SLOVENSKI STANDARD
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Vgrajene naprave za gašenje - Sestavni deli sprinklerskih sistemov in sistemov s pršečo vodo - 13. del: Sprinklerji ESFR

Fixed firefighting systems - Components for sprinkler and water spray systems - Part 13: ESFR sprinklers

Ortsfeste Brandbekämpfungsanlagen - Bauteile für Sprinkler- und Sprühwasseranlagen - Teil 13: ESFR-Sprinkler

Installations fixes de lutte contre l'incendie - Composants des systèmes d'extinction du type sprinkleur et à pulvérisation d'eau - Partie 13 : Sprinkleurs ESFR

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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European foreword

This document (prEN 12259-13:2021) has been prepared by Technical Committee CEN/TC 191 “Fixed firefighting systems”, the secretariat of which is held by BSI.

This document is currently submitted to the CEN Enquiry.

EN 12259, *Fixed firefighting systems - Components for sprinkler and water spray systems*, consists of the following parts:

— *Part 1: Sprinklers;*

— *Part 2: Wet alarm valve assemblies;*

— *Part 3: Dry alarm valve assemblies;*

— *Part 4: Water motor alarms;*

— *Part 5: Water flow detectors;*

— *Part 9: Deluge alarm valves;*

— *Part 12: Pumps;*

— *Part 13: ESFR sprinklers;*

— *Part 14: Sprinklers for residential applications.*

1 Scope

This document specifies requirements and test methods for early suppression and fast response (ESFR) sprinklers with a nominal discharge coefficient of 200 (pendent and upright), 240 (pendent and upright), 320 (pendent), 360 (pendent), 400 (pendent) and 480 (pendent) l/min/(bar)$^{1/2}$.

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.

EN 12845, *Fixed firefighting systems - Automatic sprinkler systems - Design, installation and maintenance*

EN 12259, *Fixed firefighting systems - Components for sprinkler and water spray systems*

EN 60751, *Industrial platinum resistance thermometers and platinum temperature sensors*

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

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 12845, EN 12259 and the following apply.

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

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

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

3.1
actual delivered density
ADD
measure of the rate at which water is actually deposited from an operating sprinkler type device(s) onto the top horizontal surface of a burning combustible array

Note 1 to entry: ADD is expressed in l/min/m^2.

3.2
service load
measure of the force applied to the sprinkler frame due to assembly of the operating parts, plus the equivalent force resulting from the maximum rated inlet pressure

3.3
conductivity
C-factor
measure of the conductance between the sprinkler's heat responsive element and the water filled fitting

Note 1 to entry: Conductivity is expressed in (m/s)$^{1/2}$.

3.5
mean design service load
sprinkler manufacturer's specified and assured highest mean load applied on the operating element at the maximum rated inlet pressure

3.6
cartoned expanded plastic
commodity product consisting of expanded polystyrene plastic food service trays (or meat trays) packaged in single-wall corrugated cartons

Note 1 to entry: Each carton contains 200 plastic trays arranged in four stacks of 50 trays each with a density of 0,038 g/cm^3. Typical trays weigh approximately 15,25 g each, measure approximately 270 mm × 270 mm × 5 mm thick and consists of expanded foam plastic. Each carton measures 530 mm × 530 mm × 510 mm, shall have a moisture content of between 3,8 % and 7,4 % and weigh 4 kg when filled with the plastic trays. Each pallet load consists of eight cartons placed in a 2 × 2 × 2 array upon a 1 070 mm × 1 070 mm × 130 mm two-way, slatted deck hardwood pallet. The pallet shall be minimum 90 % white, red or black oak, with an 8 % to 10 % moisture content.

3.7
standard plastic test commodity
product of cartoned, unexpanded, rigid crystalline, polystyrene jars

Note 1 to entry: Measuring 89 mm in diameter, 91,44 mm high and 1,42 mm thick (with a volume of 0,47 l), packaged in compartmented, single wall, cardboard cartons measuring 530 mm × 530mm × 510 mm. Jars are arranged in five layers, 25 per layer giving total of 125. Eight cartons are stacked two wide by two deep by two high; on a two-way, slatted deck hardwood pallet measuring 1070 mm × 1 070 mm × 1 300 mm.

3.8
fusible link sprinkler
sprinkler which opens when an element provided for that purpose melts at a prescribed temperature

3.9
glass bulb sprinkler
sprinkler which opens when a liquid-filled glass bulb bursts at a prescribed temperature

3.10
lodgement
malfunction in the operation of a sprinkler which, when operated under a typical system water pressure, experiences the hang-up of an operating part on, or between, the frame, deflector and/or compression screw, adversely affecting the water distribution for a period in excess of ten seconds

Note 1 to entry: A momentary hesitation of an operating part to clear itself from temporary contact with the frame, deflector and/or compression screw does not constitute a lodgement.

3.11
heat responsive element
component of a sprinkler assembly that, when subjected to the influence of heat, ruptures, bursts or otherwise functions, causing water to be discharged through the sprinkler orifice

3.12
leak point
pressure at which there is leakage of water from the sprinkler in excess of one drop per minute

3.14
operating temperature
temperature in degrees at which the heat responsive element of a sprinkler operates when subjected to a controlled rate-of-temperature-rise liquid bath

3.15
orientation 'A'
plunge tunnel condition in which the sprinkler is situated such that the air flow is perpendicular to both the waterway axis and the plane of the frame arms and the heat responsive element is upstream of the frame arms

3.16
orientation 'B'
plunge tunnel condition in which the sprinkler is situated such that the air flow is perpendicular to both the waterway axis and the plane of the frame arms and the heat responsive element is downstream of the frame arms

3.17
orientation 'C'
plunge tunnel condition in which the sprinkler is situated such that the axis of the sprinkler inlet is parallel to the air flow and the deflector faces and is perpendicular to the air flow

3.18
orifice
opening in a sprinkler body through which the water is discharged

3.19
pendent sprinkler
sprinkler in which the nozzle directs the water downwards

3.20
response time index
RTI
measure of the thermal sensitivity of the sprinkler

Note 1 to entry: RTI is expressed in $(ms)^{1/2}$.

3.21
service pressure
working hydrostatic pressure of a sprinkler system

3.22
strutting
partial fracture of a glass bulb or partial rupture of a fusible link heat responsive element which does not result in sprinkler operation

3.23
upright sprinkler
sprinkler in which the nozzle directs the water upwards

3.24
weep point
leak point

pressure at which any visible leakage of water is detected

3.25
aisle jump
propagation of fire through radiant heat from the commodity immediately surrounding the ignition location to the remote commodity which is separated from the main array by a 1,2 m aisle

3.26
cartoned expanded plastic commodity
commodity product consisting of expanded polystyrene plastic food service trays packaged in single-wall corrugated cartons

Note 1 to entry: Each carton contains 200 plastic trays arranged in four stacks of 50 trays each. Typical trays weigh approximately 15 g each, measure approximately 27 cm × 27 cm × 0,5 cm thick and consist of expanded foam plastic. Each carton measures 53 cm × 53 cm × 51 cm and weighs 4,0 kg when filled with the plastic trays. Each pallet load consists of eight cartons placed in a 2 ×2 × 2 array upon a 107 cm × 107 cm × 13 cm two-way, slatted deck hardwood pallet.

3.27
cartoned unexpanded plastic commodity
commodity product of cartoned unexpanded plastic, consisting of rigid crystalline polystyrene jars (empty, approximately 473 ml) packaged in compartmented, single wall, corrugated cartons measuring 53 cm × 53 cm × 51 cm

Note 1 to entry: Jars are arranged in five layers, 25 per layer for a total of 125. Each pallet load consists of eight cartons, arranged in a 2 × 2 × 2 array upon a 107 cm × 107 cm × 13 cm two-way, slatted deck hardwood pallet.

3.28
mean bulb strength
glass bulb mean bulb strength for any batch of 55 or more bulbs

3.29
mean design bulb strength
glass bulb manufacturer's specified and assured lowest mean bulb strength for any batch of 55 or more bulbs

3.30
design lower tolerance limit
DLTL
glass bulb manufacturer's specified and assured lowest lower tolerance limit

3.31
lower tolerance limit
LTL
glass bulb lowest strength determined by test and statistical analysis of a batch of 55 or more bulbs

3.32
design upper tolerance limit
DUTL
sprinkler manufacturer's specified and assured highest upper tolerance limit

3.33
upper tolerance limit
UTL
highest service load determined by test and statistical analysis of a batch of 5 or more sprinklers

4 Assessment methods and criteria

4.1 Connections

4.1.1 Assessment method

The sprinkler connection, e.g. the thread size shall be assessed by measurements.

4.1.2 Criteria

The thread connections of the sprinkler shall be in accordance with ISO 7-1 or shall be grooved connections. Alternative connection methods that have been tested and validated for use in fire sprinkler systems also fulfil 4.1.2.

4.2 Hydrostatic strength and hydraulic leak resistance

4.2.1 Assessment method

Subject the sprinklers to water pressure of (30 ± 1) bar at the inlet. Increase the pressure from 0 to (30 ± 1) bar at a rate not exceeding 1 bar/s, maintain the pressure at (30 ± 1) bar for a period of 3^{+1}_{0} min and then allow it to fall to 0 bar. After the pressure has dropped to 0 bar, increase it to (0,5 ± 0,1) bar in not more than 5 s. Maintain this pressure for 15^{+5}_{0} s, and then increase it to (10 ± 0,5) bar at a rate not exceeding 1 bar/s and maintain it for 15^{+5}_{0} s. Examine the sprinkler for evidence of leakage during the test.

After testing, each sample shall be further subjected to a gradually increasing hydrostatic pressure to 48,3 bar ± 3 % at a rate not to exceed 20,7 bar ± 3 % per second. The test pressure shall be maintained for $1^{+0,1}_{0}$ min. If leakage at the orifice prevents testing at 48,2 bar ± 3 %, the maximum attainable test pressure shall be maintained for $1^{+0,1}_{0}$ min. Leakage at the orifice above a hydrostatic pressure of 34,5 bar ± 3 % shall be deemed acceptable.

4.2.2 Criteria

No visible hydraulic leakage at 30 bar for a period of 3 min and no rupture with an internal hydrostatic pressure of up to 48,3 bar for a period of 1 min.

4.3 Pneumatic leak resistance

4.3.1 Assessment method

Four previously untested sprinklers shall be individually conditioned at (-29 ± 6) °C for $24^{+0,1}_{0}$ h. Each sample shall then be pneumatically pressurized to 2,1 ± 0,1 bar, immersed in glycol liquid conditioned to (-29 ± 6) °C and observed for $5^{+0,1}_{0}$ min.

4.3.2 Criteria

No visible pneumatic leakage.

4.4 Leakage resistance

4.4.1 Assessment method

Five previously untested samples shall be hydrostatically tested to confirm that there are no weep or leak points at, or below, 34,5 bar ± 3 %. The samples shall then be installed on a water-filled test apparatus which is to be maintained at ambient temperature and at a constant pressure of 20,7 bar ± 3 % for $30^{+0,25}_{0}$ days. The samples shall be visually examined weekly during the test period for evidence of leakage at the seal.

4.4.2 Criteria

No visible leakage at 20,7 bar for a period of 30 days and no evidence of distortion or physical damage.

4.5 Release of the sprinkler at minimum operating pressure

4.5.1 Assessment method

Ten previously untested sprinklers shall be installed in their intended orientation, subjected to an inlet water pressure of 0,35 bar ± 3 % and operated using a suitable heat source. If a sample does not operate fully as described above, the pressure shall be slowly increased to determine the actual minimum operating pressure.

4.5.2 Criteria

All parts which are intended to prohibit the discharge or leakage of water have cleared the exit of the waterway within 5^{+5}_{0} s.

4.6 Release under temperature

4.6.1 Assessment method

4.6.1.1 Apparatus

Laboratory temperature measuring device having an accuracy of ± 0,25 % of the nominal rating, calibrated to a depth of 40 mm immersion, for determining temperatures of liquids in bath tests and operating temperatures. The thermally sensitive part of the sensor (e.g. bulb of a thermometer) shall be held level with the centre of the sprinkler operating parts (fusible element). To control the temperature in the thermal bath, a PT100 sensor in accordance to EN 60751 shall be used.

For sprinklers with a nominal operating temperature less than or equal to 80 °C a liquid bath of demineralized water shall be used. For sprinklers with higher rated elements a liquid bath of glycerine, vegetable oil or synthetic oil shall be used.

NOTE An example of a typical bath is given in Figure A.1.

4.6.1.2 Procedure

A total of 10 sprinklers is to be tested. Heat sprinklers in a liquid bath from a temperature of (20 ± 5) °C to an intermediate temperature of 11,1 ± 1,1°C below their nominal operating temperature. The rate of temperature increase shall not exceed 20^{+2}_{0} °C per minute. Maintain the intermediate temperature for 10^{+1}_{0} min. Then increase the temperature at a rate of (0,5 ± 0,1) °C per minute until the sprinklers operate or up to 2,0 °C above the upper operating limit.

Determine the nominal operating temperature with temperature measuring device having an accuracy of ± 0,25 % of the nominal temperature rating.

The sprinklers shall be located in the vertical position and totally covered by the liquid to a depth of at least 5 mm. The geometric centre of the fusible element shall be located not less than 35 mm below the liquid surface and in alignment with the temperature sensing device. The temperature deviation within the test zone should be within 0,25 °C.

The preferred location of the geometric centre of the fusible element and temperature measuring device should be (40 ± 5) mm below the liquid surface.

If strutting occurs during the test the air bath test (see 4.6.1.3) shall be performed.

4.6.1.3 Air bath test

Fifty previously untested sprinklers shall be placed on their threaded inlets in a programmable oven circulating air at ambient temperature. The temperature in the oven shall be steadily raised to 11,1 ± 1,1°C below the nominal temperature rating of the sprinklers over a $20^{+0,1}_{0}$ minute period. Once this temperature is reached, the oven shall be maintained at constant temperature for a period of 60 ± 5 min. The temperature shall then be raised at a constant rate of 0,5 ± 0,3 °C per minute until the temperature reaches 22 ± 2,8 °C above the nominal temperature rating of the sprinklers.

4.6.2 Criteria

Full rupture of heat responsive element in liquid bath (see 4.6.1.2) within a temperature range of t ± (0,035 t +0,62)] °C, where 't' is the nominal operating temperature, resulting in sprinkler operation.

When subjected to the air bath test no partial fracture of a glass bulb or no partial rupture of a fusible link (i.e. strutting) shall occur.

4.7 Complete operation

4.7.1 Assessment method

Samples shall be selected in accordance with Table 1 and shall be individually installed in their intended installation position, on a pipe manifold as shown in Annex B. Each sample shall be subjected to an inlet water pressure in accordance with 4.7.2, operated using a suitable open flame heat source, and observed for complete and proper functioning. A total of 80 sprinklers shall be tested.

Five samples shall be tested at each pressure with the pipe manifold configured for double-fed flow, and the remaining samples shall be tested with single-fed flow as shown in Annex B.

Table 1 — Lodgement

Pressure [a]	Number of samples
0,5 bar	10
1,7 bar	10
3,4 bar	10
5,2 bar	10
6,9 bar	10
8,6 bar	10
10,3 bar	10
12,1 bar	10
[a] A tolerance of ± 5% applies to all pressures specified in the table.	

4.7.2 Criteria

Upon activation of each sample, the discharge coefficient shall be measured to verify complete operation.

4.8 Size of water passageways

4.8.1 Assessment method

Pass a sphere of diameter 9,5 mm through each water passage in the sprinkler. If it does not pass check if the sprinkler is fitted with an additional strainer.

4.8.2 Criteria

The sphere passes freely through each water passage or the sprinkler is fitted with an additional strainer.

4.9 Sprinkler temperature identification

4.9.1 Assessment method

4.9.1.1 Glass bulb sprinklers

Perform visual inspection to determine the colour of the liquid inside the bulb.

4.9.1.2 Fusible link sprinklers

Perform visual inspection to determine colour painted on frame arm surface. Perform visual inspection to ensure at least 50 % of frame arm surface is painted the colour, and that paint is visible from all directions. If percentage of painted colour surface is in doubt, optical measurement shall be applied.

4.9.2 Criteria

Sprinklers shall be in accordance with Table 2. In addition, fusible link sprinklers are painted for at least 50 % of each frame arm surface and the paint is visible from all directions.

Table 2 — Nominal operating temperatures and colour codes of EN 12259-1:1999 + A1:2001

Glass bulb sprinklers		Fusible link sprinklers	
Nominal operating temperature ° C	Liquid colour code	Nominal operating temperature within range ° C	Yoke arms colour code
57	orange	57 to 77	uncoloured
68	red	80 to 107	white
79	yellow	121 to 149	blue
93	green	163 to 191	red
100	green	204 to 246	green
121	blue	260 to 302	orange
141	blue	320 to 343	black
163	mauve	-	-
182	mauve	-	-
204	black	-	-
227	black	-	-
260	black	-	-
286	black	-	-
343	black	-	-

4.10 Distribution of extinguishing media

4.10.1 Assessment method

At least one sample set is tested to the values of Table C.1 for K200 pendent sprinklers. All 3,4 bar tests are performed on a system fed from both directions (double feed). All 5,2 bar tests are performed on a system fed from one direction (single feed), except for the two sprinkler, single pipe tests which are performed on a double feed system.

At least one sample set is tested to the values of Table C.2 for K240 pendent sprinklers. All 2,4 bar tests are performed on a system fed from both directions (double feed). All 3,4 bar tests are performed on a system fed from one direction (single feed), except for the two sprinkler, single pipe tests which are performed on a double feed system.

Prior to the test, all samples shall be operated using a suitable heat source to remove the heat responsive assembly. The sprinkler test area shall be in accordance with Figures C.1 to C.5. The water distribution collection areas shall be in accordance with Figure C.6. The test apparatus shall be in a room of sufficient volume so as to minimise the entrainment of additional water spray. No significant drafts or other air movement shall be allowed into, or out of, the test area.

The water collection system, Figure C.6, shall be covered until the required pressure has been obtained. At that time, the cover shall be quickly removed in such a manner as to not cause water collected on top of the cover to be deposited into the collection pans. The test shall be conducted for $5^{+0,1}_{0}$ min, or until the water level in the fullest collection bucket reaches its maximum measurable level, whichever occurs first. At the conclusion of the test, the cover shall be immediately placed over the collection pans to prevent further water collection.