

BS EN 13964:2014

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Suspended ceilings — Requirements and test methods

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National foreword

This British Standard is the UK implementation of EN 13964:2014. It supersedes BS EN 13964:2004+A1:2006 which will be withdrawn on 31 December 2015.

The UK participation in its preparation was entrusted to Technical Committee B/548, Suspended ceilings.

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

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English Version

Suspended ceilings - Requirements and test methods

Plafonds suspendus - Exigences et méthodes d'essai

Unterdecken - Anforderungen und Prüfverfahren

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Foreword

This document (EN 13964:2014) has been prepared by Technical Committee CEN/TC 277 “Suspended ceilings”, the secretariat of which is held by NBN.

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of an identical text or by endorsement, at the latest by September 2014, and conflicting national standards shall be withdrawn at the latest by December 2015.

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

This document supersedes EN 13964:2004.

Changes introduced in this document compared with the previous version have been indicated in Annex M.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this document.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

Diagram 1 shows the relationship between this European Standard prepared by CEN/TC 277 "Suspended ceilings" and other European Standards prepared by CEN/TC 241 "Gypsum products" and CEN/TC 112 "Wood-based panels".

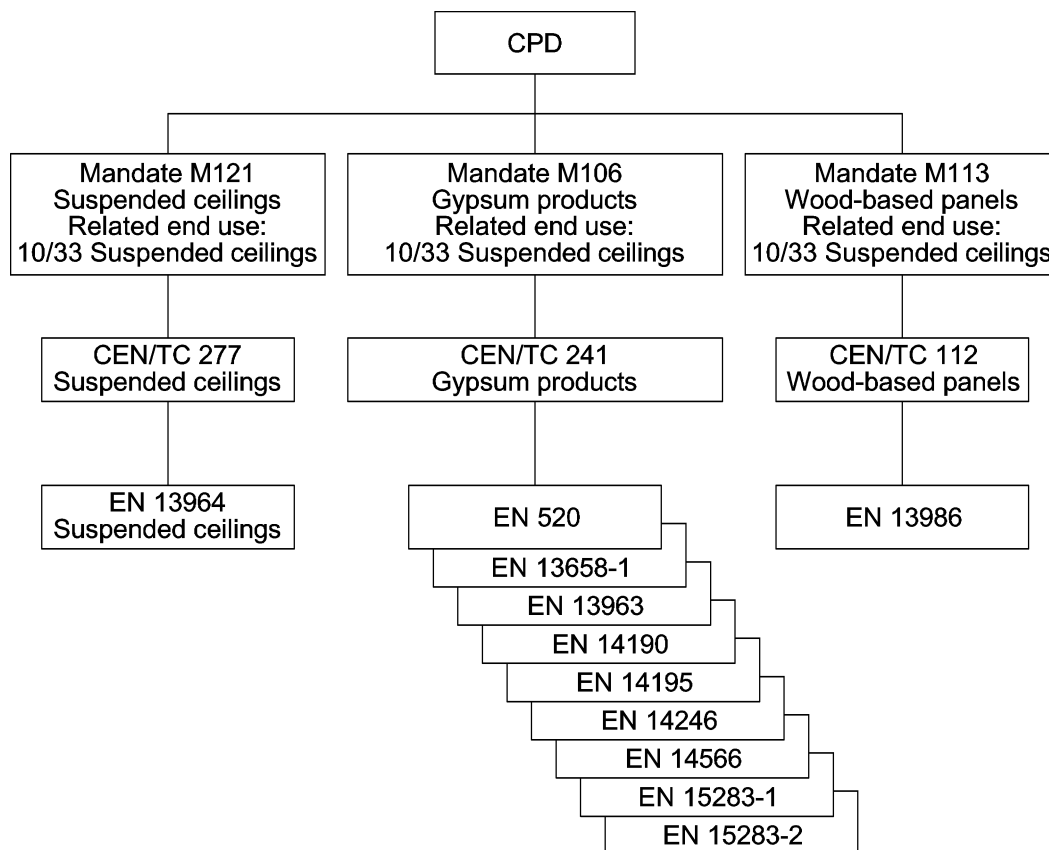


Diagram 1

1 Scope

This European Standard covers membranes, individual substructure components, substructure kits and suspended ceiling kits intended to be placed on the market. It covers suspended ceilings sold as a complete kit, substructures placed on the market as kits, individual components (products) of such substructures, and membrane components. It includes test methods and methods of assessment, as well as provisions for the evaluation of conformity and for the marking of the products to the requirements of this European Standard.

In the absence of any other European Standard, this European Standard specifies dimensions, tolerances and, where relevant, performance requirements, for commonly available ceiling substructures and membrane components.

This European Standard covers the following characteristics:

- reaction to fire;
- fire resistance (suspended ceiling kits only);
- release and/or content of dangerous substances:
 - release of asbestos (content) (suspended ceiling kits and membrane components only);
 - release of formaldehyde (suspended ceiling kits and membrane components only);
 - other dangerous substances;
- shatter properties (safe breakage)/impact resistance (for suspended ceiling kits and membrane components of brittle materials in suspended ceiling kits only);
- flexural tensile strength;
- load bearing capacity, tolerances and dimensions;
- electrical safety (as adequacy of the product to avoid electrocution from installations that may be part of the assembled ceiling, using electricity, such as ventilation devices and lighting);
- direct airborne sound insulation (suspended ceiling kits only);
- sound absorption (suspended ceiling kits and membrane components only);
- thermal conductivity (suspended ceiling kits and membrane components only);
- susceptibility to the growth of harmful micro-organisms;
- resistance to fixings (relevant for components that are mechanically fixed);
- durability of flexural tensile strength and load bearing capacity against moisture.

This European Standard also covers the following requirements:

- colour and light reflectance;
- installation.

This European Standard does not cover the following:

- ceiling substructures and membrane component covered by other harmonized European Standards, for insitu formed ceilings, covered by other European technical specifications, for which it is the installer, not the component manufacturer, who takes responsibility for ensuring that the complete installed suspended ceiling meets any regulatory requirements to which it is subject;
- stretched ceilings covered by EN 14716;
- ceilings in mobile buildings, caravans and other forms of transportation;
- characteristics needed for special applications, for which additional characteristics other than covered by this European Standard would need to be complied with;
- suspended ceilings intended for uses in ceilings subject to water penetration requirements;
- ceilings used externally where requirements other than covered by this standard would apply (tunnels, canopies, petrol stations, arcades, open sports facilities, car parks, etc.);
- heavy duty suspended ceilings or their supporting construction (e.g. ceilings that can be walked on);
- ceilings made from fire protective boards;
- the performance and health and safety requirements of light fittings and other features that, optionally, are included in the suspended ceiling;
- panels from materials covered in other harmonized European standards already prepared by CEN/TC 241 and CEN/TC 112 (see NOTE 1);

NOTE 1 These standards have been developed by CEN/TC 241 under the Mandate M/106 "Gypsum products" and by CEN/TC 112 under the Mandate M/113 "Wood-based panels".

- anchors covered by other European technical specifications.

This European Standard also gives certain specifications for the installed suspended ceiling system (see NOTE 2).

NOTE 2 There are two reasons for this:

- the individual components and kits may have to meet certain requirements in order for the installed system to be able to meet the requirement when the system is installed, and
- it is appropriate, for ease of reference, to give both component/kit requirement and installed system requirement in the same document, given the relationship between them.

This European Standard provides information for the various parties responsible for designing, manufacturing and specifying/selecting suspended ceilings used for interior applications in general building and civil engineering structures.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 120, *Wood based panels — Determination of formaldehyde content — Extraction method called the perforator method*

EN 312, *Particleboards — Specifications*

EN 335, *Durability of wood and wood-based products — Use classes: definitions, application to solid wood and wood-based products*

EN 350 (all parts), *Durability of wood and wood-based products — Natural durability of solid wood*

EN 351 (all parts), *Durability of wood and wood-based products — Preservative-treated solid wood*

EN 460, *Durability of wood and wood-based products — Natural durability of solid wood — Guide to the durability requirements for wood to be used in hazard classes*

EN 573-3, *Aluminium and aluminium alloys — Chemical composition and form of wrought products — Part 3: Chemical composition and form of products*

EN 599 (all parts), *Durability of wood and wood-based products — Performance of preventive wood preservatives as determined by biological tests*

EN 622-1, *Fibreboards — Specifications — Part 1: General requirements*

EN 717-1, *Wood-based panels — Determination of formaldehyde release — Part 1: Formaldehyde emission by the chamber method*

EN 717-2, *Wood-based panels — Determination of formaldehyde release — Part 2: Formaldehyde release by the gas analysis method*

EN 1396:2007, *Aluminium and aluminium alloys — Coil coated sheet and strip for general applications — Specifications*

EN 1912, *Structural Timber — Strength classes — Assignment of visual grades and species*

EN 1991-1-4¹⁾, *Eurocode 1: Actions on structures — Part 1-4: General actions — Wind actions*

EN 1995-1-1²⁾, *Eurocode 5: Design of timber structures — Part 1-1: General — Common rules and rules for buildings*

EN 1998-1³⁾, *Eurocode 8: Design of structures for earthquake resistance — Part 1: General rules, seismic actions and rules for buildings*

EN 10143, *Continuously hot-dip coated steel sheet and strip — Tolerances on dimensions and shape*

EN 10152, *Electrolytically zinc coated cold rolled steel flat products for cold forming — Technical delivery conditions*

EN 10169, *Continuously organic coated (coil-coated) steel flat products — Technical delivery conditions*

EN 10346, *Continuously hot-dip coated steel flat products — Technical delivery conditions*

EN 12600, *Glass in building — Pendulum test — Impact test method and classification for flat glass*

1) Superseded ENV 1991-2-4 in 2005.

2) Superseded ENV 1995-1-1 in 2004.

3) Superseded ENV 1998-1-3 in 2004.

EN 12664, *Thermal performance of building materials and products — Determination of thermal resistance by means of guarded hot plate and heat flow meter methods — Dry and moist products of medium and low thermal resistance*

EN 12667, *Thermal performance of building materials and products — Determination of thermal resistance by means of guarded hot plate and heat flow meter methods — Products of high and medium thermal resistance*

EN 13162, *Thermal insulation products for buildings — Factory made mineral wool (MW) products — Specification*

EN 13171, *Thermal insulation products for buildings — Factory made wood fibre (WF) products — Specification*

EN 13245-1:2010, *Plastics — Unplasticized poly(vinyl chloride) (PVC-U) profiles for building applications — Part 1: Designation of PVC-U profiles*

EN 13245-2:2008, *Plastics — Unplasticized poly(vinyl chloride) (PVC-U) profiles for building applications — Part 2: PVC-U profiles and PVC-UE profiles for internal and external wall and ceiling finishes*

EN 13501-1, *Fire classification of construction products and building elements — Part 1: Classification using test data from reaction to fire tests*

EN 13501-2, *Fire classification of construction products and building elements — Part 2: Classification using data from fire resistance tests, excluding ventilation services*

EN 13823, *Reaction to fire tests for building products — Building products excluding floorings exposed to the thermal attack by a single burning item*

EN ISO 354, *Acoustics — Measurement of sound absorption in a reverberation room (ISO 354)*

EN ISO 717-1, *Acoustics — Rating of sound insulation in buildings and of building elements — Part 1: Airborne sound insulation (ISO 717-1)*

EN ISO 2813, *Paints and varnishes — Determination of specular gloss of non-metallic paint films at 20°, 60° and 85° (ISO 2813)*

EN ISO 6946, *Building components and building elements — Thermal resistance and thermal transmittance — Calculation method (ISO 6946)*

EN ISO 9001:2008, *Quality management systems — Requirements (ISO 9001:2008)*

EN ISO 10140 (all parts), *Acoustics — Laboratory measurement of sound insulation of building elements (ISO 10140)*

EN ISO 10211, *Thermal bridges in building construction — Heat flows and surface temperatures — Detailed calculations (ISO 10211)*

EN ISO 10456, *Building materials and products — Hygrothermal properties — Tabulated design values and procedures for determining declared and design thermal values (ISO 10456)*

EN ISO 10848-2, *Acoustics — Laboratory measurement of the flanking transmission of airborne and impact sound between adjoining rooms — Part 2: Application to light elements when the junction has a small influence (ISO 10848-2)*

EN ISO 11654, *Acoustics — Sound absorbers for use in buildings — Rating of sound absorption (ISO 11654)*

EN ISO 11925-2, *Reaction to fire tests — Ignitability of building products subjected to direct impingement of flame — Part 2: Single-flame source test (ISO 11925-2)*

EN ISO 12944-3, *Paints and varnishes — Corrosion protection of steel structures by protective paint systems — Part 3: Design considerations (ISO 12944-3)*

ISO 1006, *Building construction — Modular co-ordination — Basic module*

ISO 7724-2, *Paints and varnishes — Colorimetry — Part 2: Colour measurement*

ISO 7724-3, *Paints and varnishes — Colorimetry — Part 3: Calculation of colour differences*

3 Terms and definitions

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

3.1 General

3.1.1 ceiling

construction covering the underside of a floor or roof, providing the overhead surface

3.1.2 suspended ceiling

ceiling hung by a suspension from or by a directly fixed substructure or perimeter trim to the load bearing structure (floor, roof, beam and walls) at a distance from the floor or roof above

3.1.3 suspended ceiling for interior application

application not exposed to outside weather conditions (wind, rain, humidity, pollution, etc.)

3.1.4 suspended ceiling kit

set of components that need to be put together to be installed permanently in the works

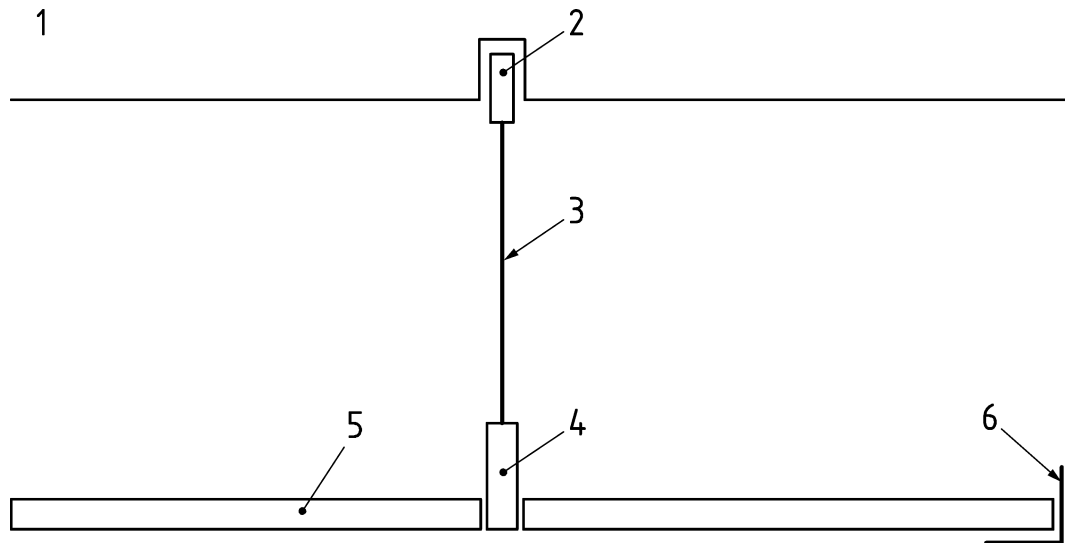
Note 1 to entry: Although the components of the kit may be produced by more than one manufacturer, it has to be placed on the market in a way that enables it to be purchased in one transaction.

Note 2 to entry: The substructure may be a complete kit or made up of individual components.

Note 3 to entry: Although it may contain all necessary components, the kit does not have to contain all the components needed to form an assembled suspended ceiling system.

3.1.5 assembled suspended ceiling system

suspended ceiling system components that are adapted to each other, and which may originate from different sources, which have been installed together in the works



Key

1	load bearing structure	4	supporting member
2	top fixing	5	ceiling membrane component
3	suspension	6	perimeter trim

Figure 1 — Principal suspended ceiling components (not all components are necessarily used in an installation)

3.2 Suspended ceiling and substructure components (see Figure 1)

3.2.1 General

3.2.1.1

substructure

suspending frame that supports the ceiling membrane

Note 1 to entry: May be a complete kit or made up of individual components. There are three types of substructure: exposed, concealed and semi-concealed substructures.

3.2.1.2

exposed substructure

substructure whose underside is exposed

3.2.1.3

concealed substructure

substructure whose underside is not exposed

3.2.1.4

semi-concealed substructure

substructure where the underside is exposed in one direction and the intermediate profiles, which are at an angle to the support profiles, are concealed

3.2.1.5

suspension component

part of the substructure, connecting it to the load bearing structure

Note 1 to entry: May be part of a kit or part of an assembled ceiling system.

3.2.2 Fixing, connections and supports

3.2.2.1

top fixing

fixing which connects the suspension components or the substructure directly to the load bearing structure

3.2.2.2

perimeter trim fixing, including corridor fixing

fixing which connects the perimeter trim directly to the load bearing structure

3.2.2.3

sub-structural connection

fixing component used to connect the anchoring component, suspension component, substructure and ceiling membrane component

3.2.2.4

supporting member

suspended component of the substructure with direct connection to the suspension component or directly fixed component

3.2.2.5

cross/secondary supporting component

component of the substructure which spans between two supporting components and with a direct supporting function for the ceiling membrane component

3.2.2.6

perimeter trim

section fixed at the perimeter of the ceiling to support the components of either the substructure or the ceiling membrane, or both, or fixed to and carried by the ceiling membrane itself

3.2.2.7

access component

component of the substructure or of the substructure and membrane component with a special access facility to enable a particular part of the ceiling membrane to be removed

3.2.2.8

splice

mechanical connection between substructure sections

3.3 Ceiling membranes and ceiling membrane components

3.3.1

ceiling membrane

exposed surface of the ceiling facing the room, excluding any exposed substructure

3.3.2

ceiling membrane component

product forming part of the ceiling membrane (e.g. a tile or plank); the ceiling membrane component can have any form (e.g. solid, open, corrugated, mesh)

3.3.3

volume membrane component

component of which the edges are shaped within the full material thickness (see Figure 3)

3.3.4

thin gauge membrane component

component of which the edges are achieved by forming the basic sheet material (see Figure 4) and where the thickness permits permanent forming

3.3.5

tile

square or rectangular component with the length (l)/width (w) ratio within the range $1 \leq l/w \leq 2$ (see Figure 2)

3.3.6

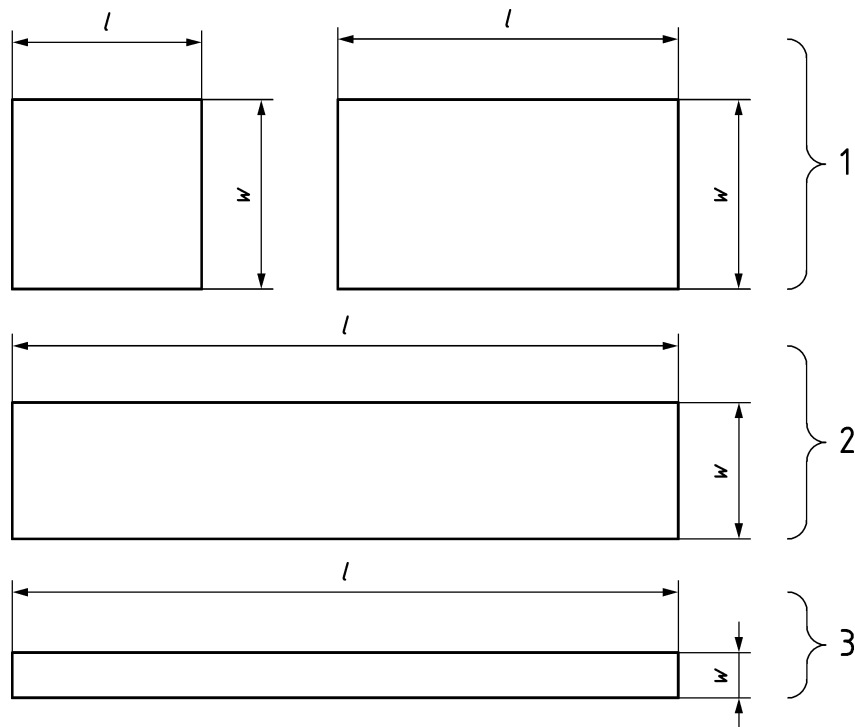
plank

rectangular component with the length (l)/width (w) ratio within the range $2 < l/w \leq n$ (see Figure 2)

3.3.7

linear component

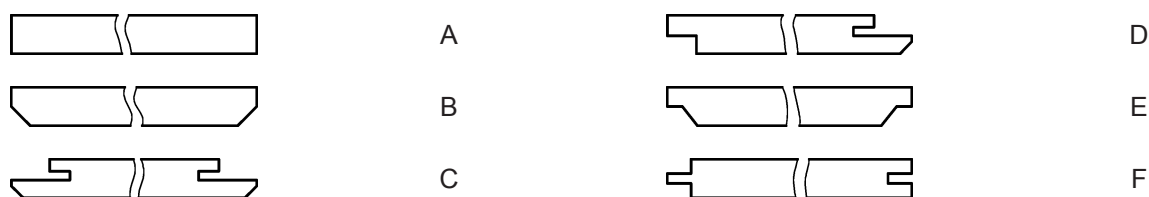
component of relatively narrow width (w) and of which the length (l) is generally made to measure (see Figure 2)



Key

- 1 tile
- 2 plank
- 3 linear component

Figure 2 — Ceiling membrane components

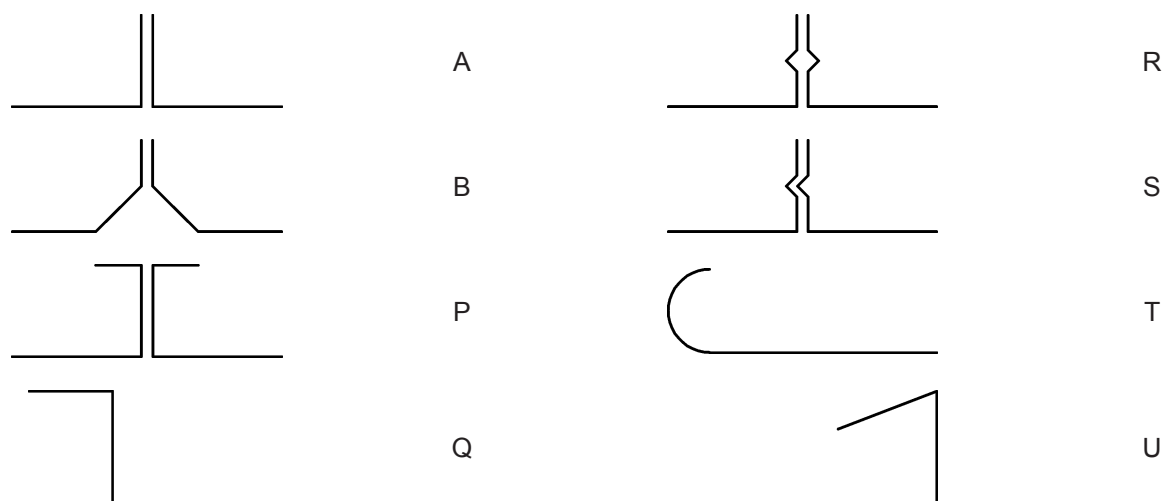


Key

A	squared	D	rebated and grooved
B	bevelled	E	rebated
C	grooved	F	tongued and grooved

NOTE Various edges may be used in different combinations. Edges may be designated using the relevant letter code. Other edge forms are possible and available.

Figure 3 — Typical edge details of volume ceiling membrane components



Key

A	squared	R	rilled or bumped
B	bevelled	S	tongued and grooved
P	return flanged	T	rounded
Q	rebated	U	reverted

NOTE Various edges may be used in different combinations. Edges may be designated using the relevant letter code. Other edge forms are possible and available.

Figure 4 — Typical edge details of thin gauge ceiling membrane components

3.4 Typical suspended ceiling systems using volume or thin gauge materials

3.4.1

suspended ceiling systems with membrane components fixed on the substructure

assembly with type A, B or F shaped edges (see Figure 3) where the boards are fixed on the substructure (concealed substructure)

Note 1 to entry: The membrane components are butted and can be visible or jointed (not visible = jointless surface) (see Figure 5).

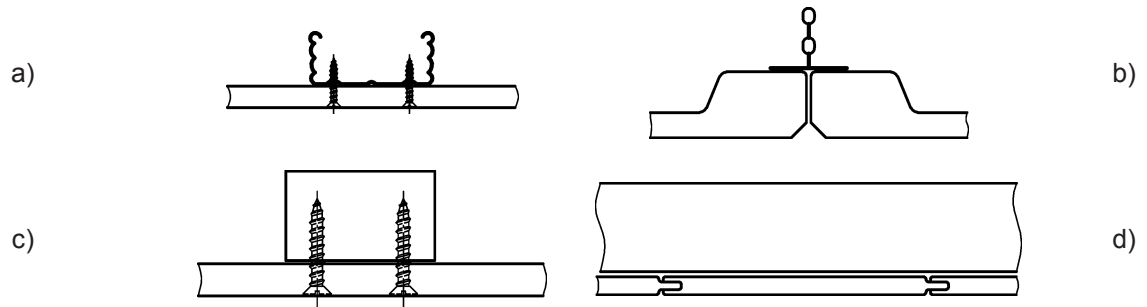


Figure 5 — Examples for possible designs with membrane components fixed on the substructure

3.4.2

suspended ceiling system with various edge types (A, B, C, D, E – see Figure 3) for volume gauge materials and with type A and Q (see Figure 4) edges for thin gauge materials
assembly in which different edge types are used

Note 1 to entry: See Figure 6 that shows very common applications of how these systems are implemented.

Note 2 to entry: The substructure can be exposed, semi-concealed or concealed.

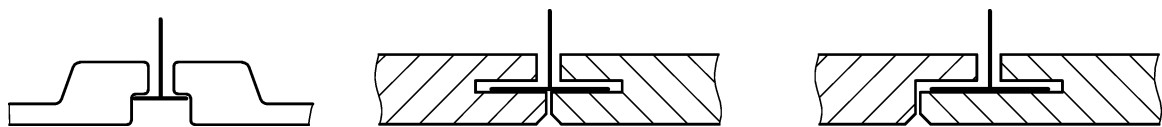
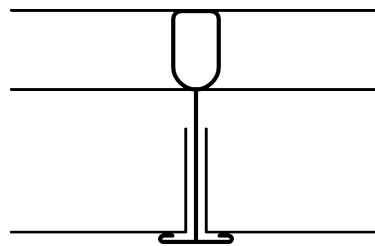


Figure 6 — Examples for possible designs with various edge types

3.4.3

lay-in suspended ceiling system

assembly with Type A or Type P shaped edges (see Figure 4) that is supported by an exposed substructure (see Figure 7)



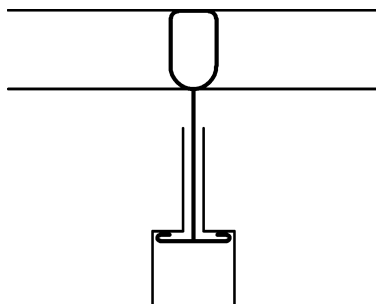
NOTE Other designs may exist.

Figure 7 — Example for a lay-in suspended ceiling system

3.4.4

rebated lay-in suspended ceiling system

assembly with Type Q edges (see Figure 4), supported by an exposed substructure (see Figure 8)



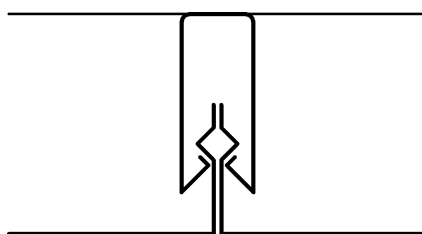
NOTE Other designs may exist.

Figure 8 — Example for a rebated lay-in suspended ceiling system

3.4.5

clip-in suspended ceiling system

assembly, normally with Type R edges (see Figure 4) that are clipped onto a concealed substructure (see Figure 9)



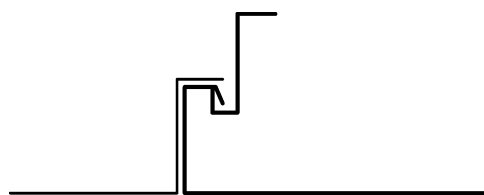
NOTE Other designs may exist.

Figure 9 — Example for a clip-in suspended ceiling system

3.4.6

hook-on suspended ceiling system

assembly, one side of which has Type Q edge and the opposite side has a Type U edge (see Figure 4) supported by a concealed substructure (see Figure 10)



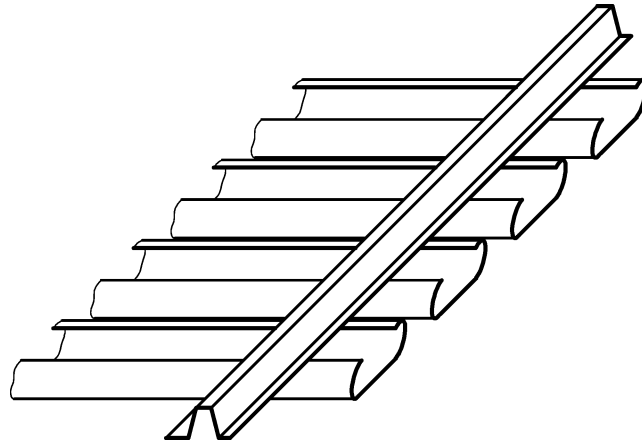
NOTE Other designs may exist.

Figure 10 — Example for a hook-on suspended ceiling system

3.4.7

linear suspended ceiling system (open or closed)

assembly with linear components that are fixed to a substructure (see Figure 11)

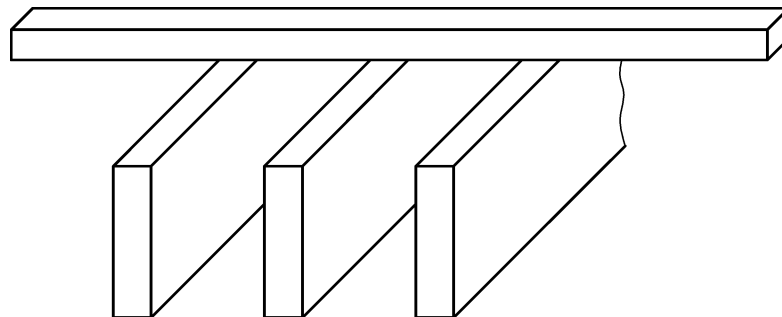


NOTE Other designs may exist.

Figure 11 — Example for a linear suspended ceiling system

**3.4.8
baffle**

assembly of vertically placed linear membrane components installed at a certain distance from each other (see Figure 12)

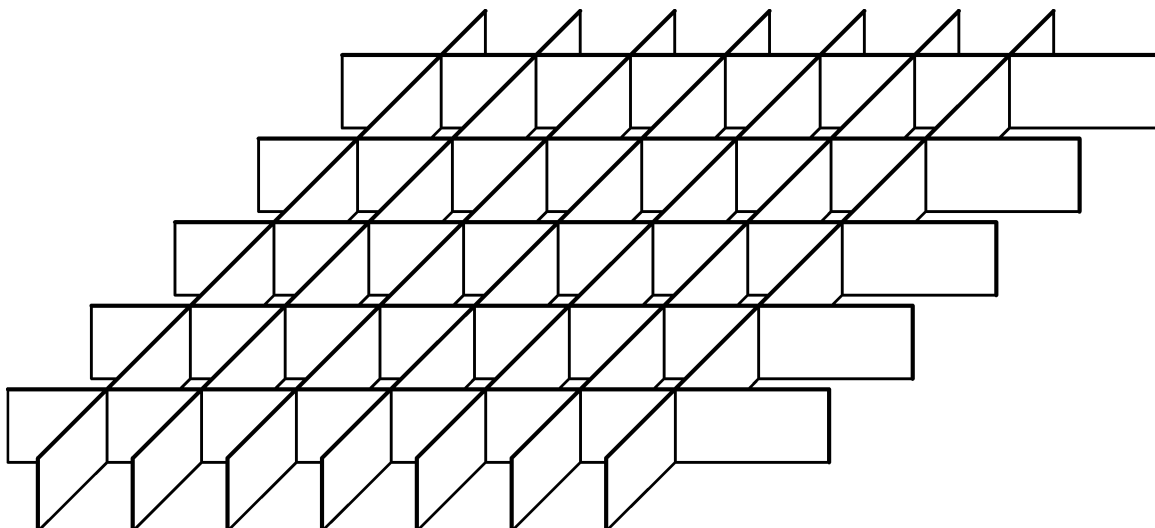


NOTE Other design systems may exist.

Figure 12 — Example for a baffle

**3.4.9
open cell**

membrane component in grid form (see Figure 13)



NOTE Other designs may exist.

Figure 13 — Example for an open grid cell

4 Requirements

4.1 Dimensions and tolerances – General

The materials and products used in the construction of suspended ceilings shall comply with the requirements of this European Standard.

If there is no separate product standard available, the tolerances for profiles shall comply with Table 1 and Table 2. The substructure for linear components shall comply with Table 5.

The manufactured dimensions and tolerances for volume and thin gauge membrane components shall comply with Table 3 and Table 4 unless a separate product standard is available.

The manufactured dimensions and tolerances for linear components shall comply with Table 5.

Where relevant, measurements shall be made with suitable accuracy.

Dimensions and the corresponding tolerances shall be declared.

4.2 Modular dimensions

The plan dimension of suspended ceiling substructure and membrane components shall be based on modular co-ordination as standardized in ISO 1006.

The commonly used modular dimensions of membrane components shall be based on $n \times 100$ mm or on sub-modules of $n \times 50$ mm or $n \times 25$ mm.

If there is no separate product standard available, Table 2 applies.

Dimensions and the corresponding tolerances shall be declared.

Table 1 — Grids in assembled suspended ceiling systems – Cross sectional tolerances

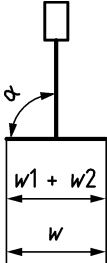
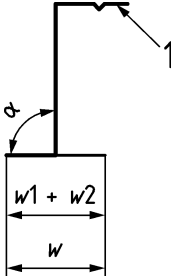
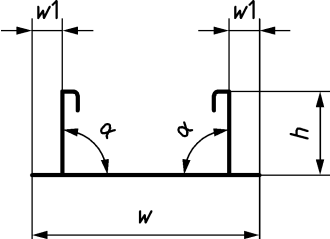
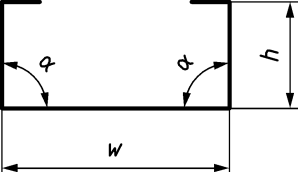
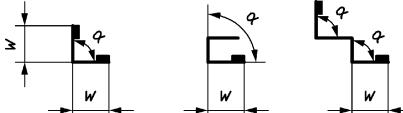
Cross section	Tolerances with regard to nominal dimensions				
	W (mm)	$w1$ (mm)	$w2$ (mm)	h (mm)	α
T-section 	+ 0,3 - 0,3	+ 0,3 - 0,3	+ 0,3 - 0,3	—	+ 1,5 ⁰ - 1,5 ⁰
Z-section  Key 1 parallel to bottom flange	+ 0,3 - 0,3	+ 0,3 - 0,3	+ 0,3 - 0,3	—	+ 1,5 ⁰ - 1,5 ⁰
Bandrastrer 	+ 0,3 - 0,3	+ 0,3 - 0,3	—	+ 0,3 - 0,3	+ 3 ⁰ - 3 ⁰
Furring channel 	+ 0,3 - 0,3	—	—	+ 0,3 - 0,3	+ 3 ⁰ - 3 ⁰
Perimeter trims 	+ 0,5 - 0,5	—	—	+ 0,3 - 0,3	+ 0 ⁰ - 3 ⁰
NOTE 1 Measurements in millimetres are related to the nominal dimensions. NOTE 2 α nominal = 90°.					

Table 2 — Supporting components – Modular tolerance

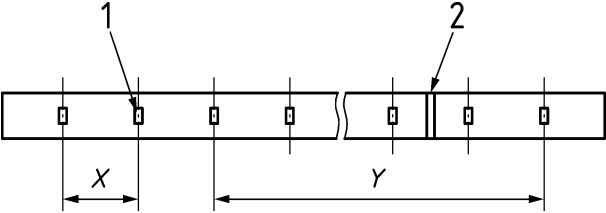
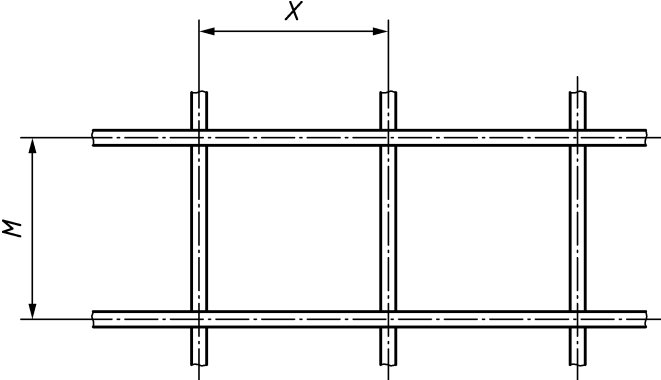
Main runners (T-section and bandraster) Substructure sections	 Key 1 interlocking holes in section 2 splice in supporting component Definition: X : 1 Slot distance Y : Sum of slot distances ≥ 1,25 m including or excluding one splice Tolerance: X : ± 0,25 mm Y : ± 0,30 mm
Centre point substructure	 Definition: M : axis- axis distance between 2 main runners X : axis- axis distance between 2 cross tees Tolerance: M : ± 0,25 mm / m X : ± 0,25 mm

Table 2 (continued)

All profiles

Bow : $\leq 1,5 \text{ mm / m}$

Camber : $\leq 1,5 \text{ mm / m}$

Twist : $\leq 2^\circ / \text{m}$

NOTE Squareness and flatness depend on the accuracy of the installation.

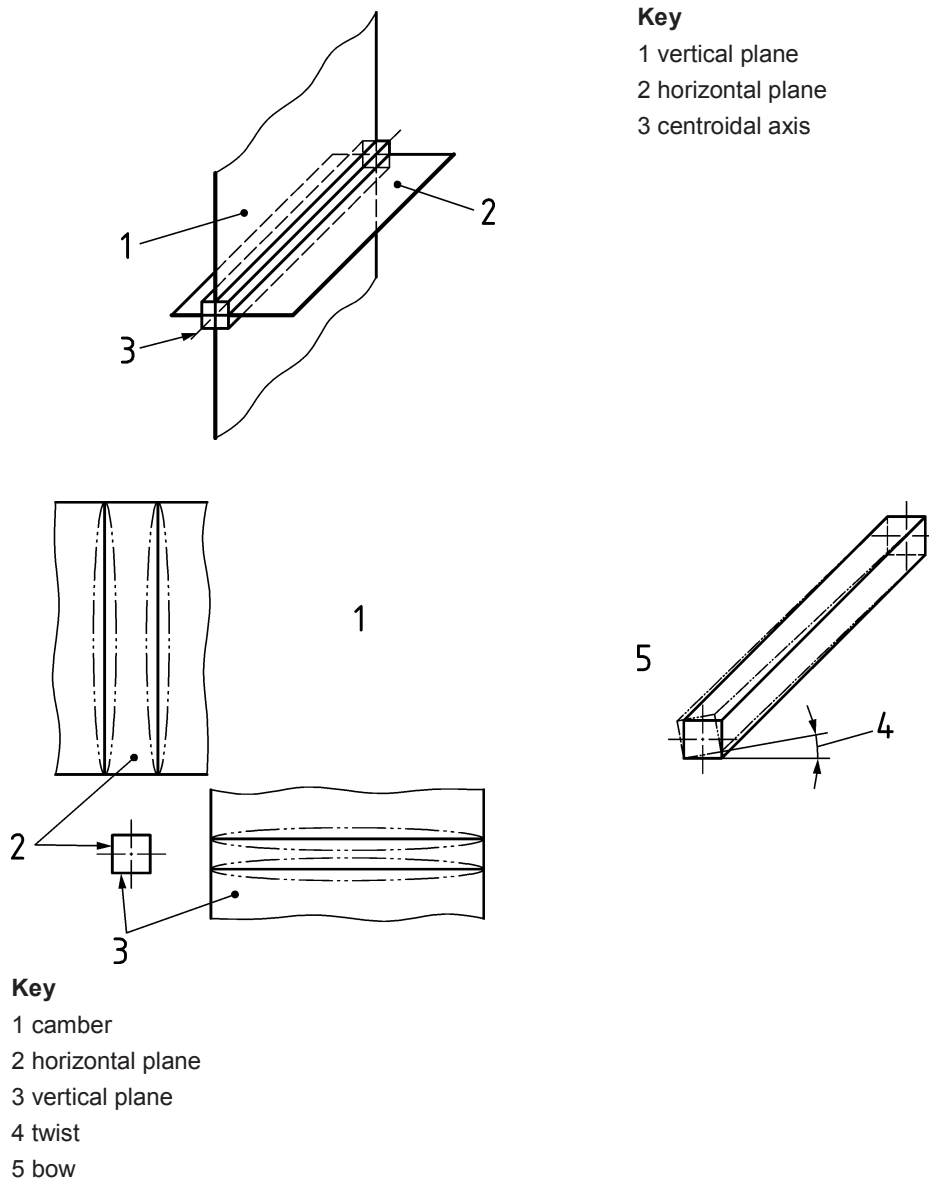


Table 3 — Tolerances of volume membrane components

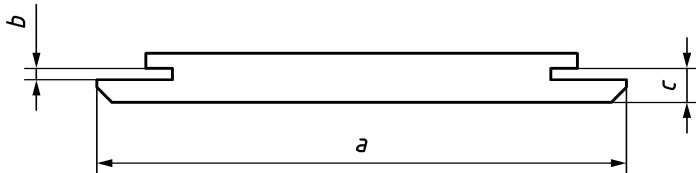
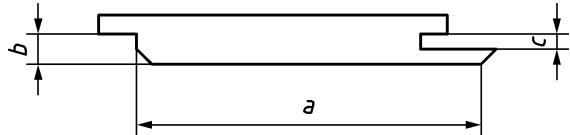
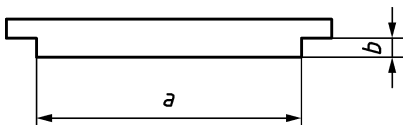
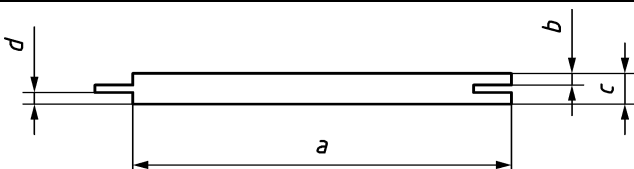
Cross section	Edge detail (mm)	Length (mm)	Width (mm)	Thickness (mm)	Squareness deviation from 90°	Flatness positive and negative bending	
A - squared edge B - bevelled edge		± 1,5	± 1,5	± 1,5	1/500	maximum tolerance = 1/300 of the measured length	
	A B						
C - grooved edge	a b c	± 0,5 ± 0,3 ± 0,3	± 1,5	± 1,5	± 1,5	1/500	maximum tolerance = 1/300 of the measured length
							
D - rebated and grooved edge	a b c	± 0,3 ± 0,5 ± 0,3	± 1,5	± 1,5	± 1,5	1/500	maximum tolerance = 1/300 of the measured length
							
E - rebated edge	a b	± 0,5 ± 0,6	± 1,5	± 1,5	± 1,5	1/500	maximum tolerance = 1/300 of the measured length
							
F - tongued and grooved edge	a b c d	± 0,5 ± 0,3 ± 0,3 ± 0,3	± 1,5	± 1,5	± 1,5	1/500	maximum tolerance = 1/300 of the measured length
							
NOTE Measurements in millimetres are related to the nominal dimensions.							

Table 4 — Tolerances of thin gauge membrane components^a

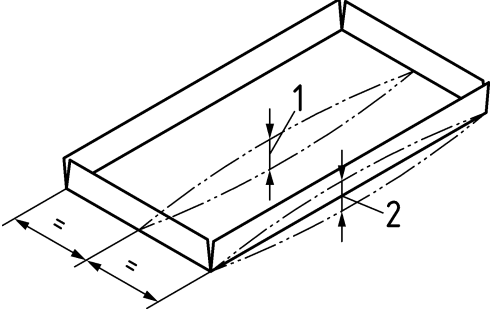
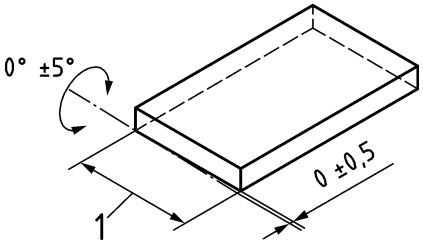
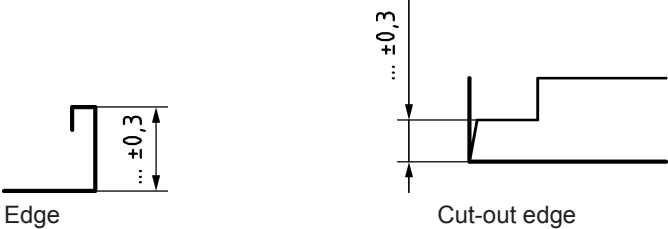
a. Panel sizes: - for lengths $\geq 1\,000$ mm $(\begin{smallmatrix} 0 \\ -0,4 \end{smallmatrix})\text{mm} / \text{m}$ - for lengths $< 1\,000$ mm $(\begin{smallmatrix} 0 \\ -0,5 \end{smallmatrix})\text{mm}$ - for width $(\begin{smallmatrix} 0 \\ -0,4 \end{smallmatrix})\text{mm}$						
b. Flatness: Key 1 tolerance b 2 tolerance a						
						
$l = \text{length (mm)}$	$0 < l \leq 1\,000$		$1\,000 < l \leq 2\,000$		$2\,000 < l \leq 3\,000$	
$b = \text{width (mm)}$	a	b	a	b	a	b
$0 < b \leq 400$	- 0,5 +0,5	- 0,2 +3,0	- 0,5 +1,5	- 0,2 +4,0	- 0,5 +3,0	- 0,2 +6,0
$400 < b \leq 500$	- 0,5 +0,5	- 0 +4,0	- 0,5 +1,5	- 0 +5,0	- 0,5 +3,5	- 0 +7,0
$500 < b \leq 625$	- 0,5 +0,5	- 0 +6,0	- 0,5 +1,5	- 0 +7,0	- 0,5 +4,0	- 0 +9,0
$625 < b \leq 1\,250$	- 0,5 +0,5	- 0 +10,0	- 0,5 +1,5	- 0 +13,0	- -	- -
c. Angularity of the long edge in relation to short edge Panel width up to 625 mm $\pm 0,5$ mm Panel width 625 mm to 1 250 mm $\pm 0,6$ mm Key 1 Panel width						
						
d. Depth of stops/supports $\pm 0,3$ mm (measured on panel cut out edge)						
						
Deviations from 90° angle on vertical upstand are dependent on the production process and the relative suspension systems. There are no fixed tolerances.						
For corrugated membrane components the deviations should be measured on a line drawn through the lowest point of the corrugations.						
NOTE Measurements in millimetres are related to the nominal dimensions.						
^a The tolerances are valid for unperforated thin gauge membrane components and for perforated thin gauge membrane components with a hole diameter of maximum 4 mm and maximum 25 % open area.						

Table 5 — Definitions and tolerances of linear ceiling systems

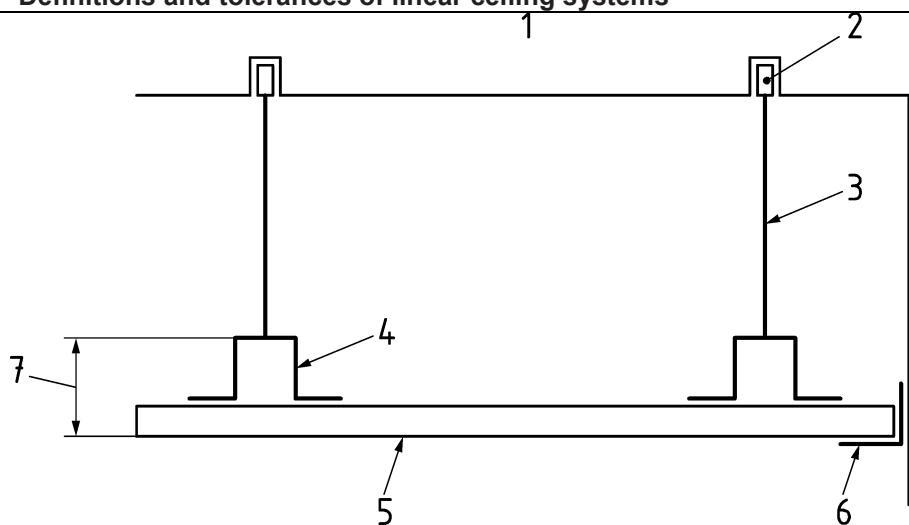
Definition

Ceiling components of relative narrow width and of which the length is generally made to measure

Width max. 400 mm

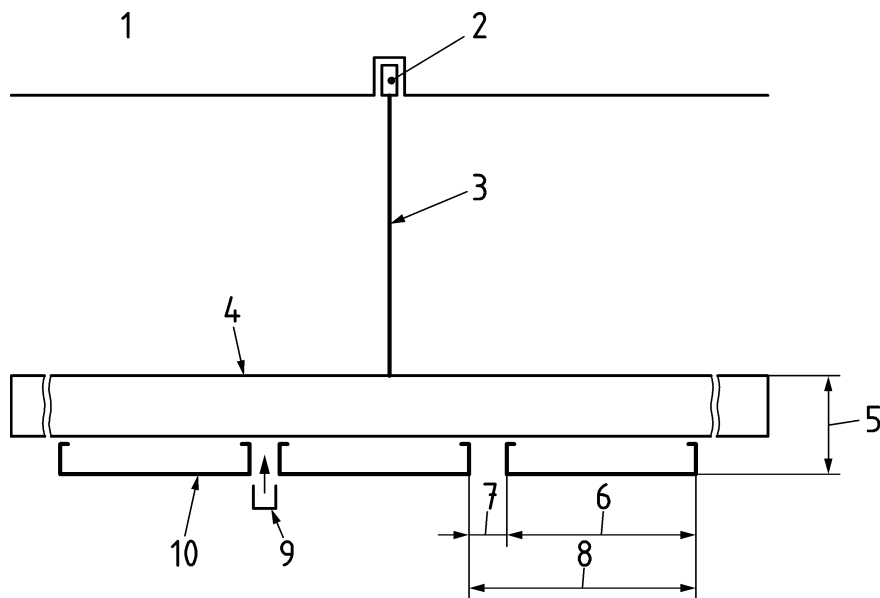
The linear components attach with their sides to the carriers. In general the angle between linear panel and carrier is 90°

- The sides of the linear components can be executed in many different shapes
- At both ends the linear components are open
- The joint between the sides of the components can have a width of 0 mm to X mm
- The modular dimension is component-width + joint
- The open joints between the components may be closed with a joint profile



Key

- | | |
|--------------------------|--------------------|
| 1 load bearing structure | 5 linear component |
| 2 top fixing | 6 perimeter trim |
| 3 suspension | 7 system height |
| 4 supporting member | |



Key

- | | |
|--------------------------|---------------------------|
| 1 load bearing structure | 6 linear component width |
| 2 top fixing | 7 joint |
| 3 suspension | 8 linear component module |
| 4 supporting member | 9 join profile |
| 5 system height | 10 linear component |

Table 5 (continued)

Tolerances of linear components
(dimensions in millimetres)

Dimensions:

Component height	± 0,5
Component length	
– (850 < 3 000) mm	± 1,25
– (3 000 ≤ 6 000) mm	± 2,0
Component width	± 0,75

Due to material and production properties additional dimensional deviations occur because of spring-back at the panel ends

Key

A	linear component length
B	linear component width
C	linear component height

Plane and waves (dimensions in millimetres)

Plane

Key

A	linear component length
B	linear component width
C	deviation from plane at A/2 panel length
D	deviation from plane at panel face

+	convex
-	concave

Linear component width (in mm)

0 < B ≤ 100	100 < B ≤ 200	200 < B ≤ 300	300 < B ≤ 400
C	C	C	C
- 1,0	- 1,25	- 1,5	- 1,75
+ 1,5	+ 2,0	+ 2,5	+ 2,7
D	D	D	D
- 1,5	- 2,5	-3,5	-4,0
+ 1,5	+ 2,0	+2,5	+2,7

Table 5 (continued)

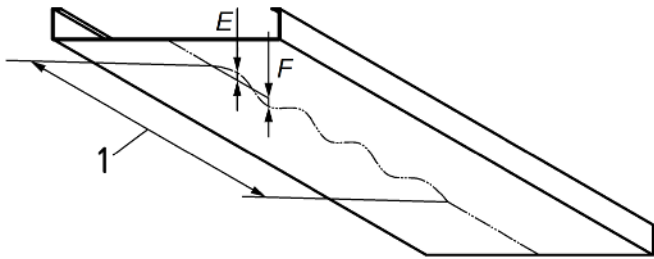
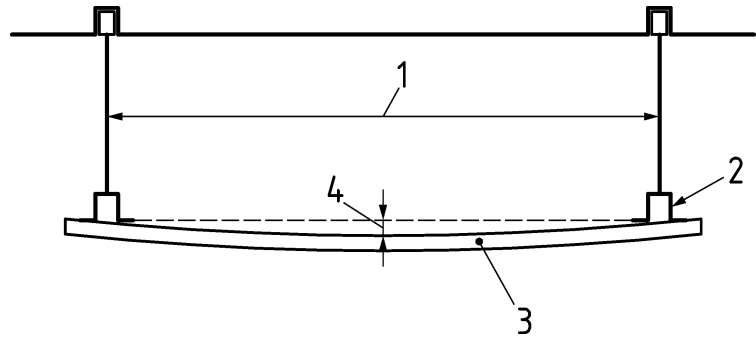
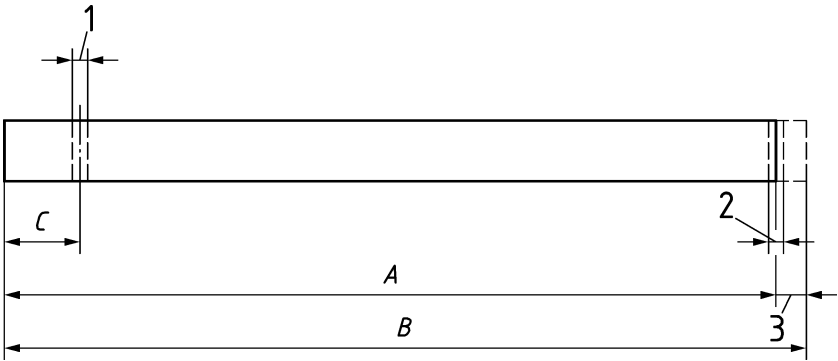
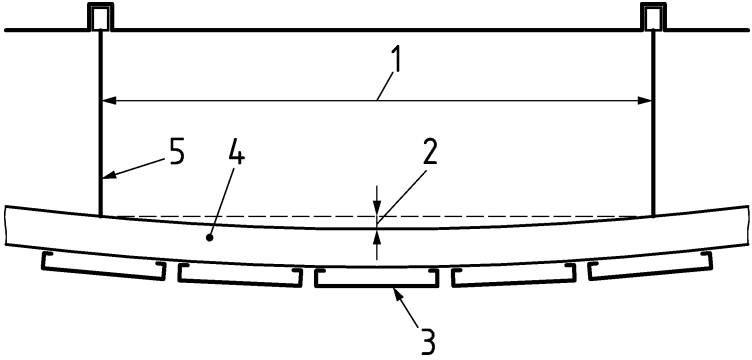
Waves			
			
Key			
1 linear component span			
E positive wave			
F negative wave			
Linear component width (in mm)			
0 < B ≤ 200		200 < B ≤ 400	
E	F	E	F
- 0,5	+ 0,5	- 0,8	+ 0,8
Camber			
The deviation is maximum 1/1 500 × linear component length, measured in the middle of the length of the linear component (equals 0,67 mm over 1,0 m length).			
Deflection of the linear components			
The maximum deflection between two supporting members/ points of support is 1/500 × supporting member distance, measured in the middle between the supporting members/ points of support.			
Key			
1 supporting member distance (linear component span)			
2 supporting member			
3 linear component			
4 linear component deflection (1/500 × supporting member distance)			
Tolerance of the supporting member module			
The tolerance of the supporting member module is ± 0,06 mm on a linear component module of 100 mm.			

Table 5 (continued)

Tolerance of the supporting-member length The length of the supporting member is a multiple of the supporting members' module The total length of the supporting member follows from the number of supporting member modules, including the module-tolerance, minus a cutting tolerance that is determined by the manufacturer Production-wise each supporting member starts and ends in the joint of the punching module Supporting-member splices or manufacturer's installation instruction ensure the modular dimensions over the length of more supporting members	 Key A supporting member length = X x Module – cutting tolerance B modular length supporting member C supporting members' module 1 module tolerance 2 length tolerance 3 cutting tolerance
Deflection of the supporting members The maximum deflection of the supporting members between two suspension points is $1/500 \times$ suspension distance, measured in the middle between two suspension points (Class 1, Table 6)	 Key 1 suspension distance (supporting member span) 2 supporting member deflection 3 linear component 4 supporting member 5 suspension
NOTE Measurements in millimetres are related to the nominal dimensions.	

4.3 Mechanical resistance and stability of load bearing components

4.3.1 General

This clause covers only the load bearing components of the suspended ceiling. It does not cover the mechanical characteristics of membrane components, for which 4.6.2 applies.

4.3.2 Substructure

4.3.2.1 Load bearing performance

The load bearing performance of the substructure shall be established by testing each of its components individually in accordance with the relevant test contained in Clause 5, unless the dimensions, nature and design of the material allow load bearing performance and deformation to be calculated.

The substructure shall be classified in accordance with its deflection limits as given in Table 6.

Where the component, once tested, is used in a configuration different to that used in the test, its admissible load bearing capacity, if required, shall be estimated by using data from the test.

Table 6 — Classes of deflection - Substructure profiles

Class	Deflection (mm)
1	L/500 and not greater than 4,0
2	L/300
3	No limit

Where L is the span in millimetres between the suspension points.

4.3.2.2 Substructure materials

4.3.2.2.1 Steel substructure

Where the substructure is formed in hot-galvanized strip or sheet of unalloyed steel, the minimum steel grade used shall be DX 51D + Z according to EN 10346.

If other steel types are used, they shall conform to EN 10152 (ZE), EN 10169 or EN 10346 (ZA, AZ), as appropriate.

The thickness tolerance shall be in accordance with EN 10143.

For corrosion protection the minimum protection shall be in accordance with Table 9 related to the class of exposure (see Table 8) to be encountered.

4.3.2.2.2 Aluminium substructure

Where substructure members are made of aluminium alloy, the alloy shall be in accordance with EN 573-3 and have 0,2 % yield strength of at least 160 N/mm².

For corrosion protection, the minimum protection shall be that given in Table 9.

4.3.2.2.3 Timber substructure

The timber used for substructure shall conform at least to quality grade S 10 (MS 10) of EN 1912.

The moisture content of the timber shall not exceed 20 % by mass.

The minimum cross section of the primary timber element shall be (40 x 60) mm. The dimensions for secondary timber elements shall be at least (48 x 24) mm or (50 x 30) mm for both primary and secondary timber elements.

Timber supporting elements fixed directly to the building structure (that is without any suspension) shall have a minimum cross section of (48 x 24) mm.

For indoor applications, wood preservation is normally not necessary. Where protection against biological or other attack, is necessary, the relevant provisions of EN 335, EN 350, EN 351, EN 460 and/or EN 599 shall apply.

4.3.3 Suspension components and fasteners

4.3.3.1 Metal suspension components

The admissible load of suspension components and their fasteners shall be tested in accordance with 5.3, unless the dimensions, nature and design of the material allow load bearing capacity and deformation to be calculated.

The admissible load shall be declared.

4.3.3.2 Timber suspension components

Timber suspension components shall either have a minimum cross section of 1 000 mm² and a minimum thickness of 20 mm, provided that a sufficiently secure connection (i.e. the timber cross section has to be enlarged when the force to be transmitted is larger than the minimum cross section allows) can be achieved by using nails or screws, or their strength shall be calculated according to EN 1995-1-1.

The admissible load shall be declared.

4.3.4 Resistance to fixings

Where and as far as relevant, manufacturers shall ensure that products withstand the loads that may be expected load, in accordance with 5.3.

4.3.5 Wind load resistance

Where the suspended ceiling is expected to be subject to interior wind load (e.g. in case of opening windows, doors), all necessary design measures shall be taken to enable the membrane components and the substructure to resist upward and/or downward load.

Under interior wind loading conditions, the ceiling membrane and substructure shall retain their stability and integrity and although some deformations could be acceptable, suspended ceilings or their parts shall be designed not to fail nor to collapse under this action.

In all other cases (circumstances) particularly buildings with large or permanent (e.g. parking houses) openings or in colonnades and open access ways the acceptance of wind loads (pressure/suction) by the suspended ceiling shall be proved, e.g. by calculation according to EN 1991-1-4.

NOTE For further information, see Annex C.

4.3.6 Impact resistance

Where the suspended ceiling is required to resist impact (e.g. in sports halls caused by ball throwing), the nature of the activity shall be ascertained and the required performance specified (e.g. classification of ball throwing resistance). The suspended ceiling shall be designed accordingly.

Where required, the impact resistance shall be tested according to Annex D.

The class of impact velocity under which the test ceiling withstands the impact without adversely affecting the strength, the function and safety of the suspended ceiling and which does not lead to a significant change in appearance shall be declared.

4.3.7 Seismic resistance

Where the suspended ceiling is exposed to seismic shocks, EN 1998-1 shall be taken into consideration. The suspended ceiling shall be designed such that the vertical and horizontal actions caused by seismic impacts do not cause damage or collapse.

4.4 Safety in case of fire

4.4.1 Fire resistance

4.4.1.1 General

Where fire resistance of suspended ceiling kits is required, EN 13501-2 shall be used for classification purposes in accordance with Decision 2000/367/EC⁴⁾, based on a test done in accordance with procedures described in the following subclauses.

NOTE Some Member States may have limitations on the use of demountable suspended ceilings for fire resistant uses.

4.4.1.2 Test specimen preparation

The suspended ceiling to be tested shall be representative of the complete ceiling system (suspension, substructure, membrane, etc.) for which the fire resistance rating is required.

In addition, the specific provisions of the test standard(s) called up by EN 13501-2 shall be followed.

4.4.1.3 Testing and classification

Suspended ceilings shall be tested in end use conditions and classified in accordance with EN 13501-2. Suspended ceilings having fire resistant performance shall be classified in one of the following three ways:

- Ceilings with fire resistance in conjunction with the element (e.g. floor or roof) above. Such ceilings shall be tested in conjunction with the roof/floor assembly above and fire resistance classification shall be related to the whole assembly.
- Ceilings which possess a fire resistant property independent of any element. The classification shall separately cover those ceilings that have a fire resistance performance from above and/or below independent of any element above the ceiling.
- As horizontal protective membranes.

4.4.2 Reaction to fire

4.4.2.1 General

Where use of suspended ceilings is subject to regulatory reaction to fire requirements, reaction to fire testing and classification shall be based on the performance of each component making up the ceiling (i.e. material-based testing approach), which shall be stated separately in the results. Where a substructure kit, substructure component or membrane component are sold separately, these are also subject to testing and classification.

For suspended ceilings placed on markets of some countries outside European Economic Area, where a full-scale testing approach is required, the suspended ceiling may be tested according to the provisions valid therein.

Where regulatory requirements exist, ceiling membrane components and substructure components shall be tested and classified in accordance with EN 13501-1 and the conditions described below, or they may be classified as reaction to fire Class A1⁵⁾ without the need for testing (CWT) or they may be classified without

4) Decision 2000/367/EC (OJEU L133 of 6.6.2000) amended by Decision 2003/629/EC (OJEU L218 of 30.08.2003).

5) See Decision of the Commission 96/603/EC of 1996-10-04 (see OJEU L267 of 1996-10-19), as amended twice by 2000/605/EC of 2000-09-26 (see OJEU L258 of 2000-10-12) and by 2003/424/EC of 2003-06-06 (see OJEU L144 of 2003-06-12).

the need for further testing (CWFT) in accordance with the appropriate agreed CWFT cases, as specified in Annex K.

Where the ceiling membrane and/or the substructure components have already been classified for reaction to fire in accordance with the provisions of EN 13501-1 and the prescriptions below (e.g. by conforming to a relevant product standard), the ceiling producer may use such classification of the ceiling membrane and/or the substructure components without the need to repeat the tests, provided that sufficient checks are in place to ensure the identification of the product.

4.4.2.2 Membrane components

The following possible options in relation to ceiling membranes may exist:

- a) the membrane is intended to be used as it is, with no addition of products above it when installed;
- b) the membrane is placed onto the market together with an insulation or other material to be installed above or below the membrane.

In case a), the ceiling membrane component shall be tested and classified on its own. In case b), the membrane component shall be tested together with an insulation or other material.

Where regulations require, the ceiling shall be tested either from the underside only (i.e. the side facing the room) or from the underside and top side (i.e. the side facing the ceiling void). Where this leads to different classifications, these shall be indicated in the results. Membrane components shall be mounted and fixed according to Annex I.

4.4.2.3 Substructure kits and substructure components

When testing substructure components in the SBI apparatus according to EN 13823, either they shall be mounted and fixed according to Annex I and tested in a way that permits their class to be determined in an appropriate way, or the class of the substructure material itself (e.g. timber or plastic) may be determined.

When testing substructure components in the small flame test apparatus according to EN ISO 11925-2, either they shall be mounted and tested in a way that permits their class to be determined in an appropriate way, or the class of the substructure material itself (e.g. timber or plastic) may be determined.

4.4.2.4 Jointing products

Where use of suspended ceilings is subject to regulatory requirements, the reaction to fire performance of jointing products shall be classified according to EN 13501-1.

Where a component or material is used, and its reaction to fire class, according to EN 13501-1, has already been determined (e.g. by compliance with harmonized European technical specification), this class may be used for declaring the reaction to fire classification of the prefabricated element according to this European Standard without the need of re-testing it.

Furthermore, the reaction to fire class of the component or material may be declared without the need for further testing (CWFT) according to relevant table in Annex K, if it meets all the requirements of that particular class given therein or where a higher class than the one in CWFT is sought.

Likewise, the reaction to fire class of such component or material may also be declared without the need for testing (CWT) as Class A1, if it meets all the requirements for such materials or products (see footnote 5)).

4.5 Hygiene, health and environment – Toxic gases and dangerous substances

4.5.1 Release of Asbestos (content)

No part of a ceiling shall release and/or contain asbestos. The indication "No content" shall be declared.

4.5.2 Release and/or content of formaldehyde

Where formaldehyde-containing material is added to any of the components of the ceiling as a part of the production procedure, the component shall be tested and classified into one of two classes: E1 or E2. The classes and related test methods shall be as specified in Annex E.

This requirement does not apply to components having naturally occurring levels of formaldehyde, which may be classified E1 without the need for testing.

Components, which have neither formaldehyde containing materials added nor which have naturally formaldehyde levels occurring do not have to be classified and declared in respect of formaldehyde release.

4.5.3 Other dangerous substances

National regulations on dangerous substances, other than those already covered in other clauses of this standard, may require verification and declaration on release, and sometimes content, when construction products covered by this standard are placed on those markets.

In the absence of European harmonized test methods, verification and declaration on release/content should be done taking into account national provisions in the place of use.

NOTE An informative database covering European and national provisions on dangerous substances is available at the Construction web site on EUROPA accessed through: <http://ec.europa.eu/enterprise/construction/cpd-ds/>.

4.5.4 Susceptibility to the growth of harmful micro-organisms

Some products covered by this standard may be susceptible to the growth of harmful micro-organisms. Given the absence of a European evaluation method, manufacturers should inform contractors and/or users of this susceptibility in accordance with Table 7.

Table 7 — levels of susceptibility

Level	Susceptibility
A	Not susceptible
B	Susceptible

In accordance with 4.8.1 and 4.10, thermal insulation/dew-point calculations, in accordance with EN ISO 6946 and EN ISO 10211, shall be made to demonstrate that the conditions producing such effects are avoided.

4.6 Safety in use

4.6.1 Shatter properties

Where membrane components are made of materials for which shatter properties or safe breakage are required (e.g. glass), the performance of the membrane in case of shattering or breakage shall be determined, classified and declared according to EN 12600.

4.6.2 Flexural tensile strength

The membrane shall have sufficient strength to support its own mass when installed in the substructure. When any additional load is to be applied, the load which may be applied shall be specified. In addition to the minimum requirement that the membrane shall not fall out, it shall be of adequate strength to ensure that safety in use is maintained. Relevant, adequate flexural tensile strength shall be determined, due account being taken of the span of the membrane component, any openings which may be made in it, and any load (in addition to its self weight) that may be attached to the membrane. Tests designed to assess the flexural tensile strength shall be performed according to Annex F, on representative samples of the membrane material, account also being taken of the end use design. The result of the test and the performance of the membrane shall be declared as one of the classes of exposure of Table 8 and the admissible type of load to be applied according to Table F.2.

4.6.3 Mechanical strength, safety against failure – baffles

Testing for flexural tensile strength is not applicable to baffles. The mechanical strength and safety against failure of baffles shall be determined according to Annex J. Whether or not the baffles meet the requirement shall be expressed as "pass" or "fail".

4.6.4 Electrical safety

Where relevant, suspended ceilings shall be capable of allowing installation of electrical appliances without risk of electrocution.

Where required, suspended ceilings shall be designed so that electrical wiring can be carried in exposed or concealed trays specifically designed and installed for that purpose.

Where regulations require that the suspended ceiling is earthed and/or bonded, the ceiling and its components shall be designed to allow this, in accordance with the requirements valid in the intended place of use of the product. Manufacturers shall declare whether the suspended ceiling is safe against the risk of electrocution and is designed (or is not designed) including earthing or bonding.

4.7 Acoustics

4.7.1 Test specimen preparation

Where acoustic performance is to be declared, the suspended ceiling to be tested shall be representative of the ceiling to be used in practice and for which the acoustic rating is required. In addition, the specific provisions of the test standard(s) listed below shall be followed.

Designers should be aware that the laboratory test results will not necessarily be reproduced on site (see EN 12354-6). For special applications or special acoustical performances studies, laboratory tests and in situ tests may be required.

4.7.2 Sound absorption

Where required, suspended ceilings having a sound absorption property shall be used and their sound absorption coefficients established according to EN ISO 354 and declared. The sound absorption coefficients shall be calculated as practical sound absorption coefficient α_p , expressed in a diagram or a table in octave bands, and into a single value α_w with shape indicator in accordance with EN ISO 11654.

NOTE Sound absorption is the reduction of sound energy that occurs when sound waves are absorbed by building surfaces and elements. The amount of sound absorption required and the location of the sound absorbing surfaces depend on a number of factors. These include the intended use of the room, the nature of the noise generated, the need to control reverberation, the shape of the room and the reflective characteristics of the enclosing surfaces.

The required reverberation time is function of the quantity and the performance of the absorption material and the shape and volume of the room (see EN 12354-6).

4.7.3 Sound insulation

4.7.3.1 General

Sound insulation concerns the acoustic performance of building elements in relation to their effect on the transmission of airborne and impact sound in a building. A suspended ceiling system may be required to:

- assist structural floors in reducing the vertical transmission of airborne and impact sound through the floor (vertical transmission);
- reduce the sound transmission from room to room. This relates to both direct and indirect sound and is of particular importance where suspended ceilings are carried over partitions (horizontal transmission).

Where the suspended ceiling is required to contribute to the reduction of the vertical transmission of airborne and impact sound through a floor, and/or where the suspended ceiling is required to contribute to the reduction of direct and indirect horizontal sound transmission (including the situation where the suspended ceiling with a plenum crosses over partitions), the performance shall be measured and expressed as described in 4.7.3.2 and 4.7.3.3, respectively.

4.7.3.2 Laboratory measurement of vertical sound reduction

The laboratory measurement of vertical sound reduction of airborne sound shall be in accordance with EN ISO 10140 and declared in accordance with EN ISO 717-1.

4.7.3.3 Laboratory measurement of horizontal transmission

The laboratory measurement of horizontal sound reduction of a suspended ceiling with a plenum above it shall be in accordance with EN ISO 10848-2 and declared in accordance with EN ISO 717-1.

4.7.4 Direct field of application

The results of acoustic tests may be extended to other ceilings of similar design, without the need for re-testing, subject to the following conditions:

- any change shall demonstrably lead to an improvement in acoustic performance (e.g. increased thickness of the membrane, increased density or greater dynamic stiffness);
- changes to the area shall be permitted, subject to the condition given above;
- components and membranes from one manufacturer may be changed to those from another manufacturer having the same or improved acoustic specification.

4.8 Durability

4.8.1 General

Products meeting the requirements specified in this clause may be deemed to satisfy the expected economical lifetime for easily replaceable products.

The exposure class in accordance with Table 8 shall be declared.

4.8.2 Dampness

Suspended ceilings shall be designed to ensure that detrimental levels of water and condensation are not formed within or on the surfaces of the ceiling and adjacent building components, during the intended working life of the ceiling, in ways which could lead to a loss of flexural tensile strength of the membrane and/or loss of load bearing capacity of the whole suspended ceiling kit or the substructure. Thermal insulation/dew-point

calculations, in accordance with EN ISO 6946 and EN ISO 10211, shall be made to verify and demonstrate that the conditions producing such effects are avoided.

The level of protection against corrosion of steel and aluminium components when exposed in the range of exposure conditions given below shall be specified in accordance with Table 9. For the protection of timber, 4.3.2.2.3 shall apply.

4.8.3 Service life requirements

The suspended ceiling shall retain its performance properties during its service life when exposed to the conditions for which it was designed (see 4.8.4), subject to receiving normal maintenance, as recommended by the designer, and not subject to ill treatment during its life.

The following information relating to durability and maintenance shall be provided as indicated:

- the ceiling manufacturer shall state if the visible surfaces of the ceiling membrane and substructure are cleanable and, if so, what cleaning technique is required and what limitations apply;
- the ceiling manufacturer shall state if the visible surface of the ceiling membrane and substructure is repaintable and, if so, what materials and techniques are recommended and what, if any, aspects of the ceiling's performance would be affected;
- the ceiling manufacturer shall state the likely effect of the cleaning and painting on other aspects of the performance of the ceiling;
- the ceiling manufacturer shall state the minimum maintenance requirements necessary to enable the ceiling to continue to meet its claimed performance during its working life.

4.8.4 Classification of ceiling exposure conditions

The ceiling or component manufacturer shall state which of the classes of exposure of Table 8 the suspended ceiling or component complies with the requirements of 4.6.2 and 4.8.3.

Table 8 — Classes of exposure

Class	Conditions
A	Building components exposed to varying relative humidity up to 70 % and varying temperature up to 25 °C but without corrosive pollutants
B	Building components exposed to varying relative humidity up to 90 % and varying temperature up to 30 °C but without corrosive pollutants
C	Building components exposed to varying relative humidity up to 95 % and varying temperature up to 30 °C and accompanied by a risk of condensation but without corrosive pollutants
D	More severe than the above

4.8.5 Corrosion protection

Metal framing components, suspensions and connecting elements shall be protected against corrosion according to Table 9.

Table 9 — Classes of corrosion protection of metal substructure components and membrane components

Class (according to Table 8)	Profiles, suspensions, connecting elements and membranes	
	Components made of steel	Components made from aluminium
A	Products with a continuously hot-dip metal coating Z100, ZA095 or AZ100 according to EN 10346 ^{a,b} . Products with electroplated zinc coating flat ZE25/25 according to EN 10152 ^b . Continuously organic coated (coil-coated) products of corrosion protection (interior) category CPI2 for the exposed side according to EN 10169 ^e (e.g. coating system ZE15/15-HDP25-2T-CPI2).	No additional corrosion protection required
B	Products with a continuously hot-dip metal coating Z100, ZA095 or AZ100 according to EN 10346 ^{a,b} . Products with electroplated zinc coating flat according to EN 10152 with or without an additional organic coating ^c as follows ^b : ZE25/25 + 40 µm per face ^d , ZE50/50 + 20µm per face ^d or ZE100/100 without OC. Continuously organic coated (coil-coated) products of corrosion protection (interior) category CPI2 for the exposed side according to EN 10169 ^e (e.g. coating system ZE15/15-HDP25-2T-CPI2).	No additional corrosion protection required or coil coating according to EN 1396:2007: corrosion index 2a
C	Products with a continuously hot-dip metal coating Z100, ZA095 or AZ100 according to EN 10346 ^{a,b} with an additional organic coating ^c of 20 µm per face. Products with electroplated zinc coating flat according to EN 10152 with an additional organic coating ^c as follows ^b : ZE25/25 + 60 µm per face ^d , ZE100/100 + 40µm per face.	Anodizing ^b (15 µm < s < 25 µm) or coil coating according to EN 1396:2007: corrosion index 2a
D	Special measures depending on use and corrosion action. Minimum corrosion protection according to Class C. Additional measures as required.	Anodizing ^b (s > 25 µm) or coil coating according to EN 1396:2007: corrosion index 2b

^a EN 10327 replaces EN 10142 (Zinc), EN 10214 (Zinc - Aluminium) and EN 10215 (Aluminium - Zinc) and EN 10346 replaces EN 10327.

^b Any equivalent corrosion protection leading to a similar level of protection is permitted.

^c Coating of exposed parts with zinc compatible organic coating according to EN ISO 12944-3 applied by a post-painting process or equivalent coil coating according to EN 10169.

^d Applies only to membrane components.

^e Applies only to "capping" material for substructure components.

4.8.6 Contact corrosion protection

In order to avoid corrosion due to contact between dissimilar materials (e.g. steel and aluminium), intermediate layers of suitable protecting materials shall be applied according to EN ISO 12944-3.

Where wood preservatives are used, the corrosion protection method for the metal components that are connected to the timber components shall be compatible with the wood preservative.

4.8.7 Durability of non-cellular PVC profiles

The durability of non-cellular PVC-U profiles shall be demonstrated by testing the impact resistance at 23 °C according to EN 13245-1:2010, Annex A, and declaring the result according to EN 13245-1:2010, Table 2. The durability of PVC-UE profiles shall be demonstrated by testing the impact resistance at 23 °C according to EN 13245-2:2008, Annex B, and declaring the result according to EN 13245-2:2008, Table B.1.

4.8.8 Durability of wooden products

With regards to biological durability of timber, the hazard classes in which a product may be used are specified in EN 335. Alternatively, an appropriate preservation treatment shall be chosen in accordance with EN 350, EN 351 and EN 460. The mechanical durability shall be determined by taking the appropriate modification factors k_{mod} and k_{def} from EN 1995-1-1.

4.9 Colour, light reflectance and gloss factor for suspended ceiling components

4.9.1 General

Colours, light reflectance and gloss factor shall be as agreed between designer and specifier and, where required, shall be tested and declared according to 4.9.2, 4.9.3 and 4.9.4.

NOTE The number of colour tests is left to the discretion of the designer.

4.9.2 Measurement method of colour composition

The colour composition of suspended ceiling components shall be measured using a computerized measuring device, operating according to the CIE-Lab method in ISO 7724-2 and ISO 7724-3.

4.9.3 Measurement method for light reflectance

The light reflectance value of suspended ceiling components shall be measured using a computerized measuring device, operating according to the CIE-Lab method in ISO 7724-2 and ISO 7724-3. The designer shall state what, if any, the effect of perforations of the components is on the recorded light reflectance value.

4.9.4 Measurement and value of gloss factor

The gloss factor of suspended ceiling components shall be determined and classified in accordance with EN ISO 2813.

4.10 Thermal insulation

Where the suspended ceiling is designed to provide thermal insulation, this shall be demonstrated by calculation using the methods of EN ISO 6946 and EN ISO 10211 with data from one (or both) of the following:

- reference design data, as tabulated values, taken from EN ISO 10456;
- test results (usually where the designer wishes to claim a better performance than obtained from reference design data), using either EN 12664 or EN 12667 with equipment calibrated according to the European level (using IRMM 440 reference material). The declared thermal resistance and/or thermal conductivity shall be calculated using one of the standards EN 13162 through EN 13171:2012, 4.2.1, as appropriate.

The thermal performance of the assembled suspended ceiling kit or component shall be declared.

5 Loading capacity of substructures components – Test methods

5.1 General

This testing method is applicable for metal substructures, suspensions and connecting elements whose loading capacity cannot be determined by calculation.

The specimen to be tested shall include all the characteristics of those products as used on site.