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Fire protection — Automatic sprinkler systems —

Part 1: Requirements and test methods for sprinklers

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

Partie 1: Prescriptions et méthodes d'essai des sprinklers

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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).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of 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 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 5, Fixed firefighting systems using water.

This fourth edition cancels and replaces the third edition (ISO 6182-1:2014) which has been technically revised.

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

— Consolidation of the requirements for early suppression fast response (ESFR) sprinklers (ISO 6182-7:2020), domestic sprinklers (ISO 6182-10:2014) and extended coverage sprinklers (ISO 6182-13:2017) into a single document.

— Increased harmonization of test methods and requirements for the different types of sprinklers.

— Expanded scope to include extended coverage sprinklers for ordinary hazard occupancies and large flow constant, *K*, storage type sprinklers.

— New water distribution and fire test methods as well as requirements for the additional sprinkler technologies.

— New requirements for electrically operated style sprinklers.

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

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

This corrected version of ISO 6182-1:2021 incorporates the following corrections:

— Correction of error in column 1, second row of Table 11 and column 1, final row of Table 12.

— First column heading in Table 22 and Table 23 changed from "Flow constant, *K*" to "Nominal flow constant, *K*".

— Corrections to key elements [a] and [b] in Figure 27 (addition of the phrase "divided by 2").

— Correction to key element [a] in Figure 28 (addition of the phrase "divided by 2").

— Figure 32 and Figure 42 reduced in size for formatting purposes.

— Two subfigures added to Figure 46 and key corrected.

— Corrections to whole key of Figure D.1.

— The term "K-factor" replaced by "flow constant, *K*," throughout.

Introduction

This document includes requirements for conventional, spray, flat spray, sidewall, extended coverage, domestic and storage sprinklers, including early suppression fast response (ESFR) sprinklers, electrically activated sprinklers (EAS) and sprinklers with monitoring of activation (SMA).

Conventional sprinklers are the oldest of the fire sprinkler technologies. These sprinklers discharge water in a spherical discharge pattern such that 40 % to 60 % of the total water flow is initially discharged in the downward direction. In general, the use of this sprinkler technology is limited to applications where this discharge characteristic has been determined to be more effective than the spray sprinkler.

Spray sprinklers were developed in the 1950s and are used to provide fire protection for a wide range of fire risks, including those found in light hazard, ordinary hazard and extra hazard occupancies, as well as storage facilities.

Flat spray sprinklers have a wider spray angle than spray sprinklers and are generally limited to use in spaces with low clearances and storage racks in specific geographic regions.

Domestic 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.

Extended coverage light hazard 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.

Extended coverage ordinary hazard sprinklers are intended to provide control of fires in occupancies or portions of occupancies where quantity and/or combustibility of contents is moderate to high, such as mercantile areas.

Storage sprinklers, including ESFR sprinklers, are primarily intended to be used to provide fire protection for storage facilities.

Electrically activated sprinklers make it possible to activate more than one sprinkler simultaneously.

Sprinklers with monitoring of activation make it possible to detect the location of an actuated sprinkler.

Fire protection — Automatic sprinkler systems —

Part 1: Requirements and test methods for sprinklers

1 Scope

This document specifies performance and marking requirements and test methods for conventional, spray, flat spray, sidewall, extended coverage, domestic and storage sprinklers, including early suppression fast response (ESFR), electrically activated sprinklers (EAS) and sprinklers with monitoring of activation (SMA) for use in water-based fire protection systems. This document is not applicable to sprinklers with multiple orifices.

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 joints are made on the threads — Part 1: Dimensions, tolerances and designation*

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

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:

— ISO Online browsing platform: available at https://www.iso.org/obp

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

3.1 General

3.1.1
actual delivered density
ADD
rate at which water is deposited from an operating *sprinkler* (3.1.13) onto the top horizontal surface of a simulated burning combustible array

3.1.2
assembly load
force exerted on the sprinkler body excluding hydrostatic pressure

3.1.3
average design strength
glass bulb supplier's specified and assured lowest average axial design strength of any batch of 50 bulbs

3.1.4
coverage length
maximum length of the sprinkler coverage area

3.1.5
coverage width
maximum width of the sprinkler coverage area

3.1.6
design load
force exerted on the release element at the *service load* (3.1.12) of the *sprinkler* (3.1.13)

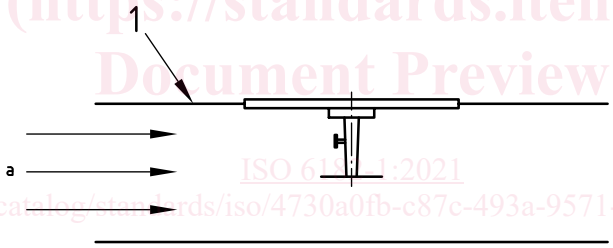
3.1.7
housing assembly
escutcheon
ornamental or protective component(s) around the hole from which the *sprinkler* (3.1.13) penetrates the plane of the ceiling or the wall

Note 1 to entry: See Figure 3.

Note 2 to entry: For the purposes of this document, housing applies to recessed and *concealed sprinklers* (3.5.2).

3.1.8
orientation A
orientation with the airflow perpendicular to both the waterway axis and the plane of the frame arms and with the heat responsive element upstream of the frame arms

Note 1 to entry: See Figure 1.



Key

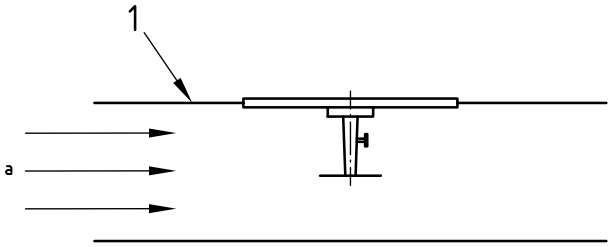
1 tunnel test section (elevation view)

a Airflow.

Figure 1 — Orientation A

3.1.9
orientation B
orientation with the airflow perpendicular to both the waterway axis and the plane of the frame arms and with the heat responsive element downstream of the frame arms

Note 1 to entry: See Figure 2.



Key

1 tunnel test section (elevation view)

[a] Airflow.

Figure 2 — Orientation B

3.1.10
protective covers
protective caps or straps intended to provide temporary protection for *sprinklers* (3.1.13) during shipping, handling and installation

3.1.11
response time index
RTI
measure of sprinkler sensitivity determined by Formula (1)

$$RTI = t\sqrt{u} \tag{1}$$

where

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

u is the gas velocity, in meters per second.

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

3.1.12
service load
combined force exerted on the sprinkler body by the *assembly load* (3.1.2) of the *sprinkler* (3.1.13) and the equivalent force of the rated pressure on the inlet

3.1.13
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

Note 1 to entry: These devices may sometimes be referred to as a sprinkler head.

3.1.14
standard orientation
orientation that produces the shortest response time with the axis of the sprinkler inlet perpendicular to the airflow

Note 1 to entry: In the case of symmetrical heat-responsive elements, standard orientation is with the airflow 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 airflow perpendicular to both the waterway axis and the plane of the frame arms which produces the shortest response time.

3.2 Types of sprinklers according to type of responsive element

3.2.1
electrically activated sprinkler
EAS
sprinkler (3.1.13) that is equipped with an integral means of activation using electricity

3.2.2
sprinklers with monitoring of activation
SMA
sprinkler (3.1.13) that is equipped with an integral means of monitoring of activation using electricity

3.2.3
electrically activated sprinkler with monitoring of activation
EAS-M
sprinkler (3.1.13) that is equipped with an integral means of activation using electricity and monitoring of activation

3.2.4
fusible element sprinkler
sprinkler (3.1.13) that opens under the influence of heat by the melting of a component

3.2.5
glass bulb sprinkler
sprinkler (3.1.13) 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 sprinklers according to type of water distribution

3.3.1
conventional sprinkler
C
sprinkler (3.1.13) giving spherical water distribution directed downward and at the ceiling for a definite protection area such that 40 % to 60 % of the total water flow is initially directed downward

3.3.2
flat spray sprinkler
F
sprinkler (3.1.13) giving water distribution directed downward for a definite protection area such that 85 % to 100 % of the total water flow is initially directed downward with a wider spray angle than expected with a *spray sprinkler* (3.3.3)

Note 1 to entry: This type of sprinkler is used in storage racks and other shallow areas in some countries.

3.3.3
spray sprinkler
S
sprinkler (3.1.13) giving paraboloid water distribution directed downward for a definite protection area such that 80 % to 100 % of the total water flow is initially directed downward

3.3.4
domestic sprinkler
D
sprinkler (3.1.13) intended to provide control of fire in domestic occupancies

3.3.5
extended coverage sprinkler
EC
sprinkler (3.1.13) with a specified area of coverage which is larger than the standard sprinkler coverage areas