
**Fire fighting — Portable fire
extinguishers — Performance and
construction**

*Lutte contre l'incendie — Extincteurs portatifs — Performances et
construction*

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ISO 7165:1999

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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 734 10 79
E-mail copyright@iso.ch
Web www.iso.ch

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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 3.

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 International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 7165 was prepared by Technical Committee ISO/TC 21, *Equipment for fire protection and fire fighting*, Subcommittee SC 2, *Manually transportable fire extinguishers*.

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Fire fighting — Portable fire extinguishers — Performance and construction

1 Scope

This International Standard specifies the principal requirements intended to ensure the safety, reliability and performance of portable fire extinguishers.

It is applicable to a fully charged extinguisher having a maximum mass of 20 kg.

NOTE In some cases, extinguishers having a total mass of up to 25 kg when fully charged may be approved, subject to local acceptance.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 3130:1975, *Wood — Determination of moisture content for physical and mechanical tests.*

ISO 3941:1977, *Classification of fires.*

ISO 4892-2:1994, *Plastics — Methods of exposure to laboratory light sources — Part 2: Xenon-arc sources.*

ISO 5923:1989, *Fire protection — Fire extinguishing media — Carbon dioxide.*

ISO 7202:1987, *Fire protection — Fire extinguishing media — Powder.*

ISO 7203 (all parts), *Fire extinguishing media — Foam concentrates.*

ISO 9227:1990, *Corrosion tests in artificial atmospheres — Salt spray tests.*

ISO 14520 (all parts), *Gaseous fire-extinguishing systems — Physical properties and system design.*

3 Terms and definitions

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

3.1

Classification of fires

[ISO 3941:1977]

3.1.1

Class A

fires involving solid materials, usually of an organic nature, in which combustion normally takes place with the formation of glowing embers

3.1.2

Class B

fires involving liquids or liquefiable solids

3.1.3

Class C

fires involving gases

3.1.4

Class D

fires involving metals

3.2

portable extinguisher

portable appliance containing an extinguishing medium which may be discharged and directed onto a fire by the action of internal pressure; discharge may be achieved by:

- stored pressure (constant pressurization of the extinguishing media container);
- cartridge operated [pressurization at the time of use by the release of a pressurizing gas stored in a separate high pressure container (cartridge)]

3.3

extinguishing medium

substance contained in the extinguisher that causes extinguishment

3.4

charge of extinguisher

mass or volume of the extinguishing medium contained in the extinguisher expressed in volume (litres) for water-based extinguishers and in mass (kilograms) for other extinguishers

3.5

service pressure

p_s

equilibrium pressure developed in a normally charged and pressurized extinguisher conditioned at 20 °C for at least 18 h

3.6

maximum service pressure

p_{ms}

equilibrium pressure developed in a normally charged and pressurized extinguisher which is conditioned at 60 °C for at least 18 h

3.7

complete discharge

point in the discharge of an extinguisher when the internal pressure has equalized with the external pressure, with the valve control being kept fully open

3.8

effective discharge time

time from the commencement of discharge of the extinguishing medium at the nozzle to the gas point of the discharge stream with the control valve fully open

3.9**rechargeable extinguisher**

extinguisher designed to be recharged after use

3.10**disposable extinguisher****non-rechargeable extinguisher**

extinguisher designed not to be recharged in the field or at the factory, but intended to be discarded after use

3.11**fill density**

mass in kilograms of extinguishing medium per litre of container volume as fitted for use, complete with valve and internal fittings

3.12**bulk range**

range of the extinguisher when 50 % of its media has been expelled

3.13**batch**

group of the same products made on the same production line using the same lot of materials during one production shift

3.14**gas point**

point where the medium discharge changes from predominately liquid medium to predominately expellant gas

3.15**propellant**

non-flammable compressed gas used to expel the extinguishing medium

3.16**clean agent**

electronically non-conductive gaseous or vaporizing liquid fire extinguishant that does not leave a residue upon evaporation

3.17**lowest observable adverse effect level****LOAEL**

lowest concentration at which an adverse physiological or toxicological effect has been observed

4 Classification of extinguishers

Extinguishers shall be classified by the type of extinguishing medium which they contain.

At present, the main classes of extinguishers are:

- a) water-based;
- b) powder;
- c) carbon dioxide;
- d) clean agents.

These classes of extinguishers may be further sub-divided, for example water-based extinguishers may contain pure water or water with additives such as wetting agents, viscosity-increasing agents, flame-retardant, or foaming agents, etc.

Powders may be of the "BC" or "ABC" types, or may be specially prepared for Class D (metals) fires.

NOTE In some countries, the manufacture and use of clean agents are regulated by the Montreal Protocol or by national regulations.

5 Extinguishing media, propellants and filling requirements

5.1 Extinguishing media

5.1.1 Carbon dioxide

Carbon dioxide used in extinguishers shall comply with ISO 5923.

5.1.2 Clean agents

Clean agents used in extinguishers shall comply with the appropriate part of ISO 14520.

NOTE In some countries, the manufacture and use of clean agents is regulated by the Montreal Protocol or by national regulations.

5.1.3 Powders

Powders used in extinguishers shall comply with ISO 7202.

EXCEPTION: Powders for use on Class D fires.

5.1.4 Foam concentrates

Foam concentrates used in extinguishers shall comply with the appropriate part of ISO 7203.

NOTE There is no ISO Standard covering non-foaming additives sometimes added to water to produce antifreeze, wetting or other special characteristics. However, such extinguishers are included in the category of water-base extinguishers.

5.2 Propellants

The propellants for stored pressure and cartridge-operated extinguishers shall be air, argon, carbon dioxide, helium, or nitrogen or mixtures of these gases having a maximum dew-point of – 55 °C.

EXCEPTION: Propellant for stored-pressure water-based extinguishers need not meet the above dew-point.

5.3 Filling requirements

5.3.1 Fill density

The maximum fill density for carbon-dioxide extinguishers shall not exceed 0,75 kg/l. The fill density for clean agent fire extinguishers shall not exceed the values given in the appropriate part of ISO 14520.

NOTE 1 The above fill densities may be subject to national pressure vessel regulations.

5.3.2 Filling tolerance

The actual charge of an extinguisher shall be the nominal charge within the following limits:

- a) water-based extinguisher: $_{-5}^0$ % by volume;

- b) powder extinguishers:
- ≤ 1 kg nominal charge ± 5 % by mass;
 - > 1 kg but < 3 kg nominal charge ± 3 % by mass;
 - ≥ 3 kg nominal charge ± 2 % by mass;
- c) clean-agent extinguishers: $_{-5}^0$ % by mass;
- d) carbon-dioxide extinguishers: $_{-5}^0$ % by mass.

5.3.3 Charges

The following are the recommended charges for fire extinguishers:

- water-based (l): 2, 3, 6, 9;
- powder (kg): 1, 2, 3, 4, 6, 9, 12;
- CO₂ (kg): 2,5;
- clean agent (kg): 1, 2, 4, 6.

6 Pressure requirements for low-pressure extinguishers

6.1 Test pressure (p_t)

The test pressure (p_t) for low-pressure extinguishers shall be $1,43 \times p_{ms}$ but in no case less than 2 MPa¹⁾ (20 bar).
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6.2 Minimum burst pressure (p_b)

The minimum burst pressure (p_b) for low-pressure extinguishers is $2,7 \times p_{ms}$ but in no case less than 5,5 MPa (55 bar).
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7 General operating performance requirements

7.1 Operating temperatures

Extinguishers shall be capable of operating reliably within one of the following temperature ranges:

- + 5 °C to + 55 °C;
- 0 °C to + 55 °C;
- 10 °C to + 55 °C;
- 20 °C to + 55 °C;
- 30 °C to + 55 °C;
- 40 °C to + 55 °C;
- 55 °C to + 55 °C;

NOTE The temperature range selected from the above ranges shall be marked on the fire extinguisher (see 10.2.1.5).

1) 1 bar = 100 kPa = 0,1 MPa; 1 Pa = 1 N/m².

7.2 Minimum effective discharge time and bulk range of discharge

7.2.1 Class A rated extinguishers

The minimum effective discharge time of extinguishers with a 1A rating shall be no less than 8 s. Extinguishers with ratings of 2A or higher shall have a minimum discharge time of 13 s.

7.2.2 Class B rated extinguishers

The minimum effective discharge time of extinguishers with a Class B rating shall be no less than the appropriate value given in Table 1.

Table 1 — Minimum effective discharge time of Class B rated extinguishers

Classification	Minimum discharge time s
8B ^a	—
13B ^a	—
21B	8
34B	8
55B (70B)	9
89B	9
(113B)	12
144B	15
(183B)	15
233B	15

^a This fire size is for a low-temperature fire test only.

7.2.3 Bulk range

7.2.3.1 Requirements

The minimum bulk range of extinguishers with a Class A rating shall be no less than 3 m when determined in accordance with 7.2.3.2.

7.2.3.2 Test method

Carry out the test indoors using lighting which gives the best possible illumination of the extinguisher media during discharge. Use a black background marked to indicate the horizontal distance. Condition the extinguisher for no less than 18 h at a temperature of (20 ± 5) °C and place it in normal operating position with the discharge nozzle held horizontally 1 m above the floor. Fully discharge the extinguisher with the control valve fully open within 5 min of conditioning. Record the bulk range of the extinguisher as the range at the time corresponding to 50 % of the effective discharge time.

NOTE Where the range of effective discharge is difficult to determine visually, supplementary means, such as collection boxes for powders and condensing plates for liquefied gases may also be used.

7.3 Resistance to temperature changes

7.3.1 Requirements

Portable extinguishers shall be able to operate at temperatures within one of the temperature ranges given in 7.1 as indicated by the manufacturer and comply with the following requirements after being subjected to the conditions given in 7.3.2:

- a) shall operate as intended;
- b) commence discharge within 5 s of the opening the control valve;
- c) not retain more than 10 % of initial charge within the extinguisher following complete discharge.

7.3.2 Test method

Subject four extinguishers to the temperature cycles given in Table 2, two extinguishers to each cycle.

Table 2 — Temperature cycles

Duration h	Cycle 1	Cycle 2
24 ± 1	Store at minimum ^a stated temperature (−2 °C)	Store at (55 ± 2) °C
24 ± 1	Store at (20 ± 5) °C	Store at (20 ± 5) °C
24 ± 1	Store at (55 ± 2) °C	Store at minimum ^a stated temperature (−2 °C)
The storage temperatures refer to the ambient temperature within the conditioning chamber. A liquid bath shall not be used.		
^a See 7.1.		

Operate the extinguisher within 1 min of its removal from the conditioning chamber.

The extinguisher is to be held in its normal working position and shall remain immobile for the duration of the test.

NOTE For cartridge extinguishers the cartridge shall be pierced and the pressure allowed to build for 6 s before opening the control valve.

7.4 Retention of charge

7.4.1 Routine checks

7.4.1.1 Extinguishers and gas cartridges shall be designed so as to permit their charge to be checked at regular intervals when they are installed.

7.4.1.2 The charge of the following shall be measured by weighing:

- a) all types of gas cartridges for extinguishers;
- b) carbon-dioxide extinguishers;
- c) stored-pressure extinguishers of various types including some clean agents in which a mass loss of 1 % of total mass is accompanied by a pressure loss of not more than 10 % of the service pressure at (20 ± 2) °C.

7.4.1.3 The charge of stored-pressure extinguishers of types not covered in 7.4.1.2 b) and c) shall be checked by direct measurement of internal pressure at (20 ± 2) °C. For this purpose, the extinguisher shall be fitted with a built-in pressure-indicating device which can be checked for satisfactory operation.

A connection to which an independent pressure-measuring appliance can be attached may be used as the means for checking the built-in pressure-indicating device; in this case, a connection of this type shall be equipped with a pressure-retaining cap.

7.4.2 Retention of charge following partial discharge

7.4.2.1 Requirements

Fire extinguishers shall be fitted with a control valve allowing the discharge of the extinguishing medium to be interrupted at any time.

The extinguisher shall be adequately resistant to leakage and the second pressure (or weight of contents as appropriate) shall be no less than 75 % of the first, after interruption of the discharge as determined in 7.4.2.2.

7.4.2.2 Test method

Discharge a fully charged extinguisher for a period equal to half the time for total discharge and the control valve shall then be closed. Measure the internal pressure (or weight of contents as appropriate) and after a further 5 min with the valve having remained closed, measure the pressure (or weight of contents as appropriate) again.

7.4.3 Long-term leakage tests

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7.4.3.1 Requirements for stored-pressure extinguishers

Stored-pressure extinguishers covered by 7.4.1.3 shall not leak at a rate exceeding 5 % per annum of service pressure.

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7.4.3.2 Requirements for gas cartridges and extinguishers checked by mass

Long term leakage requirements are as follows:

- stored-pressure extinguishers without a pressure gauge shall not leak at a rate exceeding 5 % of its contents per annum or 50 g per annum, whichever is less [see 7.4.1.2 c)];
- gas cartridges shall not leak at a rate exceeding 5 % of its contents per annum or 7 g per annum, whichever is less;
- carbon-dioxide extinguishers shall not leak at a rate exceeding 5 % of its contents per annum.

7.4.3.3 Test method

Check six samples for leakage after 30 d, 90 d, and 120 d. Any loss in pressure or contents at constant ambient temperature is an indication of a leak.

7.5 Mechanical resistance

7.5.1 Resistance to impact

NOTE This test is intended to prove the resistance of the extinguisher, and particularly that of the head and fittings, to damage from falling objects or from impact with fixed surfaces.

7.5.1.1 Requirements

The extinguisher shall not release pressure in a potentially dangerous manner when tested in accordance with 7.5.1.2.

7.5.1.2 Test method

Condition an extinguisher, correctly charged and equipped with all the fittings which are subject to internal pressure in normal operation, for 18 h to the minimum working temperature (see 7.1) with a tolerance of ± 5 °C, and maintain it at this temperature during the impact test described below.

For the purpose of this test, an anti-freeze agent may be added to prevent freezing of the contents of water-based extinguishers, and water or antifreeze may be utilized in carbon-dioxide extinguishers for safety reasons.

If the extinguisher is of the gas cartridge type, fit the charged cartridge and activate the extinguisher with the control valve shut, so as to keep the extinguisher under pressure.

Conduct the impact test as follows.

Mount a steel cylindrical hammer, of 75 mm diameter and total mass of 4,0 kg with flat faces, vertically in loose guides so that it can drop freely through a height h (minimum height 300 mm) given by:

$$h = \frac{m}{20} \text{ and } h \geq 0,3$$

where

h is the height, expressed in metres;

m is the total mass of extinguisher, expressed in kilograms.

The extinguisher shall be placed on a rigid flat surface in each of the following two positions in turn:

- a) in the normal upright position, with the longitudinal axis of the hammer coincident with the longitudinal axis of the valve;
- b) lying on its side so that the valve rests on a rigidly fixed steel block.

In each of the above positions, submit the valve of the extinguisher to an impact by allowing the steel hammer to fall vertically onto it from the height h . The point of impact is to be determined by the authority carrying out the test.

7.5.2 Resistance to vibrations

7.5.2.1 Test principle

An extinguisher shall be capable of withstanding exposure to the conditions of a vibration test without development of physical weakness which would impair its normal operation.

7.5.2.2 Extinguisher mounting requirements

Extinguishers supplied with a wall hook or bracket not intended for use in vehicles shall be subjected to the test specified in 7.5.2.5.2.

Extinguishers supplied with a bracket for use in vehicles shall be subjected to the test specified in 7.5.2.5.3.

Extinguishers supplied with a bracket suitable for both general and vehicle use shall be subjected to the test specified in 7.5.2.5.3.