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Fire protection — Fire extinguishing media — Powder

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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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 7202 was prepared by Technical Committee ISO/TC 21, *Equipment for fire protection and fire fighting*.

Users should note that all International Standards undergo revision from time to time and that any reference made herein to any other International Standard implies its latest edition, unless otherwise stated.

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Fire protection — Fire extinguishing media — Powder

0 Introduction

0.1 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.

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

0.3 Annexes A and B 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.

1 Scope and field of application

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 and C. Requirements are also given for the information and data to be declared by the manufacturer.

Extinguishing powders specifically designed for the control and extinction of class D (metal) fires do not fall within the scope of this International Standard.

NOTE — The classification of fires is given in ISO 3941.

2 References

ISO 2591, *Test sieving*.

ISO 3130, *Wood — Determination of moisture content for physical and mechanical tests*.

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

ISO 3941, *Classification of fires*.

ISO 4788, *Laboratory glassware — Graduated measuring cylinders*.

3 Definitions

For the purposes of this International Standard, the following definitions apply.

3.1 extinguishing powder: An 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 — In North American and some other countries, the term “dry powder” is 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.

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 which form glowing embers), class B and class C fires.

3.2 batch: For the purposes of acceptance and verification testing by an inspecting authority, a batch of powder is a single charge of material in the processing equipment that has been made homogeneous by subjection to the same unit and physical processing.

3.3 lot: A lot contains 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.

3.4 characterization statement: Information and data declared by the manufacturer regarding the chemical and physical properties of the powder.

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.

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.

For relatively small quantities, a 25 mm metal sampling tube shall be inserted to the full depth of the extinguishing powder container at no fewer than five locations.

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

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.

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 12.1. The bulk density shall be within $\pm 0,10$ g/ml of the value declared by the manufacturer.

5.3 Sieve analysis

When tested using the method specified in 12.2.1 or 12.2.2, the quantity retained on the 40 μm sieve and on the 63 μm sieve shall not differ from the declared value by more than ± 10 % 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

The declared chemical content of the extinguishing powder need not include constituents making up less than 10 % by mass of the extinguishing powder. However, the chemical content declared shall cover more than 75 % (m/m) of the total composition of the extinguishing powder. The allowed tolerance shall not exceed ± 10 % of the declared value for constituents comprising less than 50 % (m/m) of the extinguishing powder, and ± 5 % of the declared value for a constituent comprising more than 50 % (m/m) of the extinguishing powder.

NOTE — For example, a constituent with a declared value of 40 % will have tolerance limits of 36 % and 44 % and a constituent with a declared value of 80 % will have tolerance limits of 76 % and 84 %.

5.5 Toxicity

It is most 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

6.1 Class A

Extinguishing powders claimed by the manufacturer to be suitable for class A fires shall extinguish the test fire described in 12.3.2 in two out of a set of three tests.

6.2 Class B

Extinguishing powders claimed by the manufacturer to be suitable for class B fires shall extinguish the test fire described in 12.3.3 in two out of a set of three tests.

6.3 Class C

Any powder meeting the requirements of 6.2 shall, in addition, be deemed to possess the potential for achieving an adequate performance on class C fires.

7 Discharge performance

When discharged from an extinguisher as described in 12.4 not less than 85 % of the powder shall be discharged.

8 Resistance to caking and lumping

The resistance of the powder to caking and lumping shall be determined using the method specified in 12.5. The penetration of the needle shall be more than 15 mm.

9 Water repellency

There shall be no visually observable absorption of the water droplets by the powder when it is tested using the method specified in 12.6.

10 Resistance to extreme low temperature

When tested using the method specified in 12.7, all the powder shall fall to the stoppered end of the test tube within 5 s.

11 Electrical insulation value

The powder shall have a dielectric strength of not less than 5 kV, when measured using the method specified in 12.8.

12 Test methods

12.1 Bulk density (see 5.2)

Place $100 \pm 0,1$ 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 1 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:

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

where

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

V is the volume occupied by the powder.

NOTES

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

2 After long-term storage the bulk density may increase.

12.2 Sieve analysis (see 5.3)

NOTE — The two methods specified in 12.2.1 and 12.2.2 may give slightly differing results.

12.2.1 Method 1

12.2.1.1 Apparatus

The apparatus shall comprise the following items:

- a) **Nest of sieves**, having a nominal diameter of 200 mm and nominal sizes of 125 μm , 63 μm and 40 μm , conforming to ISO 3310-1, a lid and a collecting pan with the 125 μm sieve as the top sieve with the lid placed on top and the 40 μm sieve as the bottom sieve with the collecting pan placed underneath.
- b) **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.

12.2.1.2 Procedure

Accurately weigh to $\pm 0,02$ 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.

12.2.2 Method 2

12.2.2.1 Apparatus

The apparatus shall comprise the following items:

- a) **Three sieves**, as described in 12.2.1.1.
- b) **Air-jet sieving device**¹⁾, 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).

12.2.2.2 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.

12.3 Qualification tests

12.3.1 General

Carry out the tests of 12.3.2 and 12.3.3 at an ambient temperature of not less than 0 °C and not more than 30 °C using 3 kg of the extinguishing powder charged into an extinguisher having a nominal capacity of 3 kg, following the procedure recommended by the extinguisher manufacturer. The extinguisher shall conform to an appropriate national standard.²⁾

Use extinguishers of identical design when testing the same powder for class A (12.3.2) and class B (12.3.3) performance.

Before testing, store extinguishers in the normal operating position for not less than 24 h at a temperature of 20 ± 5 °C and maintain at this temperature until tested.

The operator of the extinguisher shall be protected against heat. A wide-brimmed hat, with a heat-resistant face-guard, a long coat and gloves of heat-resistant cloth are recommended.

CAUTION — Attention is drawn to the necessity for taking precautions to safeguard the health of personnel conducting the tests against the risk of fire and inhalation of smoke and any toxic products of combustion.

12.3.2 Class A fire test (see 6.1)

12.3.2.1 Location and ambient conditions

Carry out the test indoors in a test chamber, sheltered from draughts, which does not impede the natural development of the test fire or effective fire fighting.

1) A suitable apparatus, available commercially, is Model A200 LS manufactured by Alpine AG, 89 Augsburg, P.O. Box 101109, Germany, F. R. 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.

2) A future International Standard will deal with portable fire extinguishers.

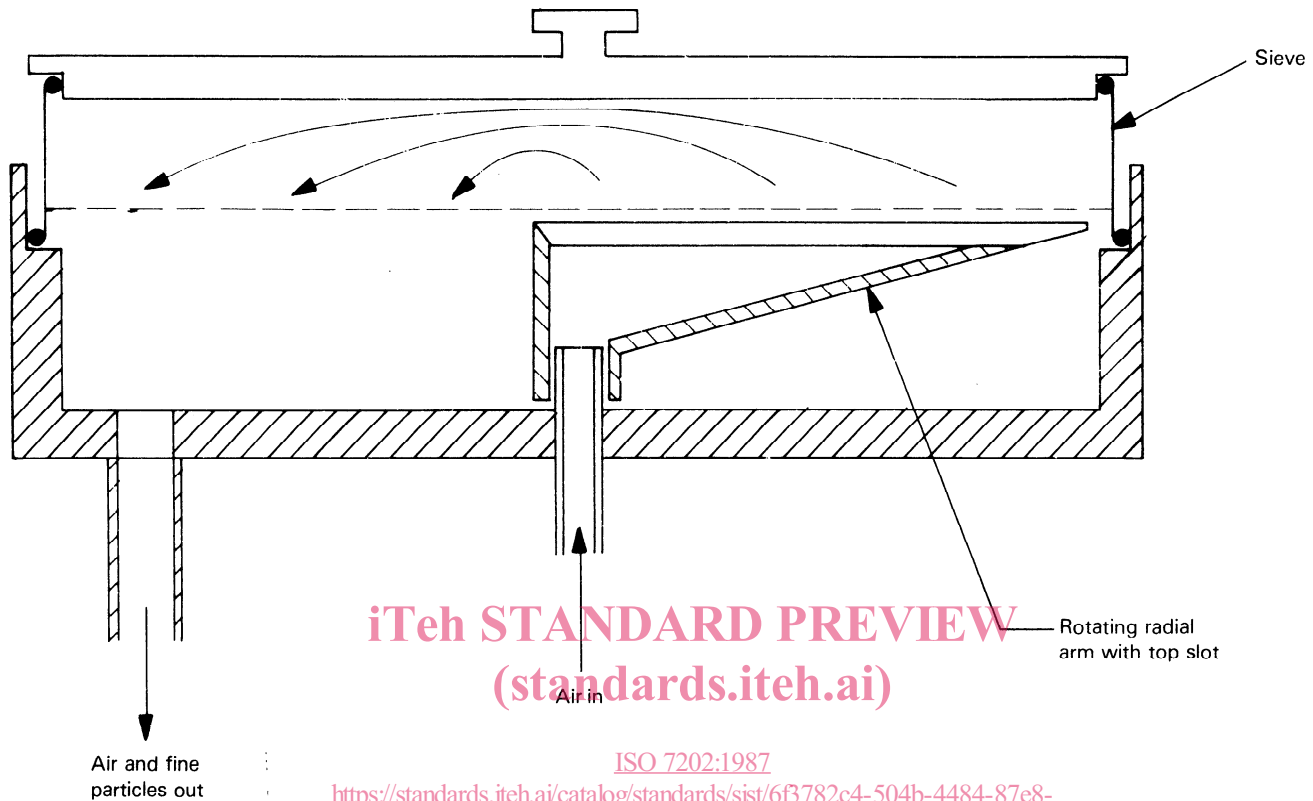


Figure 1 — Air-jet sieving device

12.3.2.2 Test fire construction

The test fire shall consist of a crib of wooden sticks constructed on two 63 mm × 38 mm angle irons, or other similar and appropriate supports, placed on concrete blocks, so that the height of the supports above the floor is 405 mm. The sticks forming the outside edges of the crib shall be stapled or nailed together to provide strength.

Use wood sticks of species, sub-species or hybrids of the genera *Pinus*, *Picea*, or *Abies*, or the species *Cryptomeria Japonica* in the form of sticks of square cross-section with sides of $38 \pm \frac{3}{4}$ mm, 651 ± 10 mm long, with a moisture content of 9 % to 13 % (m/m).

Stack the wooden sticks in 13 layers with 6 sticks in each layer. Stack each layer of sticks at right angles to the layer below.

Stack individual sticks on each layer with even spacing and in the form of a square with sides equal to the stick length (see figure 2).

NOTES

1 *Pinus Silvestris* will be found to meet specification a) requirements conveniently in many areas. In North America, mixed spruce-pine-fir lumber which may include *Picea Glauca*, *Picea Engelmanni*, *Pinus Contorta* and *Abies Lasiocarpa*, or *Pinus Banksiana*, *Picea Rubens*, *Picea Marina* and *Abies Balsamea* depending on geographical location may be used. *Cryptomeria Japonica* may be preferred in parts of Asia.

2 Determine the moisture content of the sticks using commercially available instruments which measure electrical conductivity between needle probes pushed into the sticks. Some variation in reading may be obtained due to structural variation of the timber and the direction of the grain. In cases of doubt, calibrate the instrument by determination of moisture content in accordance with ISO 3130.

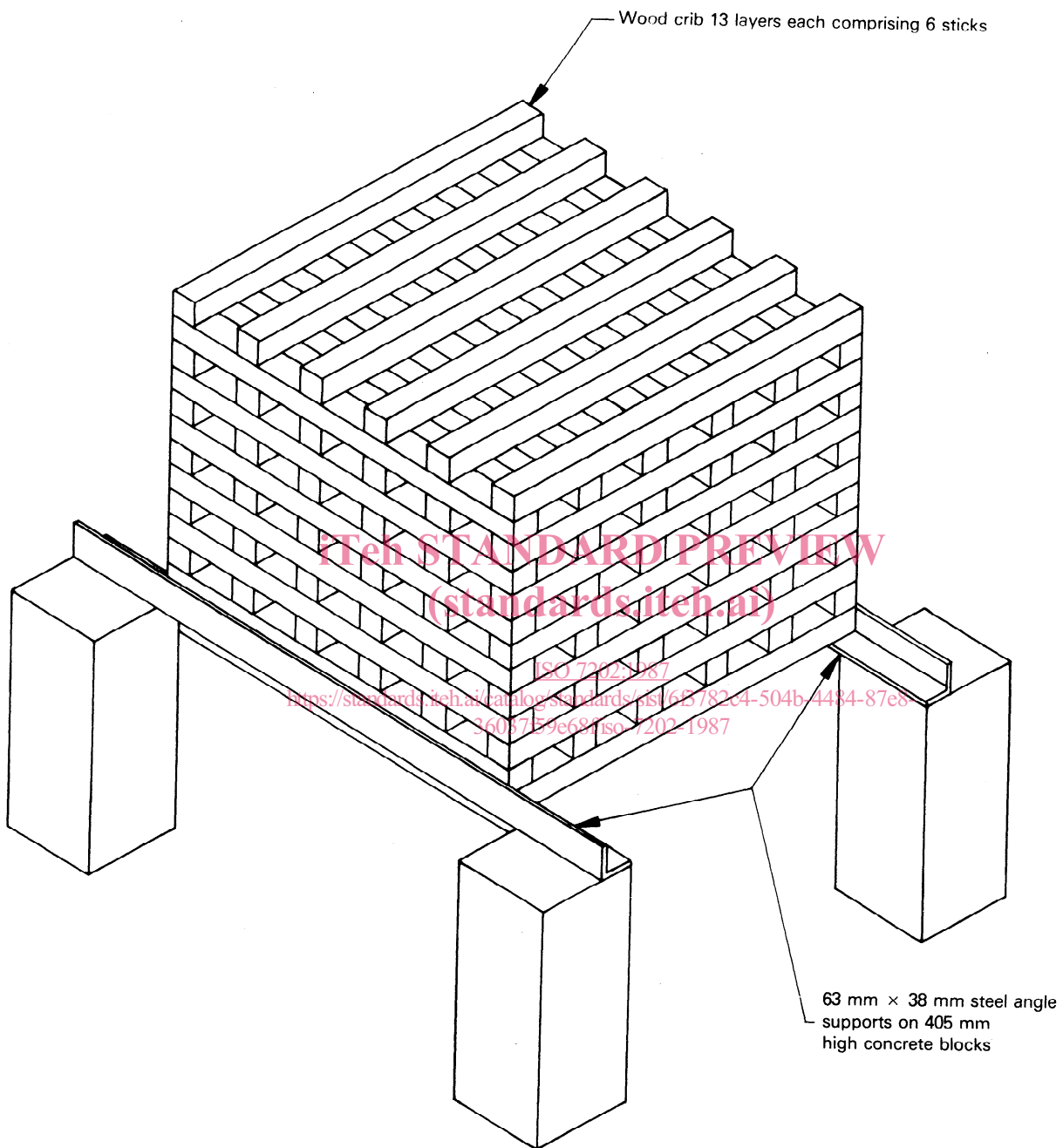


Figure 2 — Typical set-up for class A test fire