BS EN 12845-2:2024

BSI Standards Publication

Fixed firefighting systems — Automatic sprinkler systems

Part 2: Design and installation of ESFR and CMSA sprinkler systems

Documents
Document Sharing Hub

Full document details: BS EN 12845-2:2024

National foreword

This British Standard is the UK implementation of EN 12845-2:2024.

The UK participation in its preparation was entrusted to Technical Committee FSH/18/2, Sprinkler Systems.

A list of organizations represented on this committee can be obtained on request to its committee manager.

Users are advised that the UK committee has provided some further informative guidance in Annex NA, Application of early suppression fast response (ESFR) sprinklers

Contractual and legal considerations

This publication has been prepared in good faith, however no representation, warranty, assurance or undertaking (express or implied) is or will be made, and no responsibility or liability is or will be accepted by BSI in relation to the adequacy, accuracy, completeness or reasonableness of this publication. All and any such responsibility and liability is expressly disclaimed to the full extent permitted by the law.

This publication is provided as is, and is to be used at the recipient's own risk.

The recipient is advised to consider seeking professional guidance with respect to its use of this publication.

This publication is not intended to constitute a contract. Users are responsible for its correct application.

© The British Standards Institution 2025
Published by BSI Standards Limited 2025

ISBN 978 0 539 20218 2

ICS 13.220.20

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 March 2025.

Amendments/corrigenda issued since publication

Date	Text affected

Documents
Document Sharing Hub

Full document details: BS EN 12845-2:2024

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 12845-2

December 2024

ICS 13.220.20

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 - Teil 2: Auslegung und Installation von Sprinklern zur frühzeitigen Unterdrückung und schnellen Reaktion

This European Standard was approved by CEN on 11 November 2024.

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. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists 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.

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

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

© 2024 CEN All rights of exploitation in any form and by any means reserved worldwide for CEN national Members.

Ref. No. EN 12845-2:2024 E

Documents
Document Sharing Hub

Full document details: BS EN 12845-2:2024

Contents

Page

European foreword 3
Introduction 4
1 Scope 5
2 Normative references 5
3 Terms, definitions, symbols and abbreviated terms 5
3.1 Terms and definitions 5
3.2 Symbols and abbreviated terms 6
4 General 6
5 Installation requirements 7
5.1 Sprinkler type, spacing, clearance and nominal operating temperature 7
5.2 Construction and building limitations 12
5.3 Obstruction to discharge pattern of sprinklers 21
5.4 Additional requirements for protection of HHS5, with 12 sprinkler design 32
6 Design considerations 33
6.1 General 33
6.2 Protection of non-storage occupancies with ESFR and CMSA 33
6.3 Sprinkler protection for adjacent areas using a different protection concept 34
6.4 Water supply duration and shape of design 34
6.5 Protection of unheated areas with ESFR installations 35
6.6 Design with ESFR 35
6.7 Design with CMSA 48
Annex A (normative) Extract for determining the hazard classification from prEN 12845-1 59

Documents
Document Sharing Hub
Full document details: BS EN 12845-2:2024

European foreword

This document (EN 12845-2:2024) has been prepared by Technical Committee CEN/TC 191 "Fixed firefighting systems", the secretariat of which is held by BSI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by June 2025, and conflicting national standards shall be withdrawn at the latest by June 2025.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

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, *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*.

Any feedback and questions on this document should be directed to the users' national standards body. A complete listing of these bodies can be found on the CEN website.

According to the CEN-CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: 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 the United Kingdom.

AVA Documents
Document Sharing Hub

Full document details: BS EN 12845-2:2024

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 k-factors, 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 specific challenges of 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.

It is planned to publish an Amendment for EN 12845:2015+A1:2019 to align it with this document and update the references for ESFR and CMSA requirements. Annex A in this document was added to support this transition.

Documents
Document Sharing Hub

Full document details: BS EN 12845-2:2024

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 the EN 12845 series of standards.

This document does not cover all legislative requirements.

NOTE In certain countries, specific national regulations can apply. Attention is drawn to the applicability or non-applicability for this document as specified by 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.

EN 12845:2015+A1:2019, *Fixed firefighting systems — Automatic sprinkler systems —Design, installation and maintenance*

EN 12845 (series), *Fixed firefighting systems — Automatic sprinkler systems*

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*

prEN 12259-15, *Fixed firefighting systems — Components for sprinkler and water spray systems — Part 15: Spray pattern sprinklers with a k-factor of at least K160, extended coverage sprinklers of at least K80 and control mode special application 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 the EN 12845 series of standards, EN 12259-1, EN 12259-13, prEN 12259-15 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 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 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.

AVA Documents
Document Sharing Hub

Full document details: BS EN 12845-2:2024

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.

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
IRAS	in-rack automatic sprinkler
EP	expanded plastics
UP/EP	uncartoned or exposed plastics
CUP/CNP	cartoned unexpanded plastic or cartoned nonexpanded plastics
CEP	cartoned expanded plastics
UUP/ENP	uncartoned unexpanded plastic or exposed nonexpanded plastics
UEP/EEP	uncartoned expanded plastic or exposed expanded plastics

4 General

ESFR sprinklers shall be used in wet installations only. CMSA sprinklers may be used in wet and dry installations. Open top containers shall not be used in storage hazards protected by ESFR or 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. Annex A shall be applied for FH and HHS determination.

Documents
Document Sharing Hub
Full document details: BS EN 12845-2:2024

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

Tasks	Clauses	
	EN 12845:2015+A1:2019	EN 12845-2:2024
Contract planning and documentation	Clause 4	
Extent of protection	Clause 5	
Hazard review, identification and classification	Clauses 6, Annex A, B and C	Annex A
Hydraulic design criteria		Clause 6
Pipe sizing, layout and hydraulic calculations	Clause 13	
Sprinkler system components	Clause 14	
Installation type and size	Clause 11	
Spacing and location of sprinklers		5.1.3, 5.2 and 5.3
Obstruction to discharge pattern of sprinklers		5.3
Valves	Clause 15	
Pipework and pipe support	Clause 17	
Alarms and alarm devices	Clause 16	
Signs, notices, and information	Clause 18	
Alarm generation, monitoring and transmission to remote manned station	Clause 16	
Water supplies	Clause 8	6.4
Type of water supply	Clause 9	
Pumps	Clause 10	
Commissioning and first inspection	Clause 19	
Replacement sprinklers	Clause 20.1.4	
Maintenance and inspection	Clause 20	

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.

CMSA pendent, dry pendent or upright sprinklers in accordance with prEN 12259-15 shall be used. In dry CMSA systems only dry pendent and upright sprinkler shall be used.

AVA Documents
Document Sharing Hub

Full document details: BS EN 12845-2:2024

The design criteria provided in 6.6 and 6.7 are applicable under the condition that the sprinkler has been successfully tested for the ceiling height, storage height, goods and storage type that are intended.

NOTE 1 The design criteria specified in 6.6 and 6.7 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.

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

NOTE 2 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 has usually a nominal operating temperature of 141 °C.

5.1.2 Sprinkler installation type

All requirements for wet or dry installations given in EN 12845 shall be followed unless required differently in this document.

5.1.3 Sprinkler spacing, location and positioning relative to roof and ceilings

5.1.3.1 General

The linear distance between sprinklers shall be measured along the slope of the ceiling, not on the viewpoint from floor level.

5.1.3.2 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 ceiling height not exceeding 9,1 m and 3,1 m for ceiling height exceeding 9,1 m. The maximum area per sprinkler shall be 9,3 m^2. The minimum area per sprinkler shall be 6 m^2. The distance to wall shall be no more than 50 % of the maximum allowed distance between sprinklers.

5.1.3.3 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 construction where it shall be 3,1 m. The distance to wall shall be no more than 50 % of the maximum allowed distance between sprinklers.

The maximum area per sprinkler shall be 12 m^2 for STC1 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^2. The minimum area per sprinkler shall be 7,5 m^2.

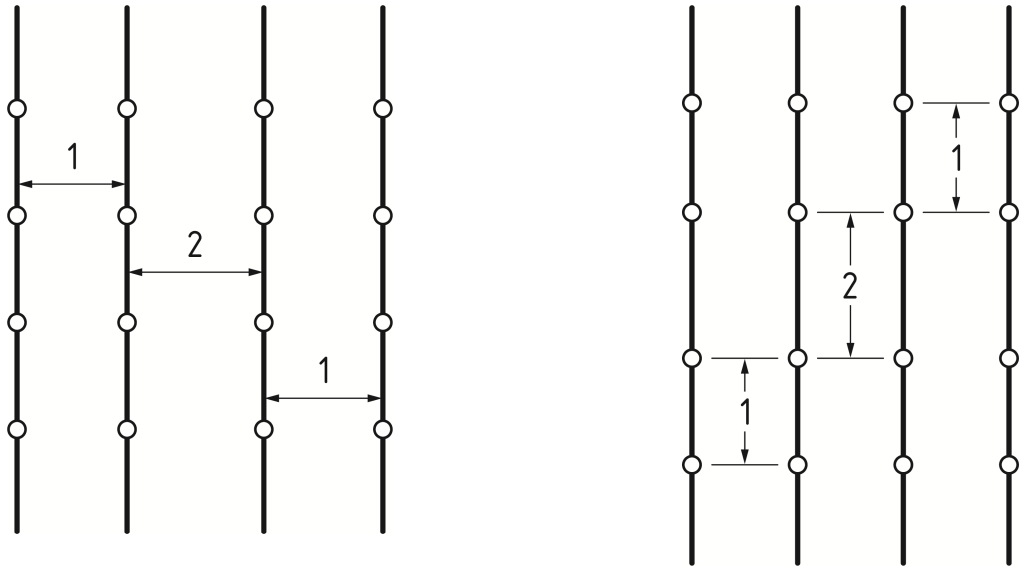
5.1.3.4 Exception for spacing and area per sprinkler due to obstruction

The maximum linear spacing of a sprinkler in each direction may be extended by maximum 0,3 m as demonstrated in Figure 1, only for the purpose to avoid unacceptable obstruction to its discharge by installed objects. This allows the maximum area to be extended up to 10,2 m^2.

This may be applied multiple times, but each time the adjacent spacing shall be in accordance with 5.1.3.2 or 5.1.3.3. This is an exception and shall not be applied as a normal standard design.

See Figure 1 for a diagram of this arrangement.

Documents
Document Sharing Hub
Full document details: BS EN 12845-2:2024



a) Extended spacing between branch lines **b) Extended spacing among branch lines**

Key

1 standard spacing

2 extended spacing

Figure 1 — Maximum increase in linear and area of coverage to avoid obstructing sprinkler discharge

5.1.3.5 Vertical distance from the ceiling to sprinkler

5.1.3.5.1 General

Vertical distance shall be measured perpendicularly to the floor, between the sprinkler's thermal element 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.

5.1.3.5.2 Distance from ceiling to sprinkler deflector

Sprinklers under unobstructed or obstructed 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 unless specified differently in Clause 6.

Documents
Document Sharing Hub
Full document details: BS EN 12845-2:2024

Table 2 — Maximum allowable vertical distance of sprinkler thermal element below the ceiling

Dimensions in millimetres

k-factor	ESFR obstructed or unobstructed construction	CMSA obstructed construction	CMSA unobstructed construction
160	-	325	225
200	325	-	-
240	325	325	225
280	-	325	325
320	425	-	-
360	425	325	325
400	325	-	-
480	425	-	-

5.1.3.5.3 Unobstructed ceiling

For ESFR and CMSA installation, the following shall be considered an unobstructed ceiling:

— smooth ceiling like a suspending ceiling;

— if all solid structural members are equal or less than 100 mm deep;

— if all solid ceiling structural members are equal to or more than 4,3 m apart;

— if solid structural members are deeper than 100 mm and the minimum distance between solid ceiling structural members for ceiling heights up to 9,0 m is 3,7 m;

— if solid structural members are deeper than 100 mm and the minimum distance between solid ceiling structural members for ceiling heights greater than 9,0 m is 3,0 m.

In all other cases the ceiling shall be considered to be obstructed.

A solid ceiling structural member is one where its cross-sectional area in a vertical plane is less than 70 % open.

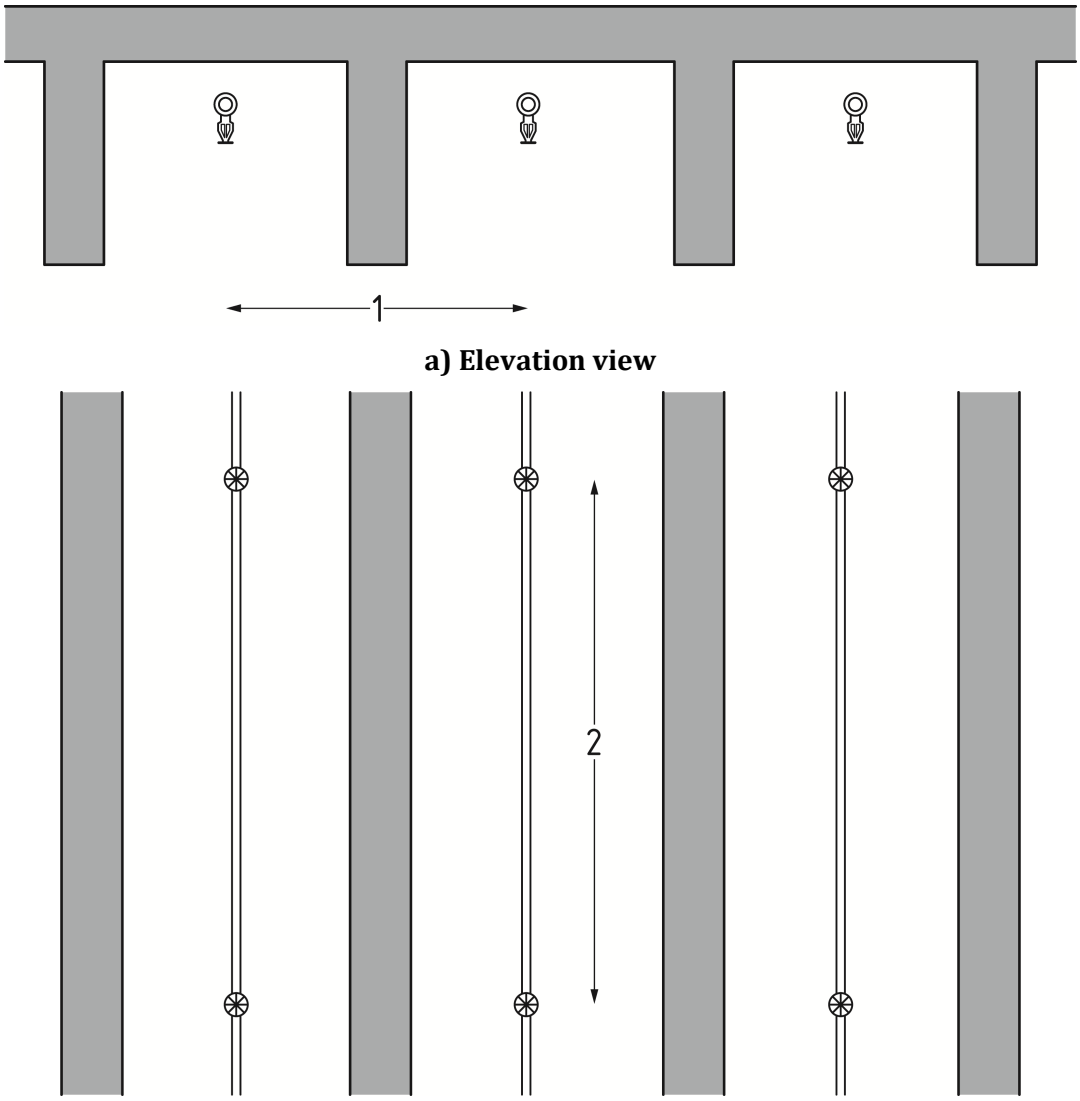
5.1.3.5.4 Obstructed ceiling – Location of sprinkler in channels

ESFR sprinklers shall be installed in every channel bay formed by obstructed 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 linear spacing within the channel (see 5.1.3.2). The minimum linear spacing between range pipes shall not apply to the sprinklers located in adjacent channel bays. See Figure 2.

Documents
Document Sharing Hub
Full document details: BS EN 12845-2:2024



a) Elevation view

b) Plan view

Key

1 Sprinkler spacing less than required minimum

2 Sprinkler spacing per required 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 shall be installed in every channel bay formed by obstructed construction except when the following criteria are fulfilled:

- solid structural members extend up to a maximum 600 mm below the ceiling; and
- the deflector shall be installed in a vertical distance of 25 mm to 150 mm below a non-combustible solid structural member. If a solid structural member extends more than 300 mm below the ceiling, formed channel bays shall not exceed 28 m^2 in area and shall not be horizontally wider than 0,9 m; or

Documents
Document Sharing Hub
Full document details: BS EN 12845-2:2024

- the deflector shall be installed in a vertical distance of 25 mm to 100 mm below a solid structural member if combustible and if it extends 300 mm to 525 mm below the ceiling and formed channel bays shall not exceed 28 m^2 in area; or

- the deflector shall be installed up to 550 mm below the ceiling and in a vertical distance of 25 mm to 150 mm below the solid structural member if it is non-combustible and extends in a vertical distance of 300 mm to 525 mm below the ceiling to form channel bays which shall not exceed 28 m^2 in area.

The same installation criteria as above shall be applied if a non-combustible solid structural member forms channel bays that exceed 28 m^2 in area with a horizontal separation of 0,9 m to 2,3 m.

5.1.3.6 Sprinkler orientation relative to the floor or pipework

Sprinklers shall be preferably installed with the deflector parallel to the floor; they may also be installed parallel to the ceiling where the slope is no more than 10°.

5.1.3.7 Vertical clearance below sprinklers

At least 1 m of clear space between ceiling sprinkler deflectors and the top of storage shall be maintained.

5.1.3.8 Positioning of sprinklers relative to draft curtains

Draft curtains should preferably not be installed within sprinkler arrays. Where required, the sprinklers on either side of the draft curtain should be generally equally spaced from the draft curtain. The obstruction criteria shall be fulfilled.

NOTE 1 The distance of sprinklers from the draft curtain can vary along the length of the draft curtain if there are changes in sprinkler spacing.

NOTE 2 Draft curtains have been shown to have a negative effect on sprinkler effectiveness. If they are required, special consideration needs to be applied in order to make any negative impact minimal.

5.2 Construction and building limitations

5.2.1 Roof or ceiling slope

The maximum ceiling slope shall not be higher than 10° (17,6 %). For ceiling slopes that exceed the maximum 10°, the following options shall be used:

- a flat, continuous horizontal false ceiling shall be installed over the affected area and for two lines of sprinkler beyond in all directions. The false ceiling shall be designed in accordance with 5.2.2. The area above the false ceiling shall be sprinkler protected. Sprinkler protection beneath the false ceiling according to the relevant occupancy hazard shall be provided; or

- for areas with only rack storage, provide in-rack sprinklers in accordance with 6.6.2.1 plus an additional level of in-rack sprinklers installed at the top of storage including face sprinklers at the same spacing as the longitudinal sprinklers; or

- sprinkler system design shall be in accordance with EN 12845.

5.2.2 Strength of ceilings, sub-ceilings and suspended ceilings

Ceilings, sub-ceilings and suspended ceilings including solid barriers shall be firmly secured and shall be capable of withstanding a vertical upward thrust of 140 N/m^2.

EXAMPLE Ceiling materials considered suitable are 10 mm gypsum board, corrugated and sheet steel and mineral tiles.

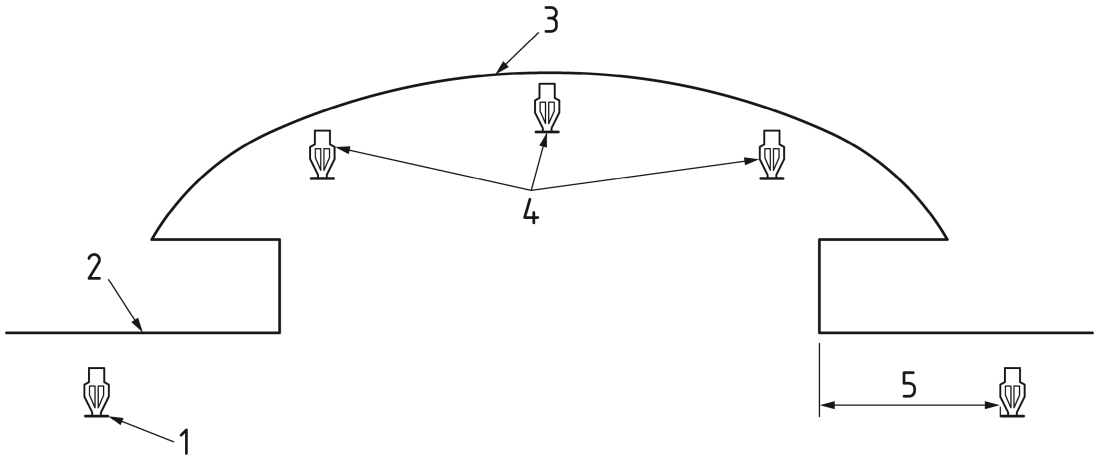
Documents
Document Sharing Hub
Full document details: BS EN 12845-2:2024

5.2.3 Skylights

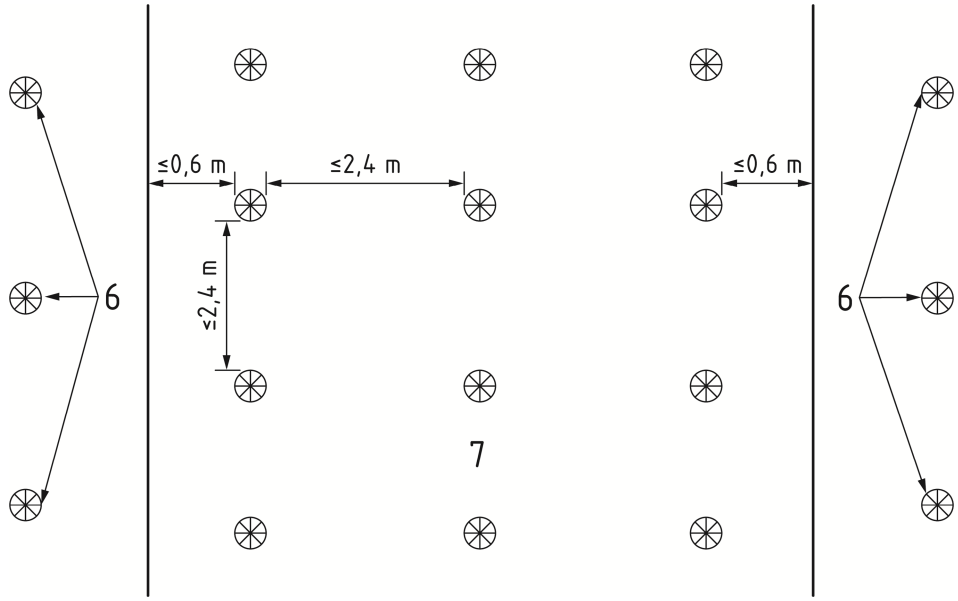
Skylights shall be capable of withstanding a temperature of 300 °C for a period of at least 5 min. Skylights with a volume greater than 1 m^3 measured above the normal ceiling level shall be sprinkler protected unless the distance from the normal ceiling level to the top of the skylight does not exceed 0,3 m, or there is a tightly fitting frame and glass level with the roof or ceiling. Any additional sprinklers in a skylight should be of the same type as the sprinklers around the skylight.

If sprinkler design is based on building height including skylight dome normal spacing can be applied. If distance between the top of skylight exceeds 0,3 m and the design exceeds the maximum building height use option 1 in Figure 3 or option 2 in Figure 4. If these options are applied, design for 0,3 m higher than ceiling.

Documents
Document Sharing Hub
Full document details: BS EN 12845-2:2024



a) Elevation view



b) Plan view

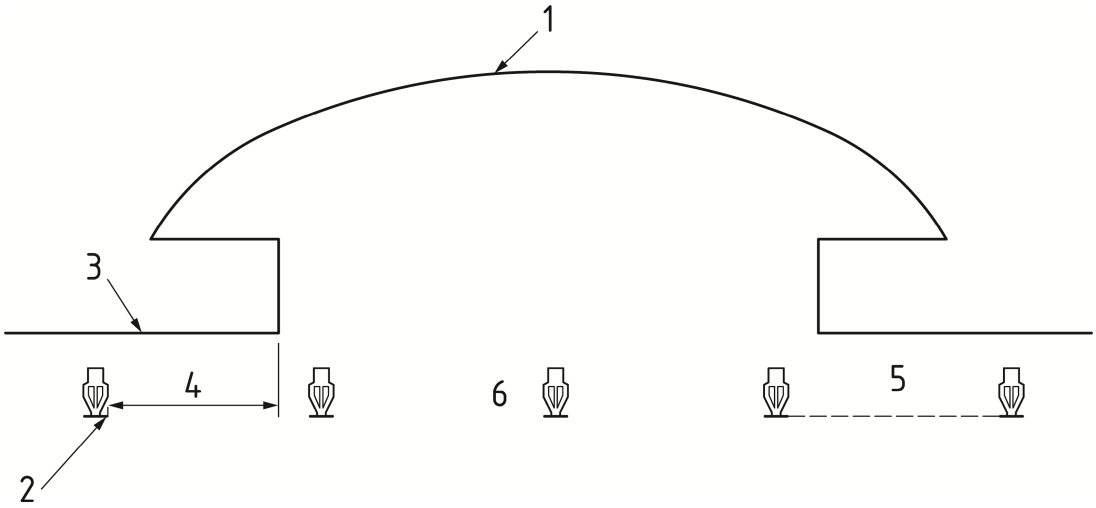
Key

1 Upright or pendent ceiling level sprinklers
2 Ceiling
3 Plastic skylight
4 Supplemental sprinklers
5 ≤ 50 % max. allowable linear spacing
6 Ceiling level sprinklers
7 Quick-response sprinklers under plastic skylights

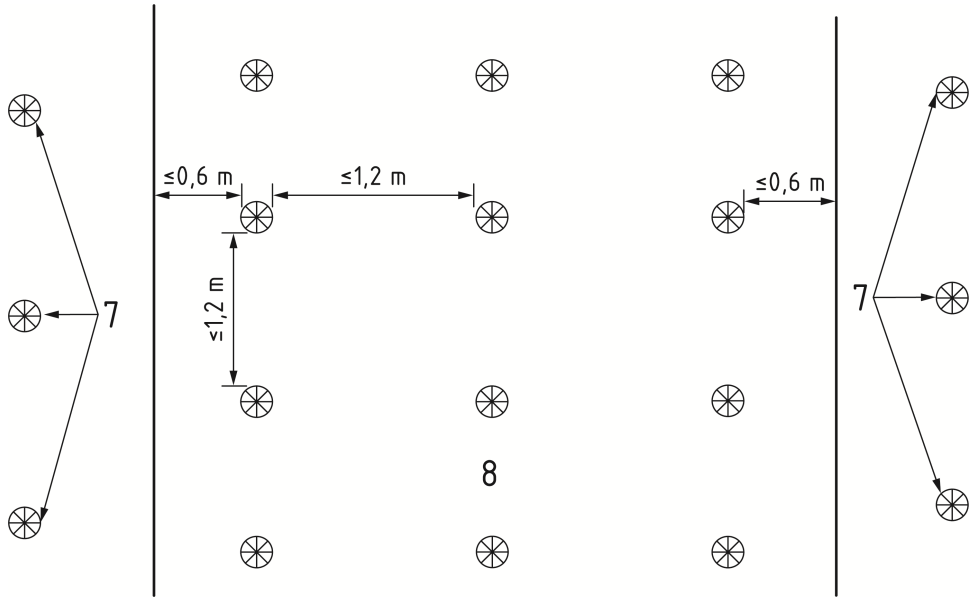
The supplemental sprinklers shall be quick response and pendent (when available) sprinklers. The maximum ceiling height of the plastic skylight shall be used for design purposes. The supplemental sprinklers shall not be included in the ceiling level sprinkler design.

Figure 3 — Protection of plastic skylights using quick-response sprinklers, Option 1

Documents
Document Sharing Hub
Full document details: BS EN 12845-2:2024



a) Elevation view



b) Plan view

Key

1 Plastic skylight
2 Upright or pendent ceiling level sprinkler
3 Ceiling
4 ≤ 50 % max. allowable linear spacing
5 Installed at the same elevation level
6 Supplemental sprinklers
7 Ceiling level sprinklers
8 Quick response sprinklers under plastic skylights at the same elevation as ceiling sprinklers

Supplemental sprinkler shall be the same as ceiling sprinklers except as follows: quick-response and pendent sprinklers (when available) shall be used. The maximum ceiling height of the main building shall be used for design purposes. The supplemental sprinklers shall not be included in the ceiling level sprinkler design.

Figure 4 — Protection of plastic skylights using quick-response sprinklers, Option 2

Documents
Document Sharing Hub

Full document details: BS EN 12845-2:2024

5.2.4 Heat and smoke vents or other ceiling vents

In ESFR or CMSA installations only manual smoke or heat vents shall be used. Drop-out-type heat vents shall not be installed.

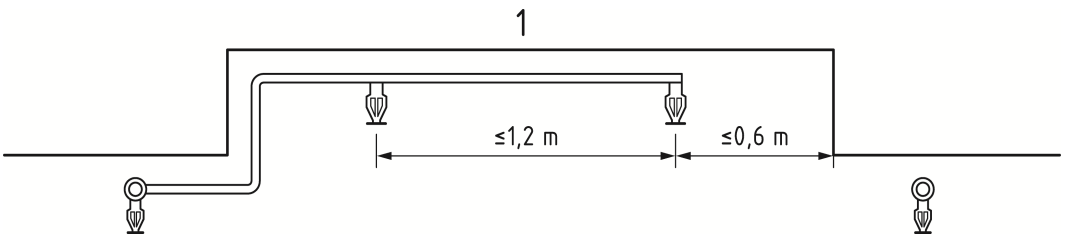
If national regulations require the installation of automatic smoke and heat vents, the operation and performance of the sprinkler system shall not be impaired by the venting system. To achieve this, the following solutions shall be applied:

- Where the installation is an ESFR or CMSA installation corresponding sprinklers, directly under the vent opening, evenly distributed on a maximum 1,2 m linear spacing with a maximum distance of 0,6 m to the edge of the vent shall be installed. When installing the sprinkler inside a skylight the requirements for minimum and maximum vertical distances (see 5.1.3.5.2) to the ceiling shall not be applied between the deflector and the closed skylight. Ensure these sprinklers have, at a minimum, the same k-factor and orientation as the adjacent ceiling-level sprinklers and are fed by sprinkler piping no smaller than the ceiling level range pipes. Sprinklers located under the ceiling vent and installed as outlined above don't need to be added to the hydraulic design of the ceiling sprinkler system. See Figure 5 for a diagram of this arrangement; or

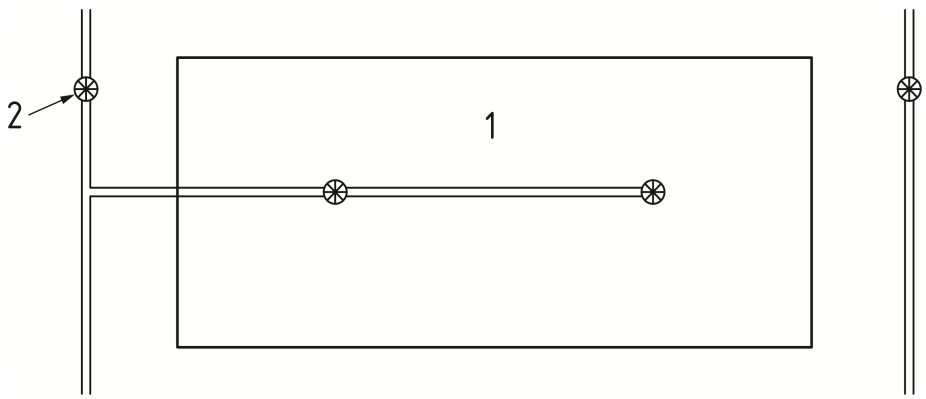
- Vents equipped with a standard-response 141 °C or higher nominal thermal activating device shall be installed; or

- Automatic smoke vents shall be individually activated.

Dimensions in metres



a) Elevation view



b) Plan view

Key

1 automatic heat, smoke or ceiling vent and skylights

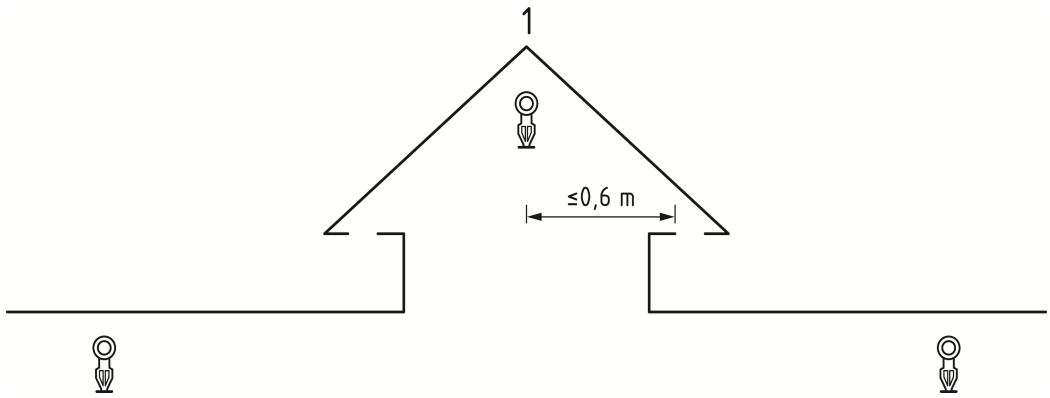
2 ceiling level sprinkler

Figure 5 — ESFR or CMSA sprinklers installed under automatic smoke, heat vents and skylights

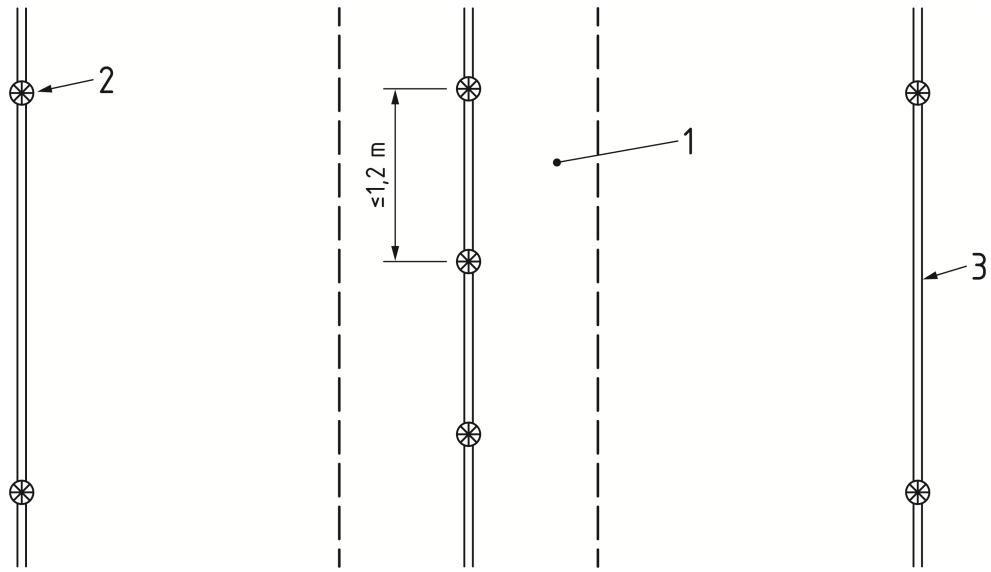
Documents
Document Sharing Hub
Full document details: BS EN 12845-2:2024

5.2.5 Natural exhaust openings at the ceiling

Where the installation is an ESFR or CMSA installation corresponding sprinklers shall be installed directly under the natural exhaust opening, evenly distributed on a maximum 1,2 m linear spacing with a maximum distance of 0,6 m to the edge of the exhaust. When installing the sprinkler inside an exhaust the requirements for minimum and maximum vertical distances (see 5.1.3.5.2) to the ceiling shall be applied between the deflector and the apex of the vent. These sprinklers shall have the same k-factor and orientation as the adjacent ceiling-level sprinklers and are fed by sprinkler piping no smaller than the ceiling level range pipes. Sprinklers located under the ceiling vent and installed as outlined above do not have to be included in the hydraulic design of the ceiling sprinkler system. See Figure 6 for a diagram of this typical arrangement.



a) Elevation view



b) Plan view

Key

1 Ridge vent
2 Ceiling level sprinkler
3 Ceiling level branchline piping

Figure 6 — Additional sprinklers installed under ceiling-level exhaust devices

Documents
Document Sharing Hub
Full document details: BS EN 12845-2:2024

5.2.6 Exhaust openings with or without fans and airflow velocities at ceiling-level

5.2.6.1 Horizontal airflow

Air-ventilation equipment shall be arranged in such a way that the airflow velocity at any ceiling-level sprinkler shall not exceed 1,5 m/s or to stop automatically upon early fire detection.

If it is not possible to avoid airflow velocities in excess of 1,5 m/s at ceiling-level sprinklers, one of the following options shall be applied (see Figure 7):

- flame detection shall be installed at ceiling level; or
- linear heat detection within the storage racks.

Either type of detection system shall be arranged to automatically shut down the flow of air upon detector actuation.

For flame detection, the detectors shall be arranged to monitor the area located within a 3,0 m radius from all affected sprinklers.

For linear heat detection, the detection shall be installed at the top of the storage rack structure, within all transverse flue spaces that are within a 3,0 m radius of any sprinkler affected by the higher velocity. The nominal temperature rating of the linear heat detection should be as low as permissible based on ambient temperature conditions.

Directly underneath the openings no storage is permitted, the horizontal distance between stored goods and the perimeter of the extraction openings shall be not less than L (in m) given by the equation:

$$L = 1/2S + d$$

where

S	is the sprinkler spacing (in m);
L	is the horizontal distance between stored goods (in m);
d	is the ventilation duct diameter (in m).

A horizontal sub-ceiling shall be installed below the openings, sprinklers shall be located below the sub-ceiling in accordance with the normal spacing requirements. The sub-ceiling shall have a minimum diameter or cross-sectional dimension W in m given by either of the equations below:

- if the ventilation airflow rate is known:

$$W = Q / (283 \text{ min/m} \times h)$$

- if the ventilation airflow rate is unknown:

$$W = 2{,}6\, A^* / h$$

where

Q	is the ventilation air flow rate (in m^3/min);
A^*	is the ventilation opening area (in m^2);
h	is the vertical distance between ceiling and top of the sub-ceiling (in m).

Ceiling sprinklers shall be a horizontal distance of at least 0,7 times the sprinkler spacing from the perimeter of the sub-ceiling.

Documents
Document Sharing Hub
Full document details: BS EN 12845-2:2024