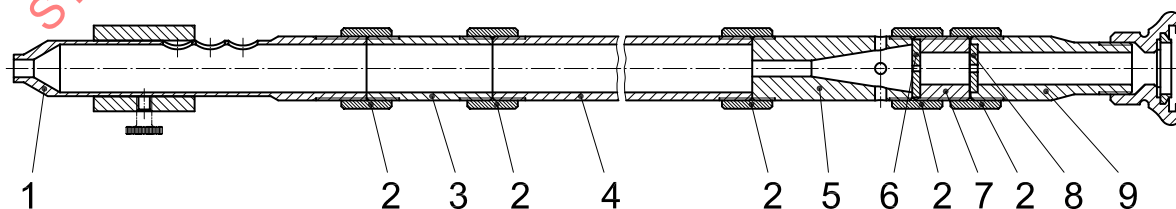


Key

- 1 burn-back pot
- 2 foam nozzle
- 3 backboard (optional)

- 4 adjustable boss
- 5 fire tray
- 6 foam solution

Figure A.1 — Small-scale fire test



Key

- | | |
|---|-------------------------------------|
| 1 nozzle with foam diverter and sleeve (see Figure A.3) | 6 orifice plate G (see Figure A.8) |
| 2 coupling (see Figure A.4) | 7 spacing piece (see Figure A.9) |
| 3 mixing tube (see Figure A.5) | 8 orifice plate P (see Figure A.10) |
| 4 stabilizing tube (see Figure A.6) | 9 inlet (see Figure A.11) |
| 5 Venturi (see Figure A.7) | |

Figure A.2 — Foam-making nozzle for small-scale fire test

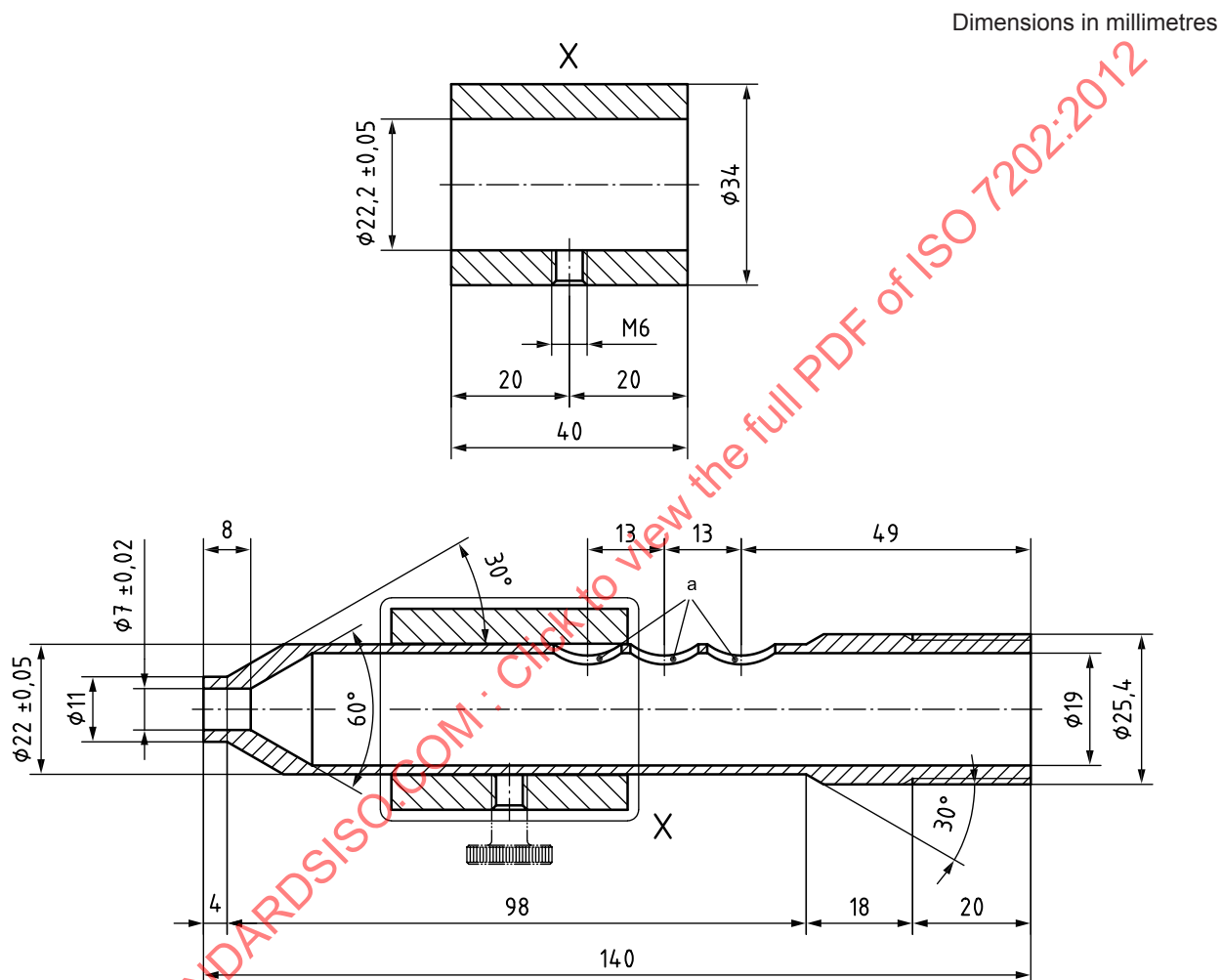
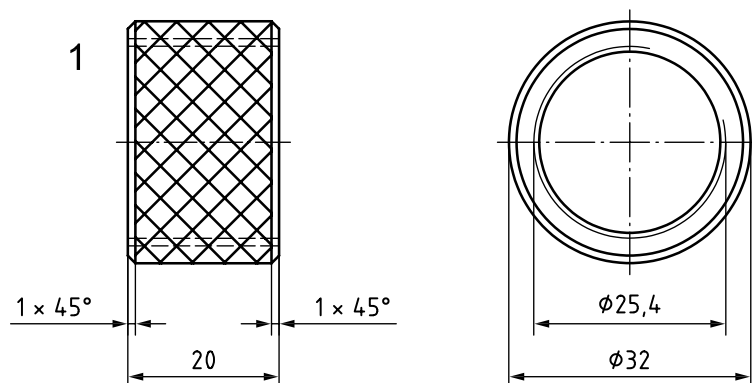


Figure A.3 — Item 1 — Nozzle with foam diverter and sleeve

Dimensions in millimetres



Key

1 coarse knurled

Figure A.4 — Item 2 — Coupling

Dimensions in millimetres

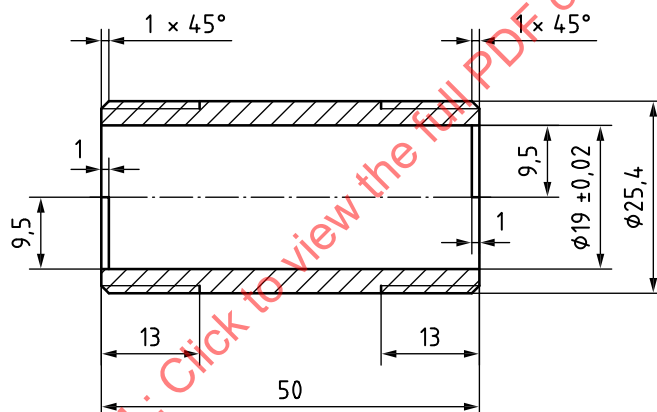


Figure A.5 — Item 3 — Mixing tube

Dimensions in millimetres

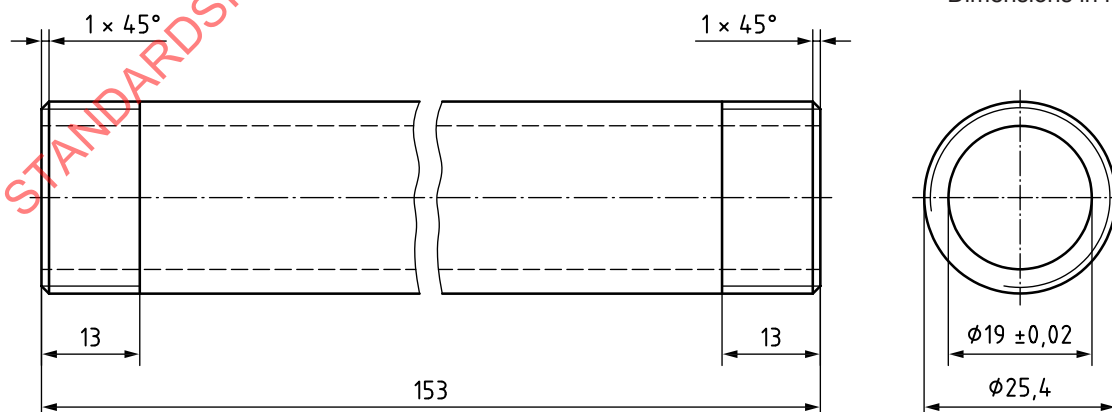


Figure A.6 — Item 4 — Stabilizing tube

