INTERNATIONAL STANDARD

ISO 6182-4

First edition
1993-09-01

Fire protection — Automatic sprinkler systems —

Part 4: Requirements and test methods for quick-opening devices

Protection contre l'incendie — Systèmes d'extinction automatique du type sprinkler —

Partie 4: Prescriptions et méthodes d'essai des dispositifs à ouverture rapide

Reference number
ISO 6182-4:1993(E)

Contents

International Organization for Standardization
Case Postale 56 • CH-1211 Genève 20 • Switzerland

Printed in Switzerland

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.

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.

International Standard ISO 6182-4 was prepared by Technical Committee ISO/TC 21, *Equipment for fire protection and fire fighting*, Sub-Committee SC 5, *Fixed fire extinguishing systems*.

ISO 6182 consists of the following parts, under the general title *Fire protection — Automatic sprinkler systems*:

- — *Part 1: Requirements and test methods for sprinklers*
- — *Part 2: Requirements and test methods for wet alarm valves, retard chambers and water motor alarms*
- — *Part 3: Requirements and test methods for dry pipe valves*
- — *Part 4: Requirements and test methods for quick-opening devices*
- — *Part 5: Requirements and test methods for deluge valves*

Introduction

ISO 6182 comprises several parts prepared by ISO/TC 21 covering components for automatic sprinklers systems.

ISO 6182 is included in a series of International Standards planned to cover:

— carbon dioxide systems (ISO 6183);

— explosion suppression systems (ISO 6184);

— foam systems (ISO 7076).

Fire protection — Automatic sprinkler systems —

Part 4:
Requirements and test methods for quick-opening devices

1 Scope

This part of ISO 6182 specifies the performance and testing requirements for quick-opening devices used with dry pipe valves in fire protection systems to hasten the operation of the valves when one or more sprinklers operate. The quick-opening devices include accelerators and exhausters for use with specific dry pipe valves.

All pressure data in this part of ISO 6182 are given as gauge pressure in bar[1].

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 6182. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 6182 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 7-1:1982, *Pipe threads where pressure-tight joints are made on the threads — Part 1: Designation, dimensions and tolerances.*

ISO 37:1977, *Rubber, vulcanized — Determination of tensile stress-strain properties.*

ISO 49:1983, *Malleable cast iron fittings threaded to ISO 7/1.*

ISO 188:1982, *Rubber, vulcanized — Accelerated ageing or heat-resistance tests.*

ISO 898-1:1988, *Mechanical properties of fasteners — Part 1: Bolts, screws and studs.*

ISO 898-2:1992, *Mechanical properties of fasteners — Part 2: Nuts with specified proof load values — Coarse thread.*

ISO 6182-1:1993, *Fire protection — Automatic sprinkler systems — Part 1: Requirements and test methods for sprinklers.*

3 Definitions

For the purposes of this part of ISO 6182, the following definitions apply.

3.1 accelerator: Quick-opening device which hastens the operation of a dry pipe valve using mechanical means other than by reducing installation pipework pressure.

3.2 antiflooding device: Device intended to prohibit excessive water or other foreign matter from entering any relevant part or parts of the quick-opening device where this might prevent subsequent operation.

3.3 corrosion-resistant material: Corrosion-resistant materials shall be either:

— bronze, brass, Monel metal or austenitic stainless steel, or equivalent; or

— plastics conforming with the requirements of 4.6.

3.4 exhauster: Quick-opening device intended to discharge dry pipe system air directly to atmosphere to reduce valve trip time.

1) 1 bar = 10^5 Pa = 0,1 MPa

3.5 rated working pressure: Maximum service pressure at which a quick-opening device is intended to operate.

3.6 service pressure: Static water pressure at the inlet to a dry pipe valve when the quick-opening device and the dry pipe valve are in the ready condition.

3.7 quick-opening device: Accelerator or exhauster as defined in 3.1 and 3.4 respectively.

3.8 holding chamber: Chamber pressurized with system air pressure which actuates a quick-opening device upon a sufficient rate of loss of system air pressure.

4 Requirements

4.1 Rated working pressures

When in the adjustment or operating condition, all internal components of a quick-opening device and an antiflooding device intended to retain system air pressure shall withstand a pneumatic pressure of 7 bar for 1 min without leakage when tested in accordance with 6.4.

4.2 Strength and leakage test

All parts of a quick-opening device and an antiflooding device subject to working pressures shall withstand a hydrostatic pressure of twice the rated working pressure for 5 min, without evidence of leakage or permanent distortion when tested in accordance with 6.5.

4.3 Materials

4.3.1 All materials shall be suitable for their intended application as determined in accordance with 6.2 to 6.5 and 6.9.

4.3.2 The suitability of non-metallic parts, excluding gaskets and seals, shall be evaluated on the basis of

— resistance to deterioration due to ageing;

— water absorption; and

— physical deterioration associated with the above conditions,

in accordance with 6.3.1 to 6.3.3. A device with components aged in accordance with 6.3.1 to 6.3.3 shall be capable of demonstrating performance when subjected to the appropriate test in clause 6 for that component.

4.3.3 If non-metallic materials, other than gaskets and pipe seals, or metals with a melting point of less than 800 °C (other than for pipe jointing purposes) are used in the construction of the body of quick-opening devices and/or antiflooding devices, with a connection to the dry pipe valve or system pipework in excess of 20 mm internal diameter, the assembled device shall be subjected to a fire exposure test in accordance with 6.9. Leakage of water from the device(s) shall not exceed comparable flow through a 20 mm diameter opening.

4.4 Bodies and covers

4.4.1 Quick-opening device bodies and covers shall be made of a material having a corrosion resistance at least equivalent to cast iron.

4.4.2 The dimension of all connections shall conform to ISO International Standards where these exist. Where this is not appropriate, national standards may be used.

4.4.3 The normal 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 valve is pressurized to 4 times the rated working pressure. The area of application of pressure shall be calculated as follows:

a) if a full face gasket is used, the area of force application 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 force application is that extending out to the centreline of the "O"-ring or gasket.

4.5 Components

4.5.1 Where practicable, the design of any component which can be normally disassembled during servicing should be such that it cannot be reassembled wrongly. It should be possible to disassemble all parts intended for field replacement using only tools normally employed by the trade.

4.5.2 Springs and diaphragms shall not fracture or rupture during 5 000 and 1 000 cycles of normal operation respectively, when tested in accordance with 6.2.

4.5.3 There shall be no sign, on visual examination, of damage to the sealing elements of the device after testing for the operational requirements of 4.10.

4.5.4 Press fit bushings shall conform to the appropriate requirements of ISO 49.

4.5.5 Where rotation or sliding motion is required, the part and its bearing shall be made of corrosion-resistant material.

4.5.6 Any non-reinforced elastomer sealing element, other than gaskets, shall have the following properties when tested in accordance with 6.3.3 and the appropriate clauses of ISO 37:

a) maximum set of 5 mm when 25 mm long marks are stretched to 75 mm, held for 2 min, and measured 2 min after release; and

b) either:

1) minimum tensile strength 100 bar (10 MPa) and minimum ultimate elongation 300 % (25 mm to 100 mm), or

2) minimum tensile strength 150 bar (15 MPa) and minimum ultimate elongation 200 % (25 mm to 75 mm),

and after exposure to oxygen for 96h at (70 ± 1,5) °C and 20 bar (2,0 MPa),

c) the tensile strength and ultimate elongation shall not be less than 70 % of the corresponding properties of specimens which have not been heated in oxygen, and change in hardness shall not be greater than 5 type A durometer units;

and after immersion in distilled water at (97,5 ± 2,5) °C for 70 h,

d) the tensile strength and ultimate elongation shall not be less than 70 % of the corresponding properties of specimens which have not been heated in water and the change of volume of the specimens shall not be greater than 20 %.

4.5.7 A reinforced elastomeric sealing element (of clapper, clapper assembly or seat seal) shall be capable of being flexed without cracking or breaking and shall have a change in volumetric expansion not greater than 20 % when tested in accordance with 6.3.3.

4.6 Non-metallic components (excluding gaskets and seals)

4.6.1 After ageing of its non-metallic parts as described in 6.3.1 and 6.3.2, a quick-opening device shall meet the requirements of 4.9 when tested in accordance with 6.5 and 6.6.

Separate samples shall be used when testing in accordance with 6.3.1 and 6.3.2.

4.6.2 There shall be no warping, creep or other signs of deterioration which may preclude the proper operation of the device. There shall be no cracking of any component.

4.7 Clearances

Clearances shall be provided between moving parts and between stationary and moving parts so that corrosion or deposits of foreign matter within an assembly will not render a quick-opening device sluggish or inoperative.

4.8 Protection of orifices

Orifices shall be protected from clogging and, when tested in accordance with 6.7, debris shall not pass through any antiflooding device, if provided.

4.9 Gauge connection

A connection shall be provided to the upper chamber (holding chamber) of a quick-opening device for a suitable pressure gauge which will facilitate the detection of a clogged pressure-equalizing orifice.

4.10 Operation

A quick-opening device shall operate a specific dry pipe valve when the rate of system air pressure drop exceeds a specific rate as a result of the operation of one or more sprinklers, at all water supply pressures from 1,4 bar to the maximum working pressure, therefore hastening the operating time of the dry pipe valve as verified by testing in accordance with 6.6.

4.11 Maintainability

A quick-opening device (and its associated antiflooding component, if provided) shall be designed to permit cleaning and maintenance without the use of special tools which shall be demonstrated by testing in accordance with 6.7.

4.12 Equilibrium time

It shall be established that the device does not exceed the criteria specified in 6.8.

5 Production testing and quality control

It shall be the responsibility of the manufacturer to implement a quality control programme to ensure that his production continuously meets the requirements of this part of ISO 6182 in the same manner as the originally tested samples.

Every quick-opening device manufactured shall pass an aerostatic test at a minimum of 3,5 bar.

Every quick-opening device manufactured shall pass a test of operation which verifies correct function with the results recorded against each quick-opening device serial number.

6 Performance tests

6.1 General

Representative samples of each quick-opening device shall be subjected to the tests described in these requirements.

6.2 Metallic materials, components

See 4.5.2.

Subject samples of a spring and a diaphragm employed in a quick-opening device to 5 000 and 1 000 cycles respectively of normal operation. The tests shall be conducted at a rate not exceeding 6 cycles per min.

6.3 Non-metallic components

6.3.1 Air-oven ageing for non-metallic components (excluding gaskets and seals)

See 4.6.

Age four samples of each component in an air oven at (120 ± 2) °C for 180 days. Support the components so that they do not touch each other or the sides of the oven. Remove the samples from the oven and allow to cool in air at (23 ± 2) °C and relative humidity (50 ± 5) % for not less than 24 h before carrying out any test, measurement or examination.

If a material cannot withstand the temperature indicated without excessive softening, distortion or deterioration, carry out an air-oven ageing test at a lower temperature (but not less than 70 °C) for a longer period of time. Calculate the duration of exposure D, in days, from

$$D = 737\,000\ e^{-0{,}069\,3t}$$

where t is the test temperature, in degrees Celsius.

NOTE 1 This equation is based on the 10 °C rule, i.e. for every 10 °C rise, the rate of a chemical reaction is approximately doubled. When applied to plastic ageing, it is assumed that the life at a temperature, t, in degrees Celsius, is half the life at $(t - 10)$, in degrees Celsius.

Examine the component for cracking and warping, creep or other signs of deterioration which can preclude the proper operation of the device.

6.3.2 Warm water ageing for non-metallic components (excluding gaskets and seals)

See 4.6.

Immerse four samples of each component in tap water at (87 ± 2) °C for 180 days. For parts which are occasionally exposed to water when the device operates, the test shall be conducted for a duration of only 14 days. Remove from the water and allow to cool to room temperature for examination.

If a material cannot withstand the temperature indicated without excessive softening, distortion or deterioration, carry out a water ageing test at a lower temperature (but not less than 70 °C) for a longer period of time. Calculate the duration of exposure D, in days, from:

$$D = 74\,857\ e^{-0{,}069\,3t}$$

where t is the test temperature, in degrees Celsius.

NOTE 2 See note 1.

Examine the component for cracking and warping, creep or other signs of deterioration which may preclude the proper operation of the device.

6.3.3 Elastomeric sealing element tests

6.3.3.1 Reinforced elastomeric sealing element test

See 4.5.7.

Measure the volume of 12 reinforced elastomer sealing elements and identify each sample. Expose six samples to an atmosphere of oxygen at a pressure of 20 bar for 96 h at 70 °C. Submerge the remaining six samples in boiling distilled water for 70 h; remove the samples and allow to cool to room temperature. Measure the volume of each sample before bending each through an arc of 180° three times.

6.3.3.2 Non-reinforced elastomeric sealing element test

See 4.5.6.

Prepare 16 test specimens in accordance with ISO 37. Use four to satisfy the test requirements in either 4.5.6 b) 1) or 4.5.6 b) 2) and four to satisfy each of the test requirements in 4.5.6 a), 4.5.6 c) and 4.5.6 d).

6.4 Pneumatic static pressure

The quick-opening device shall have all external parts blanked off, except one which will enable the whole device to be pressurized pneumatically at 7 bar for 1 min. The device shall be assessed in accordance with 4.1.

6.5 Leakage and deformation test

There shall be a connection for hydrostatically pressurizing the downstream connection and a means of venting the air and pressurizing fluid. The device shall be hydrostatically pressurized internally to twice the rated working pressure, but not less than 24 bar for a period of 5 min. The device shall be assessed in accordance with 4.2.

6.6 Operational tests

The tests are to be conducted with water pressures of 1,4 bar, 3 bar and then further increments of 3 bar until the rated working pressure is reached. Initial air pressure in each test is to be set at a value of 1,4 bar plus one fifth of the initial water pressure or the manufacturers recommended air pressure whichever is the higher. In no case, however, shall the initial air pressure exceed water pressure. At each pressure increment, release air from the system piping in accordance with the decay curve of figure 1. The air pressure tank utilized shall have a capacity of at least 1 000 l. The time between the start of air release and the opening of the dry pipe valve shall not exceed 30 s.

NOTES

3 An orifice with a K factor of 80 in combination with a 6 000 l capacity air pressure tank will produce a curve equivalent to figure 1. For K factor, see ISO 6182-1.

4 If the dry pipe valve does not trip before 1 bar air pressure in the 1,4 bar tests, then the time between reaching 1 bar air pressure and the tripping of the dry pipe shall not exceed 5 s.

6.7 Clogging test

Repeat each test four times. In all tests, debris shall not pass through the antiflooding device, if provided. If an antiflooding device is provided, the quick-opening device shall not be cleaned or adjusted between tests. It shall be permitted to remove debris from the entrance to the antiflooding device between tests or, if no antiflooding device is provided, from the quick-opening device.

Place 3 cm^3 of organic matter, such as sunflower seeds of approximate dimensions 13 mm long by 8 mm wide at the large end by 5 mm thick, in the piping of a quick-opening device to simulate loosened debris making its way through the system during operation of the dry pipe valve at 7 bar water pressure.

Repeat above tests using 6 cm^3 of wooden toothpick segments. The segments shall be made by cutting a standard round pointed toothpick, approximately 3 mm in diameter, into approximately 3 mm lengths.

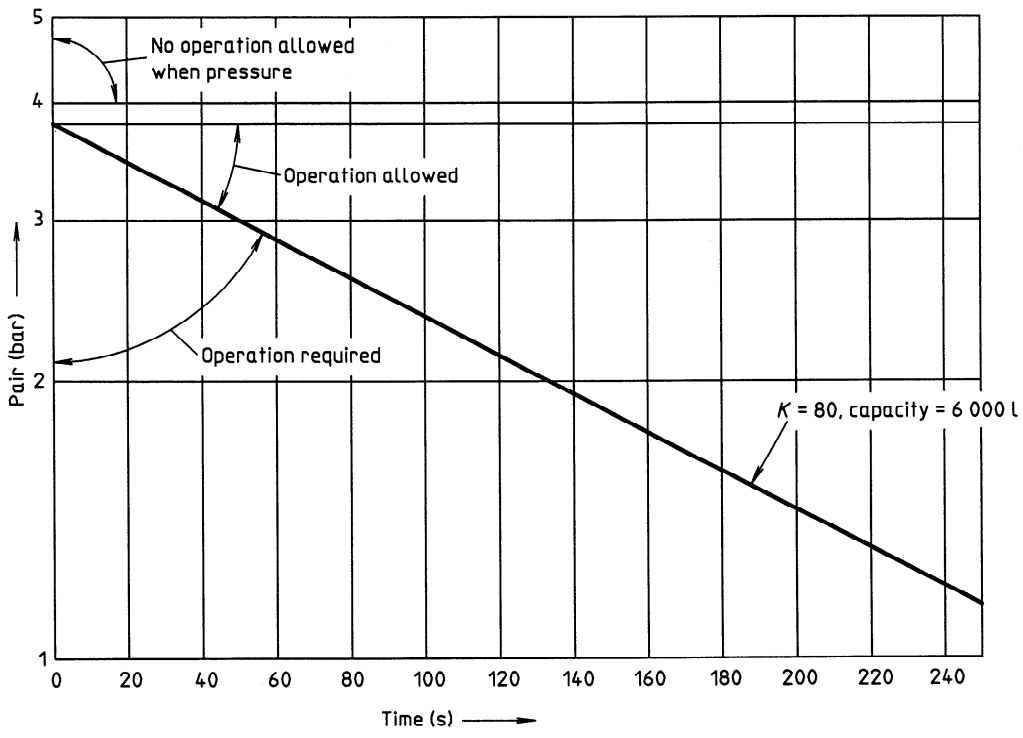

Figure 1