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Fire protection — Automatic sprinkler systems —

Part 13: Requirements and test methods for extended-coverage sprinklers

Protection contre l'incendie — Systèmes d'extinction automatiques du type sprinkler —
Partie 13: Prescriptions et méthodes d'essai des sprinklers couvrant une surface plus étendue que la normale

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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 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 ISO/TC 21, *Equipment for fire protection and fire fighting*, Subcommittee SC 5, *Fixed firefighting systems using water*.

A list of all parts in the ISO 6182 series can be found on the ISO website.

Introduction

Extended coverage sprinklers are intended provide fire control in occupancies or portions of occupancies where the quantity and/or combustibility of contents is low and fires with relatively low rates of heat release are expected. Examples of occupancies where these sprinklers may be installed include offices, restaurant seating areas, educational facilities and other areas having similar fire challenges.

These sprinklers have a relatively flat spray pattern compared to the sprinklers described in ISO 6182-1. This allows the sprinklers to effectively distribute water over a larger area; thus permitting the sprinklers to be spaced greater distances from each other, as well as from the walls of the compartment. Obstructions can pose a greater challenge to extended coverage sprinklers because of the flat spray pattern. Extended coverage sprinkler installation guidelines need to account for the flat spray pattern when considering the distances between obstructions and the sprinkler.

Product standards, such as this one, can provide a minimum level of safety in the built environment, as well as a level of quality to the products on the market.

Fire protection — Automatic sprinkler systems —

Part 13: Requirements and test methods for extended-coverage sprinklers

1 Scope

This document specifies performance and marking requirements and test methods for extended coverage sprinklers.

These sprinklers are intended to provide control of fires in occupancies or portions of occupancies where quantity and/or combustibility of contents is low such as office spaces.

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

ASTM G36, *Standard Practice for Evaluating Stress-Corrosion-Cracking Resistance of Metals and Alloys in a Boiling Magnesium Chloride Solution*

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 General

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

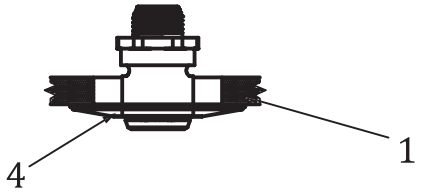
3.1.2
average design strength
glass bulb supplier's specified lowest average axial design strength of any batch of 50 bulbs

3.1.3
design load
force exerted on the release element at the service load of the sprinkler

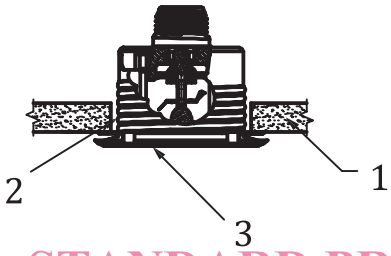
3.1.4
housing assembly/escutcheon
ornamental or protective component(s) around the hole from which the sprinkler penetrates the plane of the ceiling or the wall

Note 1 to entry: See Figure 1.

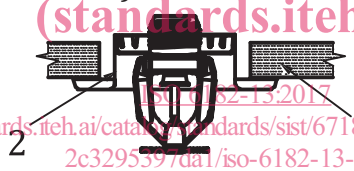
Note 2 to entry: For the purposes of this document, housing applies to recessed and concealed sprinklers.



a) Flush



b) Concealed



c) Recessed

Key

1 ceiling
2 housing assembly
3 cover plate
4 escutcheon

Figure 1 — Concealed, recessed, flush

3.1.5
protective covering
protective caps or straps intended to provide temporary protection for sprinklers during shipping, handling and installation

3.1.6
response time index, RTI
measure of sprinkler sensitivity

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

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

3.1.7
service load
combined force exerted on the sprinkler body by the assembly load of the sprinkler and the equivalent force of the rated pressure on the inlet

3.1.8
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

3.1.8.1
extended coverage sprinkler
sprinkler having a specified area of coverage larger than 21 m^2

Note 1 to entry: See 3.3 for additional detail.

Note 2 to entry: For the purposes of this document, sprinkler is intended to refer to extended coverage sprinklers.

3.1.9
standard orientation
orientation that produces the shortest response time with the axis of the sprinkler inlet perpendicular to the air flow

Note 1 to entry: 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 Types of sprinkler 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 through pressure resulting from expansion of the fluid enclosed therein

3.3 Types of sprinkler according to position

3.3.1
pendent extended coverage sprinkler
extended coverage sprinkler that is arranged in such a way that the water stream is directed initially downwards against the deflector

Note 1 to entry: This sprinkler has a square area of coverage not exceeding 36 m^2 with sprinkler spacings in 0,5 m increments. The maximum spacing between sprinklers is 6,0 m.

3.3.2
sidewall extended coverage sprinkler
extended coverage sprinkler giving a one-sided (half-paraboloid) water distribution over a definite protection area

Note 1 to entry: The axis of the sprinkler waterway may be either horizontal or vertical. This sprinkler has an area of coverage not exceeding 36 m^2, with sprinkler spacings in 0,5 m increments, with no dimension exceeding 7 m.

3.3.3
upright extended coverage sprinkler
extended coverage sprinkler that is arranged in such a way that the water stream is directed initially upwards against the deflector

Note 1 to entry: This sprinkler has a square area of coverage not exceeding 36 m^2 with sprinkler spacings in 0,5 m increments. The maximum spacing between sprinklers is 6,0 m.

3.4 Special types of extended coverage sprinklers

3.4.1
coated sprinkler
sprinkler that has a factory-applied coating for corrosion protection

Note 1 to entry: For this document, coated sprinkler does not include coatings intended for aesthetic purposes.

3.4.2
concealed sprinkler
recessed sprinkler having a cover plate

Note 1 to entry: See Figure 1.

3.4.3
dry sprinkler
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 1 to entry: These sprinklers may consist of pendent, sidewall or other types.

3.4.4
flush sprinkler
for pendent sprinklers, all or part of the body is mounted above the lower plane of the ceiling, but all of the heat-responsive collector is below the lower plane of the ceiling

Note 1 to entry: See Figure 1.

Note 2 to entry: For sidewall sprinklers, the sprinkler is within the wall, but the heat-responsive collector projects into the room beyond the plane of the wall.

Note 3 to entry: These are not typically frame arm sprinklers.

3.4.5
recessed sprinkler
sprinkler of which all or part of the body, other than the thread, is mounted within a recessed housing

Note 1 to entry: 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 document.

4.2 Leak resistance testing

Every manufactured sprinkler shall pass a leak resistance test equivalent to a hydrostatic pressure of at least twice the rated pressure 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.

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 sprinklers shall be designed and manufactured such that they cannot be readily adjusted, dismantled or reassembled.

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

5.2 Dynamic O-ring seals

The closure of the water way 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 Rated Pressure

Sprinklers shall have a rated pressure of not less than 1,2 MPa (12 bar).

5.4 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 substantially impact the sprinkler k-factor or pressure loss through the fitting.

6 Requirements

6.1 Dimensions

6.1.1 Orifice size

All sprinklers shall be constructed so that a sphere of diameter 8 mm can pass through each water passage in the sprinkler.

6.1.2 Nominal thread sizes

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 Temperature ratings and colour coding

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

Table 1 — Nominal temperature rating and colour coding

Glass bulb sprinklers		Fusible element sprinklers
Marked nominal temperature rating, °C	Liquid colour code	Marked nominal temperature rating, °C
57	orange	57 to 77
68	red	
79	yellow	80 to 107
93, 107	green	
121, 141	blue	121 to 149

6.3 Operating temperature (see 7.3)

Sprinklers shall be verified to operate within a temperature range given in Formula (1):

$$t = x \pm (0,035x + 0,62) \quad (1)$$

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 constant (see 7.4)

The flow constant, K, for sprinklers is given in Formula (2):

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

where

p is the pressure, expressed in megapascals (MPa);

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

K-factor for sprinklers according to this document shall be in accordance with Table 2 when determined by the test method given in 7.4.

Table 2 — Flow constant requirements

Flow constant K (l/min)/(bar$^{1/2}$)	**Flow constant** K **for dry sprinklers** (l/min)/(bar$^{1/2}$)
80 ± 4 115 ± 6	80 ± 6 115 ± 9
160 ± 8	160 ± 12
202 ± 10	200 ± 15
NOTE 1 (l/min)/(bar$^{1/2}$) = 0,003 2 (m^3/min)/(MPa$^{1/2}$).	

6.5 Water distribution (see 7.5)

6.5.1 When tested as described in 7.5, extended coverage sprinklers shall meet the requirements of 6.5.2 to 6.5.4.

6.5.2 For each test, not more than one pan shall have a collection less than 0,6 mm/min and the pan shall not have a collection less than 0,2 mm/min.

6.5.3 For each test, the average collection of all pans shall be a minimum of 1,6 mm/min.

6.5.4 Coated sprinklers shall be subjected to additional distribution tests if the coating is observed to deform or deteriorate during the dynamic heating test of 6.15.

Table 3 — Distribution testing parameters for upright and pendent sprinklers

Nominal flow constant, K [l/m/(bar)^{0,5}]	**Nominal room dimensions** (width × length) (m × m)	**Deflector to ceiling distance** (mm)	**Nominal flow rate** (l/min)
80	5,0 × 5,0	100	102
80	5,5 × 5,5	100	123
80	6,0 × 6,0	100	147
115	5,0 × 5,0	100	102
115	5,5 × 5,5	100	123
115	6,0 × 6,0	100	147
160	5,0 × 5,0	100	111
160	5,5 × 5,5	100	123
160	6,0 × 6,0	100	147
202	5,0 × 5,0	100	139
202	5,5 × 5,5	100	139
202	6,0 × 6,0	100	147