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Fire protection — Automatic sprinkler systems —

Part 10:
Requirements and test methods for domestic sprinklers

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

Partie 10: Exigences et méthodes d'essai des sprinklers domestiques

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Foreword

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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.

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ISO 6182-10 was prepared by Technical Committee ISO/TC 21, *Equipment for fire protection and fire fighting*, Subcommittee SC 5, *Fixed fire fighting systems using water*.

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*

— *Part 6: Requirements and test methods for check valves*

— *Part 7: Requirements and test methods for early suppression fast response (ESFR) sprinklers*

— *Part 8: Requirements and test methods for pre-action dry alarm valves*

— *Part 9: Requirements and test methods for water mist nozzles*

— *Part 10: Requirements and test methods for domestic sprinklers*

— *Part 11: Requirements and test methods for pipe hangers*

— *Part 12: Requirements and test methods for grooved-end components for steel pipe systems*

Introduction

This part of ISO 6182 is one of a number of ISO Standards prepared by ISO/TC 21/SC 5 covering components for fixed fire protection systems using water.

They are included in a series of ISO Standards prepared under ISO/TC 21 planned to cover the following:

a) carbon dioxide systems;

b) explosion suppression systems;

c) foam systems.

Fire protection — Automatic sprinkler systems —

Part 10: Requirements and test methods for domestic sprinklers

1 Scope

This part of ISO 6182 specifies performance requirements, test methods and marking requirements for domestic sprinklers.

These sprinklers are intended to provide control of fires in domestic occupancies, to prevent flashover (total involvement) in the room of fire origin and to improve the probability for successful escape or evacuation of the occupants.

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 7-1, *Pipe threads where pressure-tight joints are made on the threads — Part 1: Dimensions, tolerances and designation*

ISO 5660-1:2002, *Reaction-to-fire tests — Heat release, smoke production and mass loss rate — Part 1: Heat release rate (cone calorimeter method)*

ANSI/UL 723:2003, *Test for surface burning characteristics of building materials*

3 Terms and definitions

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

3.1 General

3.1.1
assembly load
force exerted on the sprinkler body excluding hydrostatic pressure

3.1.2
average design strength
glass bulb suppliers' specified and assured lowest average design strength of any batch of 50 bulbs

3.1.3
design length
maximum length of the sprinkler coverage area

3.1.4
design load
force exerted on the release element at the service load of the sprinkler

3.1.5
design width
maximum width of the sprinkler coverage area

3.1.6
escutcheon
A housing of recessed or concealed sprinklers.

3.1.7
response time index, RTI
measure of sprinkler sensitivity

$$RTI = t\sqrt{u}$$

where

t is equal to the time constant, expressed in seconds, of the heat-responsive element;

u is the gas velocity, expressed in meters per second

NOTE 1 The response time index is expressed in units of $(m \cdot s)^{0,5}$.

3.1.8
service load
combined force exerted on the sprinkler body by the assembly load of the sprinkler and the equivalent force of a 1,2 MPa (12 bar) hydrostatic pressure of the inlet

3.1.9
sprinkler
thermosensitive device designed to react at a predetermined temperature by automatically releasing a stream of water and distributing it in a specified pattern and quantity over a designated area

3.1.9.1
domestic sprinkler
to provide control of fires in domestic occupancies

3.1.10
standard orientation
orientation that produces the shortest response time with the axis of the sprinkler inlet perpendicular to the air flow

NOTE In the case of symmetrical heat-responsive elements, standard orientation is with the air flow perpendicular to both the axis of the waterway and the plane of the frame arms; in the case of non-symmetrical heat-responsive elements, it is with the air flow perpendicular to both the waterway axis and the plane of the frame arms which produces the shortest response time.

3.2 Type of sprinklers according to type of heat-responsive element

3.2.1
fusible element sprinkler
sprinkler that opens under the influence of heat by the melting of a component

3.2.2
glass bulb sprinkler
sprinkler that opens under the influence of heat by the bursting of the glass bulb, caused by pressure resulting from expansion of the fluid enclosed therein

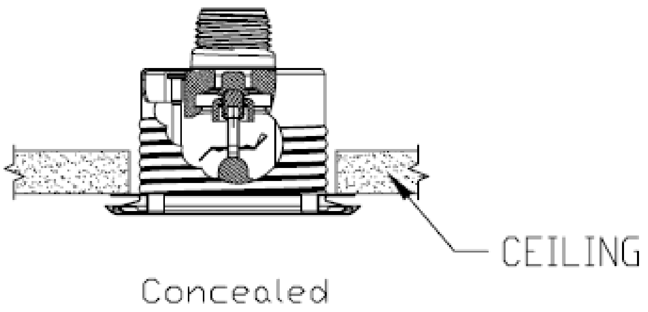
3.3 Type of sprinklers according to type of water distribution

3.3.1
pendent sprinkler
sprinkler arranged such that the water stream is directed downwards against the distribution plate

3.3.2
sidewall sprinkler
sprinkler giving a one-sided water distribution over a definite protection area

3.4 Special types of sprinklers

3.4.1
concealed sprinkler
recessed sprinkler having a cover plate (see Figure 1)



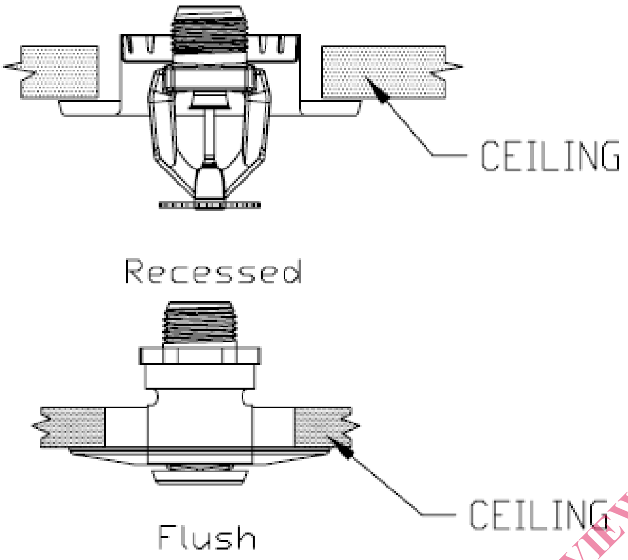


Figure 1 — Concealed, recessed, and flush pendent sprinklers

3.4.2
dry sprinkler
an assembly comprising of a sprinkler mounted at the outlet of a special extension with a seal at the inlet that prevents water from entering the extension until it is released by operation of the sprinkler.

NOTE These sprinklers may consist of pendent, sidewall, or other types.

3.4.3
flush sprinkler
sprinkler of which all or part of the body, including the shank thread, is mounted above the lower plane of the ceiling, but all of the heat-responsive collector is below the lower plane of the ceiling (See Figure 1)

NOTE These are not typically frame arm sprinklers

3.4.4
recessed sprinkler
sprinkler of which all or part of the body, other than the thread, is mounted within recessed housing (see Figure 1)

4 Product consistency

4.1 Quality Control Program

It shall be the responsibility of the manufacturer to implement a quality control program to ensure that production continuously meets the requirements of this part of ISO 6182.

4.2 Leak Resistance Testing

Every manufactured sprinkler shall pass a leak resistance test equivalent to a hydrostatic pressure of at least 3,4 MPa (34 bar) for at least 2 s.

4.3 Glass bulb integrity test

Each glass bulb sprinkler assembly shall be evaluated for glass bulb cracking, breaking, or other damage as indicated by the loss of fluid. The test shall be conducted after the leakage test.

Example The bubble in each glass bulb shall be examined at room ambient temperature. The sprinkler shall then be heated in a circulating air oven or liquid bath to 5°C below the minimum operating temperature range of the sprinkler. The bubble shall then be examined to determine the bubble size has been reduced in accordance with the glass bulb manufacturer's specifications. After cooling, the bubble size shall again be examined to determine the bubble returned to the original size within the tolerance allowed by the glass bulb manufacturer.

5 Product assembly

5.1 General

All domestic sprinklers shall be designed and manufactured in such a way that they cannot be readily adjusted, dismantled or reassembled.

NOTE This requirement does not apply to units intended for assembly/adjustment on site, e.g. combinations of sprinkler and escutcheons or the assembly of the cover plate to concealed sprinklers.

5.2 Dynamic O-ring seals

The closure of the water seat shall not be achieved by the use of a dynamic O-ring or similar seal (an O-ring or similar seal that moves during operation or is in contact with a component that moves during operation).

5.3 Dry Sprinklers

When installed with the intended fittings specified in the manufacturer's installation instructions, dry sprinklers installed in dry systems shall be constructed to minimize the potential to accumulate water, scale, and sediment on the sprinkler inlet. The sprinkler inlet shall also be constructed not to significantly obstruct the flow path.

5.4 Dezincification

Consideration should be given to the possible weakening of brass components of the sprinkler due to dezincification processes when the components are in constant contact with water. Annex D contains a procedure to prove that the selected materials are suitable.

NOTE Caution should be exercised when using a piping system that exchanges its water inside more frequently, and/or, when using non-corrosive piping material such as resin piping material.

5.5 Stainless steel components

Consideration should be given to the possible weakening of stainless steel components of the sprinkler due to the environment of installation. Annex E contains a procedure to prove that the selected materials are suitable.

6 Requirements

6.1 Dimensions

6.1.1 Coverage area

This sprinkler shall have an area of coverage not exceeding 37,2 m^2.

6.1.2 Orifices

All sprinklers shall be constructed so that a sphere of diameter 5 mm can pass through the sprinkler.

6.1.3 Nominal thread sizes

6.1.3.1 Nominal thread sizes shall be suitable for fittings threaded in accordance with ISO 7-1. The dimensions of all threaded connections should conform to International Standards where applied or shall conform to national standards where International Standards are not applicable.

6.2 Nominal operating temperatures (see 7.3)

The marked nominal temperature rating and color coding of sprinkler shall be in accordance with Table 1.

Table 1 — Nominal operating temperature

Glass bulb sprinklers		Fusible element sprinklers	
Marked Nominal temperature rating °C	Liquid color code	Marked Nominal temperature rating °C	Yoke arm color code
57	Orange	57 to 77	Uncolored
68	Red	79 to 107	White
79	Yellow	—	—
93, 107	Green	—	—

NOTE See 8.1.5 for concealed, flush, coated and plated sprinklers.

6.3 Operating temperatures (see 7.3)

Sprinklers shall operate within the temperature range given by Equation (1):

$t = x \pm (0{,}035x + 0{,}62)$°C

where *t* is the temperature range, rounded to the nearest 0.1°C;

x is the marked nominal temperature rating (see Table 1).

6.4 Water flow and distribution

6.4.1 Flow constant (see 7.4)

6.4.1.1 The flow constant, K, for sprinklers is given by Equation (2):

$$K = \frac{q}{\sqrt{10p}} \qquad (2)$$

where

p is the pressure, expressed in MPa;

q is the flow rate, expressed in liters per minute.

6.4.1.2 The value of the nominal flow constant, K, published in the manufacturer's design and installation instructions shall be verified using the test method of 7.4. Each flow constant, K, (calculated) shall be within ± 5 % or ± 3 units of the manufacturer's value, whichever is greater.

6.4.2 Water distribution (see 7.5)

6.4.2.1 General

To demonstrate the required coverage of the protected area allotted to it, a domestic sprinkler shall comply with the horizontal- and vertical-surface water-distribution requirements described in 6.4.2.2 and 6.4.2.3.

6.4.2.2 Horizontal surfaces

When installed in accordance with the manufacturer's design and installation instructions and tested as described in 7.5.1.1 through 7.5.1.4, a sprinkler shall distribute water over a horizontal surface such that the discharge density collected in any single 300 mm × 300 mm collection pan within the design area shall be at least 0,8 mm/min, except that

a) no more than four collection pans in each quadrant shall be allowed to be at least 0,6 mm/min for upright and pendent sprinklers; and

b) no more than eight collection pans shall be allowed to be at least 0,6 mm/min for each half (split along the sprinkler centerline) of the design area for sidewall sprinklers.

6.4.2.3 Vertical surfaces

When installed in accordance with the design and installation instructions and tested as described in 7.5.2, a sprinkler shall distribute water over vertical surfaces as follows

a) Walls within the coverage area shall be wetted to at least 700 mm of the ceiling with one sprinkler operating at the specified design flow rate.

b) For square coverage areas, each wall within the coverage area shall be wetted with at least 5 % of the sprinkler flow; for rectangular coverage areas, each wall within the coverage area shall be wetted with a proportional water amount based on 20 % of the total sprinkler discharge in accordance with Equation (3):

$$A_{\text{col}} = 0{,}2\frac{l_{\text{W}}}{l_{\text{P}}} \qquad (3)$$

where

A_{col} is the required amount of water collected on a wall, expressed in percent;

l_{W} is the wall length, expressed in meters;

l_{P} is the total perimeter of coverage area e.g., the length of all walls combined, expressed in meters.

6.5 Function (see 7.6)

6.5.1 Lodgement

When tested in accordance with 7.6.1, the sprinkler shall open and, any lodgement of released parts shall be cleared within 10 s of release of the heat-responsive element.

6.5.2 Deflector Strength

The deflector and its supporting parts shall not sustain significant damage as a result of the deflector strength test specified in 7.6.2.

If minor damage is noted, testing in accordance with 6.4.2 can be done to demonstrate compliance.

NOTE In most instances, visual examination of the sprinkler will be sufficient to establish conformance with 6.5.2.

6.6 Service load and strength of sprinkler body (see 7.7)

6.6.1 The sprinkler body shall comply with the requirements of 6.6.1.1 or 6.6.1.2

6.6.1.1 The sprinkler body shall not show permanent elongation of more than 0,2 % between the load-bearing points of the sprinkler body after being subjected to twice the service load as measured according to 7.7.1 or 7.7.2.

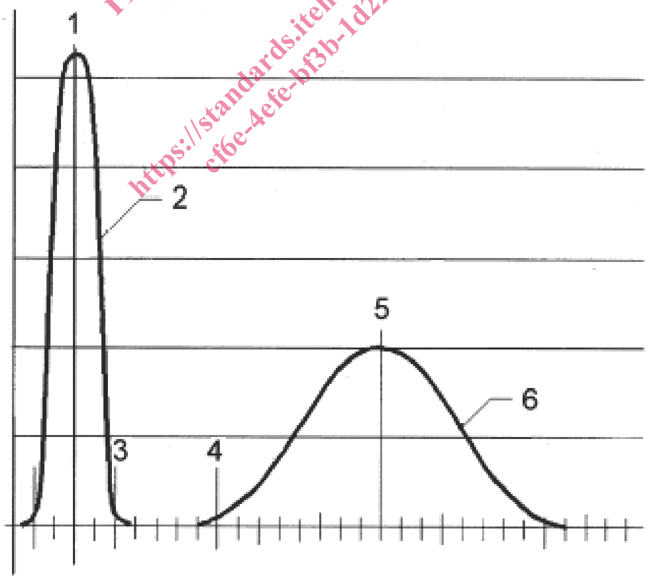
6.6.1.2 The sprinkler body shall not show permanent elongation of more than 50 % of the sprinkler body with the design load being applied after being subjected to twice the service load as measured according to 7.7.3.

6.6.2 The manufacturer shall specify the average and upper limit of the service load. These values shall not be exceeded when tested in accordance with 7.7.1, 7.7.2, or 7.7.3 as applicable.

6.7 Strength of heat-responsive element (see 7.8)

6.7.1 Glass bulb elements

When tested in accordance with 7.8, glass bulb elements shall have a design strength lower tolerance limit (LTL) on the strength distribution curve of at least twice the upper tolerance limit (UTL) of the service load distribution curve based on calculations with a degree of confidence (γ) of 0,99 for 99 % of the samples (P). Calculations will be based on normal or Gaussian distribution, except where another distribution can be shown to be more applicable owing to manufacturing of design factors. (See Figure 2).



1 average service load
2 service load curve
3 UTL
4 LTL
5 average design strength
6 design strength curve

Figure 2 — Strength curve