



# SLOVENSKI STANDARD

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### Vgrajene naprave za gašenje - Avtomatski sprinklerski sistemi - 2. del: Projektiranje in vgradnja sprinklerskih sistemov ESFR in CMSA

Fixed firefighting systems - Automatic sprinkler systems - Part 2: Design and installation of ESFR and CMSA sprinkler systems

Ortsfeste Feuerlöschanlagen– Automatische Sprinkleranlagen– Teil2: Auslegung und Installation von Sprinklern zur frühzeitigen Unterdrückung und schnellen Reaktion

Installations fixes de lutte contre l'incendie - Systèmes d'extinction automatique du type sprinkleur - Partie 2 : Conception et installation de système de sprinkleurs ESFR et CMSA

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## Fixed firefighting systems - Automatic sprinkler systems - Part 2: Design and installation of ESFR and CMSA sprinkler systems

Installations fixes de lutte contre l'incendie - Systèmes  
d'extinction automatique du type sprinkleur - Partie 2 :  
Conception et installation de système de sprinkleurs  
ESFR et CMSA

Ortsfeste Feuerlöschanlagen- Automatische  
Sprinkleranlagen- Teil2: Auslegung und Installation  
von Sprinklern zur frühzeitigen Unterdrückung und  
schnellen Reaktion

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## European foreword

This document (prEN 12845-2:2022) 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.

This document is included in a series of European standards:

CEN/TS 14816, *Fixed firefighting systems - Water spray systems - Design, installation and maintenance*;

CEN/TS 17551, *Fixed firefighting systems - Automatic sprinkler systems - Guidance for earthquake bracing*;

EN 671 (all parts), *Fixed firefighting systems - Hose systems*;

EN 12094 (all parts), *Fixed firefighting systems - Components for gas extinguishing systems*;

EN 12101 (all parts), *Smoke and heat control systems*;

EN 12259 (all parts), *Fixed firefighting systems - Components for sprinkler and water spray systems*;

EN 12416 (all parts), *Fixed firefighting systems - Powder systems*;

EN 12845-1, *Fixed firefighting systems - Automatic sprinkler systems - Design, installation and maintenance*;

EN 13565 (all parts), *Fixed firefighting systems - Foam systems*;

EN 14972 (all parts), *Fixed firefighting systems - Water mist systems*;

EN 17451, *Fixed firefighting systems - Automatic sprinkler systems - Design, assembly, installation and commissioning of pump sets*.

## Introduction

ESFR (early suppression fast response) sprinkler protection to this standard utilizes sprinklers in accordance with EN 12259-13 operating in suppression mode, i.e. which have the capability of markedly suppressing (reducing the heat release rate of) fires typically within storage risks. ESFR sprinkler protection tends to be used in high hazard storage scenarios to provide effective ceiling-only sprinkler protection (although ESFR protection schemes utilizing in-rack sprinkler heads do also exist). Designs are typically specified in terms of numbers of heads operating and required head pressures.

CMSA (Control Mode Specific Application) sprinkler protection to this standard utilizes sprinklers operating in control mode, i.e. which have the capability of controlling (limiting the heat release rate) fires within storage risks. CMSA sprinkler protection tends to be used in a variety of especially challenging high hazard storage scenarios, where alternative approaches are not considered suitable. Designs are typically specified in terms of numbers of heads operating and required head pressures.

CMDA (control mode density area) sprinkler protection to EN 12845-1 typically utilizes sprinklers in accordance with EN 12259-1 operating in control mode, i.e. which have the capability of controlling (limiting the heat release rate) fires in residential, commercial, industrial or storage applications. CMDA sprinkler protection tends to be used to good effect in a wide variety of built environment scenarios. Designs are typically specified in terms of a minimum application rate of water “density” (mm/min) to be applied over a specified area of operation “area”.

All three approaches are designed to provide rapid and effective control of a fire. The selection of the most appropriate option is best entrusted to competent personnel. In all cases, it is expected that final extinguishment to be performed by the Fire and Rescue Service will be necessary.

Both sprinkler types ESFR and CMSA were developed for storage fires. The ESFR sprinkler concept is a technical innovation developed from CMSA sprinklers. ESFR and CMSA sprinkler designs are less able to cope with adverse design features and non-compliances (e.g. those caused by incorrect design or change in practice in the protected premises over time). The risk that design and installation deviations from this standard are likely to result in a total system failure is highlighted, as is the particular importance of complying with all the requirements of this standard, without exception.



## 1 Scope

This document specifies requirements for the design and installation of early suppression fast response (ESFR) and control mode specific application (CMSA) sprinklers in automatic sprinkler systems (in accordance with this standard and additionally EN 12845-1).

This document does not cover all legislative requirements. In certain countries, specific national regulations can apply and take precedence over this document. Users of this document are advised to inform themselves of the applicability or non-applicability for this document by their national responsible authorities.

## 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.

prEN 12845-1:2021, *Fixed firefighting systems — Automatic sprinkler systems — Design, installation and maintenance*

EN 12259-1, *Fixed firefighting systems — Components for sprinkler and water spray systems — Part 1: Sprinklers*

EN 12259-13, *Fixed firefighting systems — Components for sprinkler and water spray systems — Part 13: ESFR sprinklers*

## 3 Terms, definitions, symbols and abbreviated terms

### 3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 12845-1, EN 12259-1, EN 12259-13 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>

#### 3.1.1

##### **open-top containers**

boxes having an open on top and which can retain water

Note 1 to entry: Containers that have five sides will collect and hold up water that has been discharged from operating ceiling-level sprinklers thus delaying the water delivery down through the flue spaces where it is needed to either suppress or control the fire.

Note 2 to entry: Containers with less than five full-height sides redirect the discharged water from operating sprinklers so that the water delivery down through the flues is not uniform. Five-sided, open-top containers made of wood, cardboard, plastic, or other combustible material promote faster horizontal fire spread compared to closed-top combustible containers.

Note 3 to entry: Non-combustible open-top containers help promote faster horizontal fire spread if combustible containers are located below them within a storage rack. See Clause 4 when open-top containers are present within a storage rack arrangement.

**prEN 12845-2:2022 (E)****3.1.2****closed array**

roll paper storage arrangement with flues no more than 50 mm in one direction and no more than 25 mm in the other direction

## 3.1.3

**standard array**

roll paper storage arrangement with flues no more than 25 mm in one direction but more than 50 mm in the other direction

## 3.1.4

**open array**

roll paper storage arrangement where air movement through the pile is enhanced because of vertical flues larger than those in standard or closed array

## 3.1.5

**banded roll paper storage**

rolls provided with a circumferential steel strap of 10 mm or wider at each end of the roll

**3.2 Symbols and abbreviated terms**

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

ESFR	early suppression fast response
CMSA	control mode specific application

**4 General**

ESFR sprinkler shall be used in wet installations only. CMSA sprinkler may be used in wet and dry installations.

Open top containers shall not be used in storage hazards protected by ESFR and CMSA sprinklers, unless otherwise specifically stated in a clause in this standard. Open-top non-combustible containers can be treated as closed-top non-combustible containers when:

- all of the storage located below the open-top non-combustible containers is either non-combustible or in non-combustible containers, or
- all of the open-top non-combustible containers are located on the bottom tier of the storage rack.

For an overview of the sequence of tasks and their corresponding clauses see Table 1.

**Table 1 — Overview of the sequence of tasks and their corresponding clauses**

Tasks	Clauses
Contract planning and documentation	prEN 12845-1:2021, Clause 4
Extent of protection	prEN 12845-1:2021, Clause 5
Hazard review, identification and classification	prEN 12845-1:2021, Clauses 6, 7 and 8
Hydraulic design criteria	Clause 6
Pipe sizing, layout and hydraulic calculations	prEN 12845-1:2021, Clause 12
Sprinkler system components	prEN 12845-1:2021, Clause 13
Installation type and size	prEN 12845-1:2021, 14.1.3 and Clause 6
Spacing and location of sprinklers	5.1.3, 5.2, 5.3 and 6.6.2
Obstruction to discharge pattern of sprinklers	5.3
Valves	prEN 12845-1:2021, Clause 17
Pipework and pipe supports	prEN 12845-1:2021, Clause 18
Alarms and alarm devices	prEN 12845-1:2021, Clause 19
Signs, notices, and information	prEN 12845-1:2021, Clause 20
Alarm generation, monitoring and transmission to remote manned station	prEN 12845-1:2021, Clause 21
Water supplies	6.4, prEN 12845-1:2021, 22.1.2, 22.1.3, 22.2, 22.3, 22.4, 22.5
Type of water supply	prEN 12845-1:2021, Clause 23
Pumps	prEN 12845-1:2021, Clause 24
Commissioning and first inspection	prEN 12845-1:2021, Clause 25
Replacement sprinklers	prEN 12845-1:2021, Clause 26
Maintenance and inspection	prEN 12845-1:2021, Clause 27

## 5 Installation requirements

### 5.1 Sprinkler type, spacing, clearance and nominal operating temperature

#### 5.1.1 Sprinkler type

ESFR pendent, dry pendent or upright sprinklers in accordance with EN 12259-13 shall be used. The design criteria provided in 6.6 are applicable under the condition that the sprinkler has been successfully tested for the building height, storage height, goods and storage type that are intended.

**NOTE** The design criteria specified in 6.6 reflects the test results of full-scale fire tests conducted at various fire test laboratories in line with their test requirements to support various design guidelines. 6.6 therefore contains information which can seem to overlap or contradict but actually reflects the specific data available.

CMSA pendent, dry pendent or upright sprinklers in accordance to their manufacturer's specification shall be used. In dry CMSA systems pendent type sprinkler shall not be used.

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Sprinkler nominal operating temperature and response characteristic are specified in the design tables in Clause 6.

NOTE Typically ESFR has a nominal operating temperature of 68°C to 74°C and is fast response. CMSA typically has a nominal operating temperature of 68 °C to 74 °C except for dry systems where it is usually a nominal operating temperature of 141°C.

**5.1.2 Sprinkler installation type**

All requirements for wet or dry installations given in prEN 12845-1 shall be followed.

**5.1.3 Sprinkler spacing, location and positioning relative to roof and ceilings****5.1.3.1 ESFR sprinkler spacing and location**

The minimum distance between two sprinklers shall be 2,4 m. The maximum spacing between two adjacent sprinklers shall be 3,7 m in building height not exceeding 9,1 m and 3,1 m for building height exceeding 9,1 m. The maximum area per sprinkler shall be 9,3 m<sup>2</sup>. The minimum area per sprinkler shall be 6 m<sup>2</sup>.

**5.1.3.2 CMSA sprinkler spacing and location**

The minimum distance between two sprinklers shall be 2,4 m. The maximum spacing between two adjacent sprinklers shall be 3,7 m except for combustible obstructed ceiling construction where it shall be 3,1 m.

The maximum area per sprinkler shall be 12 m<sup>2</sup> for STC 1 where the ceiling corresponds the following:

- unobstructed and non-combustible;
- obstructed and non-combustible;
- unobstructed and combustible.

For all other cases it shall be 9,3 m<sup>2</sup>.

The minimum area per sprinkler shall be 6 m<sup>2</sup> except for the following cases where the minimum area per sprinkler shall be 7,5 m<sup>2</sup>:

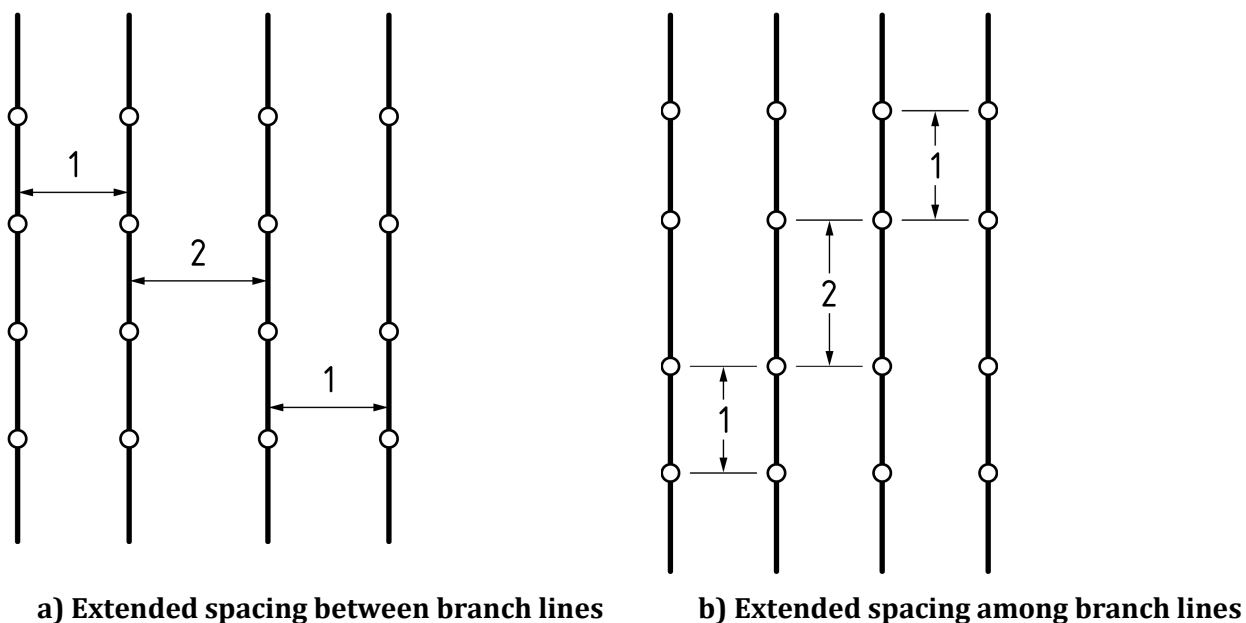
- sprinkler with a k-factor of 160;
- upright standard response sprinkler with any other k-factor;
- pendent standard response sprinkler with any other k factor in a building exceeding 9,1 m.

**5.1.3.3 Exception for spacing and area of coverage due to obstruction**

The maximum linear spacing of a sprinkler, as well as its maximum area spacing, may be increased by 0,3 m and 1,4 m<sup>2</sup> respectively in order to avoid obstructing sprinkler discharge. Note that the extension in sprinkler spacing outlined above shall only apply to:

- a maximum of two adjacent sprinklers on the same range pipe, or
- a maximum of two adjacent range pipes.

See Figure 1 for a diagram of this arrangement.

**Key**

- 1 standard spacing
- 2 extended spacing

**Figure 1 — Maximum increase in linear and area spacing to avoid obstructing sprinkler discharge**

### 5.1.3.4 Vertical distance from the ceiling to sprinkler

#### 5.1.3.4.1 General

Vertical distance shall be measured perpendicularly to the floor, between the sprinkler's deflector to the uppermost portion of the ceiling.

Exceptionally, for corrugated metal deck roofs up to 75 mm in depth, the distance to the deflector shall be measured from the bottom of the flange. In other cases, the measurement shall be made from the top of the flange.

#### 5.1.3.4.2 Distance from ceiling to sprinkler deflector

Sprinklers under unobstructed or obstructed ceiling construction shall be installed so that the deflector is at least 100 mm below ceiling. The maximum vertical distance of the deflector below a ceiling shall be in accordance with Table 2.

**Table 2 —Maximum allowable distance of sprinkler deflector**

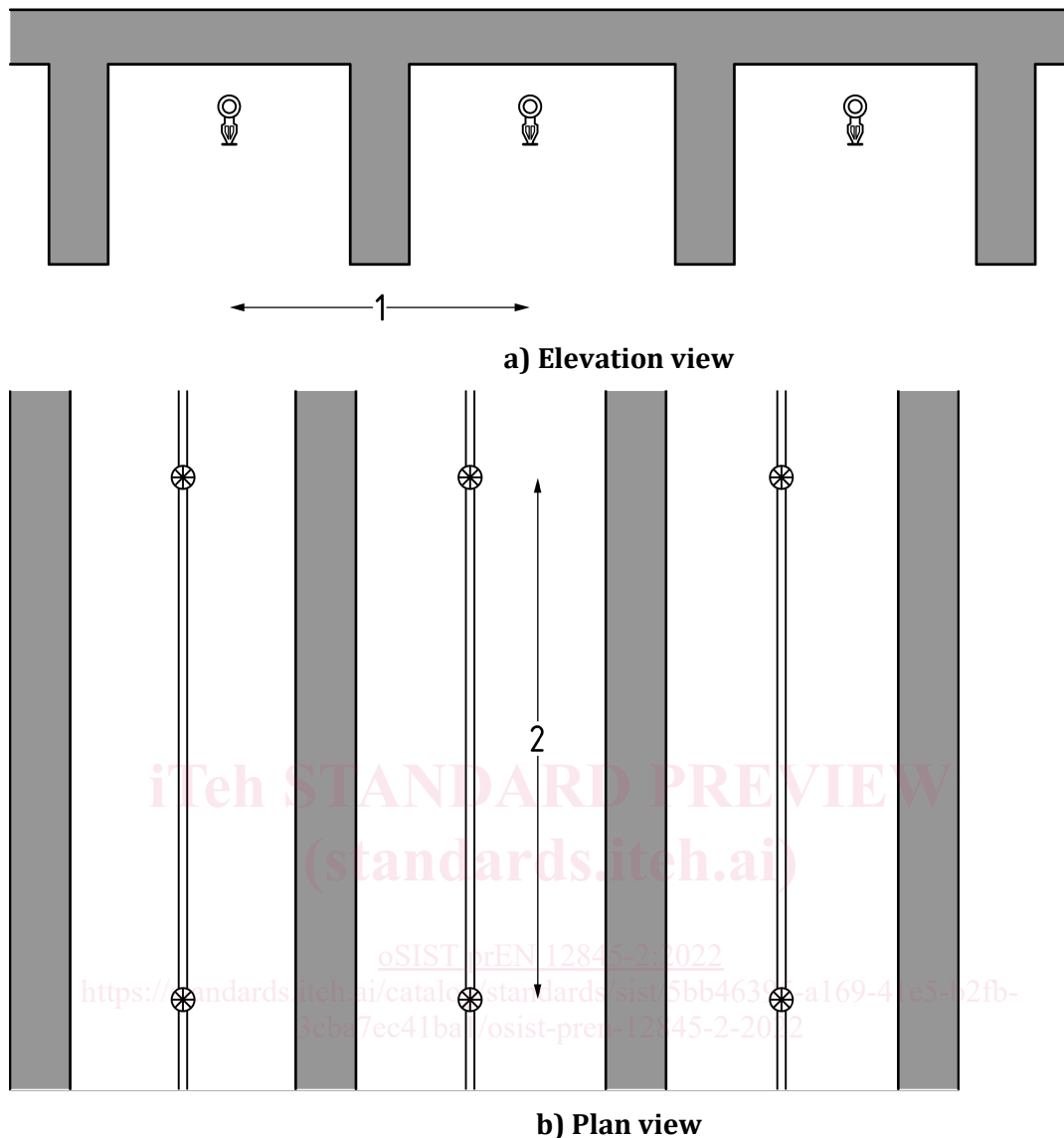
k-factor	ESFR obstructed or unobstructed construction	CMSA obstructed construction	CMSA unobstructed construction
160	-	300	200
200	350	-	-
240	350	300	200
280	-	300	300
320	450	-	-
360	450	300	300
400	350	-	-
480	450	-	-
NOTE Unless specified differently in Clause 6.			

**5.1.3.4.3 Obstructed ceiling construction****5.1.3.4.3.1 Location of sprinkler in channels**

ESFR sprinklers shall be installed in every channel bay formed by obstructed ceiling construction except when the following criteria are met:

- solid structural members extend up to a maximum 300 mm below the ceiling; and
- sprinklers are located below the bottom of the structural members.

Sprinklers shall be installed in every channel in accordance with the minimum and maximum area of coverage (see 5.1.3.1). The minimum linear spacing between range pipes shall not apply to the sprinklers located in adjacent channel bays. See Figure 2.

**Key**

- 1 Sprinkler spacing less than recommended minimum
- 2 Sprinkler spacing per recommended linear spacing

**Figure 2 — Spacing of sprinklers when installed in every bay channel formed by solid structural members**

CMSA sprinklers with a standard response element are not necessary in every channel bay formed by obstructed ceiling construction and can have a maximum spacing in accordance with 5.1.3.2 when the following criteria are fulfilled:

- the deflector shall be installed in a vertical distance of 25 to 150 mm below the solid structural member. If a solid structural member extends more than 300 mm below the ceiling, formed channel bays shall not exceed 28 m<sup>2</sup> in area and shall not be horizontally wider than 0,9 m; or
- the deflector shall be installed 25 to 100 mm below the combustible solid structural member if it extends 300 to 525 mm below the ceiling and formed channel bays shall not exceed 28 m<sup>2</sup> in area; or