

English Version

**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

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 191.

If this draft becomes a European Standard, CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

This draft European Standard was established by CEN in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Türkiye and United Kingdom.

Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

**Warning :** This document is not a European Standard. It is distributed for review and comments. It is subject to change without notice and shall not be referred to as a European Standard.



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

**CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels**

# Contents

Page

European foreword .....	5
Introduction .....	6
1 Scope.....	7
2 Normative references.....	7
3 Terms, definitions, symbols and abbreviated terms .....	7
3.1 Terms and definitions .....	7
3.2 Symbols and abbreviated terms.....	8
4 General.....	8
Table 1 — Overview of the sequence of tasks and their corresponding clauses .....	9
5 Installation requirements .....	9
5.1 Sprinkler type, spacing, clearance and nominal operating temperature .....	9
5.1.1 Sprinkler type .....	9
5.1.2 Sprinkler installation type .....	10
5.1.3 Sprinkler spacing, location and positioning relative to roof and ceilings.....	10
Figure 1 — Maximum increase in linear and area spacing to avoid obstructing sprinkler discharge.....	11
Table 2 —Maximum allowable distance of sprinkler deflector .....	12
Figure 2 — Spacing of sprinklers when installed in every bay channel formed by solid structural members .....	13
5.2 Construction and building limitations .....	14
5.2.1 Roof or ceiling slope.....	14
5.2.2 Strength of ceilings, sub-ceilings and suspended ceilings .....	14
5.2.3 Skylights .....	15
5.2.4 Heat and smoke vents or other ceiling vents.....	15
Figure 3 — Quick-response sprinklers installed under automatic smoke and heat vents ....	16
5.2.5 Natural exhaust openings at the ceiling .....	16
Figure 4 — Quick-response sprinklers installed under ceiling-level exhaust devices.....	17
5.2.6 Exhaust openings with or without fans and airflow velocities at ceiling-level sprinklers .....	17
Figure 5 — Sprinklered sub-ceiling below a ceiling vent or fan .....	19
5.2.7 Solid mezzanines, walkways and conveyors.....	19
5.3 Obstruction to discharge pattern of sprinklers.....	19
5.3.1 General.....	19
5.3.2 Obstruction located at or near ceiling.....	19
Figure 6 —Objects near ceiling level not considered obstruction to ESFR and CMSA sprinkler .....	20
Figure 7 — Example or objects at ceiling level considered to obstruct ESFR and CMSA sprinkler .....	20
Figure 8 — Positioning ceiling level Sprinklers when structural members obstruct sprinkler discharge of ESFR and CMSA sprinkler .....	21

Table 3 — Minimum horizontal distance of ceiling objects to avoid obstructing umbrella patterns of sprinklers .....	21
5.3.3 Obstruction entirely below sprinkler deflector level.....	22
Figure 9 — Grouped obstructions.....	22
Table 4 — Installation guidelines to avoid obstructions to inner core distribution pattern of sprinklers .....	23
Figure 10 — Allowed obstructions within discharge pattern of ceiling-level ESFR sprinklers .....	24
Table 5 — Supplementary sprinklers below obstructions.....	25
Figure 11 — Supplementary sprinklers below obstructions.....	25
Figure 12 — Additional sprinklers installed below flat, continuous, solid obstructions from over 0,6 m wide to 3,0 m wide .....	27
Figure 13 — Additional sprinklers installed below non-flat, continuous, solid obstructions from over 0,6 m wide to 3,0 m wide.....	27
Figure 14 — View of additional sprinklers installed below non-flat, non-continuous, or non-solid obstructions over 0,6 m and up to 3,0 m wide without a flat, continuous, solid barrier provided .....	29
Figure 15 — Additional sprinklers installed below non-flat, non-continuous, or non-solid obstructions over 0,6 m and up to 3,0 m wide without a flat, continuous, solid barrier provided.....	30
6 Design considerations.....	31
6.1 General .....	31
6.2 Protection of non-storage occupancies with ESFR and CMSA.....	31
6.3 Sprinkler protection for adjacent areas using a different protection concept .....	31
6.4 Considerations for water demand and water supply .....	32
Table 6 — Water supply duration and shape of design .....	32
6.5 Protection of unheated areas with ESFR.....	33
6.6 Design with ESFR .....	33
6.6.1 Ceiling only protection .....	33
Table 7 — Minimum operating pressure for ESFR sprinklers design for HHS.....	34
Table 8 — Minimum operating pressure for 12 ESFR sprinkler design for rubber tyres .....	38
Table 9 — Minimum operating pressure for 12 ESFR sprinkler design for paper .....	39
6.6.2 ESFR in combination with in-rack .....	39
Table 10 — Ceiling sprinkler system design protection of HHS4 and lower HHS classes in open-frame storage racks under ceilings up to 13,7 m high using K200 and larger, pendent ceiling level ESFR sprinklers.....	41
Figure 16 — Plan view of alternative in-rack sprinkler arrangement for single-row racks up to 0,9 m deep .....	42
Figure 17 — Plan view of alternative in-rack sprinkler arrangement for single-row racks up to 1,8 m deep .....	42
Figure 18 — Plan view of alternative in-rack sprinkler arrangement for single-row racks up to 1,8 m deep located against a wall .....	42
Figure 19 — Plan view of alternative in-rack sprinkler arrangement for double-row racks up to 2,7 m deep .....	43

Figure 20 — Plan view of alternative in-rack sprinkler arrangement for double-row racks up to 3,7 m deep .....	43
Figure 21 — Plan view of alternative in-rack sprinkler arrangement for multiple-row racks .....	43
Table 11 — Number of sprinklers in the in-rack design.....	44
Table 12 — Minimum flow in the modular in-rack design .....	45
Figure 22 — Determining ceiling height.....	46
6.7 Design with CMSA .....	46
6.7.1 General design table .....	46
Table 13 — Design criteria for STC1 storage .....	47
Table 14 — Design criteria for STC4.1, STC4.2 and STC4.3 ceiling only.....	49
Table 15 — Rubber tyres on thread or on side storage .....	52
Table 16 — Heavyweight roll paper storage protection for on-end storage in standard or closed array (excluding on-end storage in an open array).....	52
Table 17 — Medium weight Roll Paper Storage Protection for on-end storage in standard or closed array. (Excluding On-end storage in an open array).....	53
Table 18 — Lightweight roll paper storage protection for on-end storage in standard or closed array (excluding on-end storage in an open array).....	53
Annex A (informative) Extract for determining the hazard classification from EN 12845-1 .....	54
Figure A.1 — Methodology and process of hazard classification.....	55
Figure A.2 — Fire hazard classification process for storage commodities containing plastic .....	56

## 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.