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

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

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Reference number
ISO 7165:2017(E)

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

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

This third edition cancels and replaces the second edition (ISO 7165:2009), which has been technically revised.

The main changes compared to the previous edition are as follows:

- new requirements for four clean agents have been added;
- tests using polar solvents as a fuel for water-based fire extinguishers have been added.

Fire fighting — Portable fire extinguishers — Performance and construction

1 Scope

This document 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. Subject to local acceptance, application can be extended to extinguishers having a total mass of up to 25 kg when fully charged.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 4892-2:2013, *Plastics — Methods of exposure to laboratory light sources — Part 2: Xenon-arc lamps*

ISO 5923, *Equipment for fire protection and fire fighting — Fire extinguishing media — Carbon dioxide*

ISO 7202, *Fire protection — Fire extinguishing media — Powder*

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

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

ISO 10619-2:2011, *Rubber and plastics hoses and tubing — Measurement of flexibility and stiffness — Part 2: Bending tests at sub-ambient temperatures*

ISO 11601, *Fire fighting — Wheeled fire extinguishers — Performance and construction*

ISO 13061-1, *Physical and mechanical properties of wood — Test methods for small clear wood specimens — Part 1: Determination of moisture content for physical and mechanical tests*

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at <http://www.electropedia.org/>

— ISO Online browsing platform: available at <http://www.iso.org/obp>

3.1

batch

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

3.2

bulk range

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

3.3

charge of extinguisher

mass or volume of the *extinguishing medium* (3.9) contained in the extinguisher expressed in volume (litres) for water-based extinguishers and in mass (kilograms) for other extinguishers

3.4

classification of fires

grouping of fires on the basis of the characteristics as given in 3.4.1 to 3.4.5

Note 1 to entry: See ISO 3941.

3.4.1

class A

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

3.4.2

class B

involving liquids or liquefiable solids

3.4.3

class C

involving gases

3.4.4

class D

involving metals

3.4.5

class F

involving cooking media (vegetable or animal oils and fats) in cooking appliances

3.5

clean agent

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

Note 1 to entry: For conductive properties and amount of residue, see Annexes C, D, E and F.

3.6

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

3.7

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

3.8

effective discharge time

time from the commencement of discharge of the *extinguishing medium* (3.9) at the nozzle to the *gas point* (3.12) of the discharge stream with the control valve fully open

3.9

extinguishing medium

substance contained in the extinguisher that causes extinguishment

3.10**fill density**

mass in kilograms of *extinguishing medium* (3.9) per litre of container volume as fitted for use, complete with valve and internal fittings

3.11**fire extinguisher**

appliance containing an *extinguishing medium* (3.9) that can be discharged and directed onto a fire by the action of internal pressure

Note 1 to entry: 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)]

3.12**gas point**

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

3.13**lowest observable adverse effect level****LOAEL**

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

3.14**low pressure extinguisher**

extinguisher having a service pressure, p_s , not exceeding 25 bar

3.15**maximum service pressure**

p_{ms}

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

3.16**portable fire extinguisher**

fire extinguisher (3.11) that is designed to be carried and operated by hand and that, in working order, has a mass of not more than 20 kg

Note 1 to entry: Subject to local acceptance, extinguishers having a total mass of up to 25 kg when fully charged are permitted.

3.17**pressure gauge**

device that shows the pressure in the cylinder and the operating range of the extinguisher based on the operating temperature-pressure relationship

Note 1 to entry: The gauge face is marked with the appropriate units.

3.18**pressure indicator**

device that shows that the extinguisher is pressurized at its rated expellant gas pressure

3.19**propellant**

non-flammable compressed gas used to expel the *extinguishing medium* (3.9)

3.20

rechargeable extinguisher

extinguisher designed to be recharged after use

3.21

service pressure

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

3.22

wet chemical

water-based chemical agents that include, but are not limited to, aqueous solutions of potassium acetate, potassium carbonate, potassium citrate or combinations of these materials

4 Classification of extinguishers

Extinguishers shall be classified by the type of extinguishing medium that they contain. At present, the main classes of extinguishers are

- water-based,
- powder,
- carbon dioxide, and
- 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, foaming agents, wet chemical, etc. Water-based extinguishers, including foam, containing different types of freezing-point depressants shall be treated as separate and distinct models for the fire rating tests and for the purpose of testing the range of the operating temperatures, electrical conductivity, etc. All other requirements relating to the design and construction of water-based extinguishers are applicable to all models, irrespective of contents.

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 [Annex C](#) for FK-5-1-12, [Annex D](#) for HCFC Blend B, [Annex E](#) for HFC-227ea or [Annex F](#) for HFC-236fa, as appropriate, or shall be regulated by the national environmental regulatory body of a country.

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

5.1.3 Powders

Powders used in extinguishers shall comply with ISO 7202, with the exception of 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 International 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-based extinguishers.

5.1.5 Water-based agents

When the extinguishing agent has a pH exceeding 9,5, a warning statement shall be required for the extinguisher nameplate (see [10.2](#)).

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 $-55\text{ }^{\circ}\text{C}$. Non-flammable tracers may be added to the propellant to facilitate leakage detection. The percentage of the tracer shall be indicated by the manufacturer and verified by the test laboratory, with the exception that it is not necessary for the propellant for stored-pressure, water-based extinguishers to 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 [Annexes C, D, E](#) or [F](#) as appropriate.

NOTE The above fill densities can 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: +0 % –5 % 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: +0 % –5 % by mass;
- d) carbon dioxide extinguishers: +0 % –5 % by mass.

5.3.3 Charges

The following are the recommended charges for fire extinguishers:

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

6 Pressure requirements for low-pressure extinguishers

6.1 Test pressure

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).

6.2 Minimum burst pressure

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

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 +60 °C;
- -5 °C to +60 °C;
- -10 °C to +60 °C;
- -20 °C to +60 °C;
- -30 °C to +60 °C;
- -40 °C to +60 °C;
- -55 °C to +60 °C.

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

For water-based extinguishers without any protection against freezing, the minimum operating temperature shall be 5 °C.

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.

7.2.1.1 Requirements

When three portable fire extinguishers are tested in accordance with [7.2.1.2](#), the duration of operation of each extinguisher shall be within ± 3 s of the average value for powder extinguishers and within 15 % of the average value for other extinguishers, but duration value shall not be less than the minimum specified.

7.2.1.2 Test method

Carry out the testing of portable extinguishers within 5 min of removal of the extinguisher from the conditioning temperature. Store portable fire extinguishers for testing in a vertical position for at least

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

18 h at a temperature of $20\text{ °C} \pm 5\text{ °C}$ before the tests are carried out and maintain the temperature within this range until tested as given below.

- a) Weigh the extinguisher.
- b) Hold the extinguisher in its normal working position (i.e. hand-held) and keep it immobile for the duration of the test.
- c) For cartridge-operated extinguishers supplied with a final control valve and an independent activation system, pressurize with the final control valve closed. Open this final control valve 6 s after the commencement of pressurization of the extinguisher.
- d) For cartridge-operated extinguishers where activation is by a simple action, pierce the cartridge and close the control valve immediately for a period of 6 s, after which reopen the control valve.
- e) For extinguishers that are activated by a single operation of the control valve, open the control valve and leave it open for the duration of the test.
- f) Measure and record the time between the opening of the final control valve and the commencement of discharge. Measure and record the effective discharge time.
- g) For gaseous extinguishers, reweigh, then calculate and record the residual charge. For all other extinguishers, reweigh, empty the residual extinguishant, then reweigh or measure and record the residual change.

All portable fire extinguishers shall operate within 4 s after the final control valve is opened.

7.2.2 Class B rated extinguishers

7.2.2.1 General

The minimum effective discharge time of extinguishers with a class B rating shall be no less than the appropriate value given in [Table 1](#).

7.2.2.2 Requirements

When three portable fire extinguishers are tested in accordance with [7.2.2.3](#), the duration of operation of each extinguisher shall be within ± 3 s of the average value for powder extinguishers and within 15 % of the average value for other extinguishers, but duration value shall not be less than the minimum specified.

7.2.2.3 Test method

Carry out the testing of portable extinguishers within 5 min of the removal of the extinguisher from the conditioning temperature. Store portable fire extinguishers for testing in a vertical position for at least 18 h at a temperature of $20\text{ °C} \pm 5\text{ °C}$ before the tests are carried out and maintain the temperature within this range until tested as given below.

- a) Weigh the extinguisher.
- b) Hold the extinguisher in its normal working position (i.e. hand-held) and keep it immobile for the duration of the test.
- c) For cartridge-operated extinguishers supplied with a final control valve and an independent activation system, pressurize with the final control valve closed. Open this final control valve 6 s after the commencement of pressurization of the extinguisher.
- d) For cartridge-operated extinguishers where activation is by a simple action, pierce the cartridge and close the control valve immediately for a period of 6 s, after which reopen the control valve.

- e) For extinguishers that are activated by a single operation of the control valve, open the control valve and leave it open for the duration of the test.
- f) Measure and record the time between the opening of the final control valve and the commencement of discharge. Measure and record the effective discharge time.
- g) For gaseous extinguishers, reweigh, then calculate and record the residual charge. For all other extinguishers, reweigh, empty the residual extinguishant, then reweigh or measure and record the residual change.

All portable fire extinguishers shall operate within 4 s after the final control valve is opened.

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	9
(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 that gives the best possible illumination of the extinguisher medium 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 °C ± 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 2 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, can 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 shall comply with the following requirements after being subjected to the conditions given in 7.3.2.

- The extinguisher shall operate as intended. The duration of operation shall not be less than 8 s. Carbon dioxide extinguishers, when tested at 60 °C, shall have duration of not more than the duration established at 20 °C. When tested at the minimum operating temperature, the discharge duration shall not be greater than 2,5 times the duration established at 20 °C.
- The extinguisher shall commence discharge within 5 s of opening the control valve.
- Powder extinguishers shall not retain more than 15 % of initial charge within the extinguisher following complete discharge. All other types shall have a maximum residue of 10 %.

7.3.2 Test method

Carry out testing on four extinguishers. Before testing, weigh each extinguisher, then subject two extinguishers to temperature cycle 1, as given in Table 2, and subject the other two extinguishers to temperature cycle 2, as given in Table 2. Store at the temperatures given in Table 2 in conditioning chambers; do not use liquid baths. Maintain extinguishers in an upright position during temperature cycling. The tolerances given in Table 2 shall be considered as nominal tolerances, with the climatic chamber empty.

Table 2 — Temperature cycles

Duration h	Cycle 1 ^a	Cycle 2 ^a
24 ± 1	Store at minimum ^b stated temperature (±2 °C)	Store at (60 ± 2) °C
24 ± 1	Store at (20 ± 5) °C	Store at (20 ± 5) °C
24 ± 1	Store at (60 ± 2) °C	Store at minimum ^b stated temperature (±2 °C)
^a The storage temperatures refer to the ambient temperature within the conditioning chamber. A liquid bath shall not be used.		
^b See 7.1.		

Operate the extinguisher within 2 min after its removal from the conditioning chamber. Hold the extinguisher in its normal working position and keep it immobile for the duration of the test.

Operate the extinguisher in accordance with 7.2.2.3.

Measure and record the time between the opening of the final control valve and the commencement of discharge. For gaseous extinguishers, reweigh, then calculate and record the residual charge. For all other extinguishers, reweigh, empty the residual extinguishant, then reweigh or measure and record the residual charge.

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.