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Fire resistance tests for non-loadbearing elements - Part 4: Curtain walling - Part configuration

Feuerwiderstandsprüfungen für nichttragende Bauteile - Teil 4: Vorhangfassaden - Teilausführung

Essais de résistance au feu des éléments non-porteurs - Partie 4: Façades rideaux - Configuration partielle

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Foreword

This document (EN 1364-4:2014) has been prepared by Technical Committee CEN/TC 127 “Fire safety in buildings”, 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of an identical text or by endorsement, at the latest by August 2014, and conflicting national standards shall be withdrawn at the latest by August 2014.

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This document supersedes EN 1364 −4:2007.

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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, 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

WARNING

The attention of all persons concerned with managing and carrying out this fire resistance test is drawn to the fact that fire testing can be hazardous and that there is a possibility that toxic and/or harmful smoke and gases can be developed during the test. Mechanical and operational hazards can also arise during the construction of the test elements or structures, their testing and disposal of test residues.

An assessment of all potential hazards and risks to health should be made and safety precautions should be identified and provided. Written safety instructions should be issued. Appropriate training should be given to relevant personnel. Laboratory personnel should ensure that they follow written safety instructions at all times.

1 Scope

This European Standard specifies a method for determining the fire resistance of parts of curtain walling and of the perimeter seal. It examines the fire resistance to internal and external fire exposure of:

— the spandrel panel, i.e. downstand, upstand or a combination thereof, or

— the perimeter seal, or

— the fixing of the framing system (anchoring) used to attach the curtain walling to the floor element, or

— combinations thereof.

Results from tests according to this standard form the basis for classification of curtain walling type A (see 3.3 for definition).

For curtain walling type B (see 3.4 for definition) results may be used to determine fire resistance of parts of a curtain walling to increase the field of application when previously tested to EN 1364-3. For intended classification EW and for corner/faceted specimens EN 1364-3 should be used.

This European Standard does not cover double skin façades, over-cladding systems and ventilated façade systems on external walls. It does not deal with the reaction to fire behaviour of curtain walling.

This standard is intended to be read in conjunction with EN 1363-1 and EN 1363-2 as well as EN 1364-3 for curtain walling type B.

NOTE Annex A gives informative guidance on the principles of testing parts of curtain walling and the test method.

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 1363-1, *Fire resistance tests - Part 1: General Requirements*

EN 1363-2, *Fire resistance tests - Part 2: Alternative and additional procedures*

EN 1364-3, *Fire resistance tests for non-loadbearing elements - Part 3: Curtain walling - Full configuration (complete assembly)*

EN 13119, *Curtain walling - Terminology*

EN 13501-1, *Fire classification of construction products and building elements — Part 1: Classification using 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 13830, *Curtain walling - Product standard*

EN ISO 13943, *Fire safety - Vocabulary (ISO 13943)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 1363-1, EN 13119, EN 13830, EN ISO 13943 and the following apply.

3.1
anchoring
see *fixing of the framing system*

3.2
associated wall construction
form of construction required to close the vertical side of the furnace (not part of the test specimen)

3.3
curtain walling type A
curtain walling without fire resistant glazing outside the spandrel area – fire resistant only in the spandrel area

3.4
curtain walling type B
curtain walling with fire resistant glazing outside the spandrel area - fully fire resistant curtain walling

3.5
downstand
special type of spandrel panel, hanging down from or located in front of the floor

Note 1 to entry: See Figure A.2.

3.6
fire-resistant glazing
glazing system consisting of one or more transparent or translucent panes with a suitable method of mounting, with e.g. frames, seals and fixing materials, capable of satisfying the appropriate fire resistance criteria

3.7
fire resistant translucent or transparent spandrel panel
glass product, monolithic, laminated or insulating glass unit, manufactured by a particular manufacturer and intended to be used as spandrel panel in curtain walling, which is CE marked based on a classification according to EN 13501-2 in minimum one glazed construction

Note 1 to entry: The term “insulating” when used with “insulating glass unit” according to EN 1279–1, should not be confused with the term “insulation” used in classification standard EN 13501–2.

3.8
fixing of the framing system
system used to attach the curtain wall to the loadbearing floor. It contains the brackets but not the anchor or other devices used to fix the brackets to the floor

3.9
glazing materials
all materials used to glaze the fire resistant translucent or transparent spandrel panel into its frame

3.10
horizontally faceted curtain walling
curtain walling with an angle between horizontally adjacent infill panels at the common mullion (see Figure 1)

3.11
insulating glass unit (IGU)
glass product according to EN 1279–1

3.12
over-cladding system
protection system fixed to an external wall for weather protection

3.13
overrun time
time of fire resistance in minutes beyond the envisaged classification time, achieved in the test

3.14
perimeter seal
see EN 13119

3.15
standard configuration
standard arrangement of curtain walling components in a test specimen

3.16
supporting floor
representation of a floor, forming part of the test construction, to allow the fixing of the test specimen of the curtain walling and the installation of the perimeter seal

3.17
upstand
special type of spandrel panel, standing up from or located in front of the floor

Note 1 to entry: See Figure A.2.

4 Test equipment

4.1 General testing principles

Table 1 defines which specific standard test configuration may be used for each part of the curtain walling depending on the type of fire exposure and type of curtain walling.

The test equipment specified in EN 1363-1 and EN 1363-2 shall be used where applicable.

Table 1 — Standard test configurations and exposure conditions

Product / component of curtain walling	Type of curtain walling [a]	Fire exposure / heating conditions	Test configuration (see Annex B)	Surfaces
Spandrel panel (upstand, downstand or combinations thereof)	A	Internal (STC) + external (ef) [b]	1	S3
		Internal (STC) + external (STC) [c]	2	S3
	B	Internal (STC)	3	S2, S3
		External (STC or ef) [d]	4	S1
Perimeter seal	A	Internal (STC)	1, 5	-
	B	Internal (STC)	3, 5	-
Fixing of the framing system	A	Internal (STC)	1, 5	-
	B	Internal (STC)	3, 5	-

ef External fire curve as specified in EN 1363–2.

STC Standard temperature / time curve as specified in EN 1363–1.

For more information on the test configuration depending on the heating exposure and explanation, see Table A.1.

a For definition of type of curtain walling see 3.2 and 3.3

b In case the requirement for the external fire exposure is the external fire curve as specified in EN 1363–2.

c In case the requirement for the external fire exposure is the standard temperature/time curve as specified in EN 1363–1.

d Depending on national requirements.

4.2 Furnace configuration

A floor or a wall furnace may be chosen. The minimum dimensions of the furnace are given in Figures B.1 to B.5. For the installation of the specimen, wall or floor furnaces shall be modified, if necessary, to accommodate the three-dimensional construction. The three dimensional construction includes the perimeter seal.

The test according to EN 1364-4 is performed on a three-dimensional specimen to allow an exposure of a number of surfaces of the upstand/downstand (spandrel area) and incorporates a supporting floor, which provides the support for the curtain walling.

4.3 Supporting floor

A supporting floor is provided as a base for the attachment of the fixing of the framing system and as a location for the perimeter seal under examination. If information on the fire resistance of the curtain walling in conjunction with a particular type of floor construction is required, such a construction shall be used, see 7.2.

5 Test conditions

The pressure conditions and the furnace atmosphere shall conform to those given in EN 1363-1, subject to a nominal pressure of 20 Pa at the positions shown in Figures B.1 to B.5.

The heating conditions shall conform to those given in EN 1363-1 and/or EN 1363-2 for the test configuration selected as given in Table 1. For details see Annex B.

6 Test specimen

6.1 Size

The size of the test specimen shall be as follows:

a) the height of the spandrel area as in practice (normally about 1 m),

b) if the width of the curtain walling in practice is less than 3 m, the specimen shall be full size as in practice,

c) if the width of the curtain walling in practice is larger than 3 m, the width of the specimen shall be not less than 3 m.

NOTE 1 A width larger than 3 m may be the result of single panels with a width of more than 3 m or the result of the repetition of smaller construction units (mullion distance < 3m).

NOTE 2 The height depends on national requirements.

Where the width of a single spandrel panel (upstand/downstand) is less than 3 m, at least 3 panels with the mid panel at the maximum dimension shall be incorporated in the test specimen. Where the width of the panel is greater than or equal to 3 m, at least 3 panels with the mid panel at the maximum width shall be incorporated in the test specimen. The outer panels may be cut, subject to a minimum clearance between the mullions at the boundary of the mid panel and the inner surface of the furnace of 200 mm.

The height h is the total of upstand and downstand (spandrel area).

If the height of the specimen is smaller than the vertical opening of the furnace, the furnace opening shall be closed with a furnace closure according to 7.3.

6.2 Number of specimens

The performance of curtain walling or parts of curtain walling type A for internal and external exposure shall be determined from a single test where the specimen is heated from both sides. For details see Annex B. For curtain walling type B separate tests shall be performed for internal and external exposure.

NOTE Depending on national requirements the external exposure may be the external fire curve as specified in EN 1363–2 or the standard temperature/time curve as specified in EN 1363–1.

6.3 Design

6.3.1 General

The test specimen shall be:

— either fully representative of the construction intended for use in practice, including fixing of the framing system, expansion joints, perimeter seals, any surface finishes and fittings which are essential and may influence its behaviour in the test, or

— a standard configuration as defined in Annex B.

NOTE The use of a standard configuration allows the use of field of application rules to obtain the widest applicability of the test result to other similar constructions.

The test specimen shall consist of parts of the curtain walling. It shall fully represent the construction on which information is required. For use of field of application rules, one of the standard configurations given in Table 1 as described in Annex B shall be used, see Clause 13. The test specimen shall consist of:

— the curtain walling part,

— the perimeter seal and

— the fixing of the framing system.

If the scope of the test is the perimeter seal and movement capability is intended to be considered (see A.3.4) the fixing may be omitted.

All design features which influence fire resistance performance shall be included. If the scope of the test includes an assessment of the fixing of the framing system additional load may be required to take account of the part of the curtain walling not included in the test.

6.3.2 Standard configuration

6.3.2.1 General

A straight test specimen shall comprise a section of the curtain walling with minimum two mullions or two vertical joints between panels in case of systems without frame or mullions, fully exposed to the fire, see Figure 2. In case a T-connection and/ or cross connection is intended to be included these shall be located in the heated area.

A transom shall be used on top and bottom of the spandrel panel except it is the intention of the test to demonstrate the performance of panels not fixed on top or bottom.

A faceted specimen shall comprise minimum four sections of the curtain walling forming minimum one corner of 90 degrees and two angles of 135 degrees, all sections with a minimum width of 500 mm, minimum three sections with a width of minimum 1000 mm, see Figures 3A to 3D for examples. Two such specimens may be combined to a specimen forming two corners of 90 degrees and two angles of 135 degrees, see Figures 3E and 3F for examples.

In case a transom is located in front of the floor slab in practice the test specimen shall also contain a transom in front of the supporting floor. Such a transom is not considered being part of the perimeter seal but part of the framing.

A supporting floor shall be used for standard configurations 1, 2, 3 and 5. The design of the standard supporting floor is given in 7.2.1.

6.3.2.2 Test configuration for curtain walling type A

The test specimen shall be heated from both sides at the same time. Depending on the requirements for the external exposure the heating of conditions of the standard temperature/time curve as specified in EN 1363-1 are maintained on one side only or on both sides of the specimen – for details see Figures B.1 and B.2.

6.3.2.3 Test configuration for curtain walling type B

The test specimen shall be heated only from one side. In standard configurations for curtain walling type B the furnace closure or fire-resistant glazing may be positioned directly beneath the upstand/downstand. For the furnace closure see 7.3.

For details see Figures B.3 and B.4.

6.3.3 Restraint of the specimen

The test specimen shall be fixed to the supporting floor using the fixing of the framing system (anchoring) of the mullions as in practice. The mullions shall not be fixed at the lower end but may be fixed additionally to the

furnace frame on the upper end. The mullions may be fixed by spigot to simulate the situation that the mullions abut each other in front of the floor in practice.

In case of external fire exposure (test specimen without supporting floor, standard configuration 4 according to Figure B.4) the mullions shall be fixed to the furnace frame at the top of the specimen.

Both vertical edges shall be unrestrained. The furnace closure on the free edge between the associated wall construction or furnace frame and the mullions, e.g. a mineral wool packing, shall allow unrestrained movement of the mullions (see Figure 4).

The bottom edge of the test specimen shall be unrestrained. The furnace closure below the test specimen shall allow unrestrained extension/movement of the mullions and the spandrel panel.

At the top of the specimen a mineral wool packing shall be placed so that the top edge of the test specimen is unrestrained.

In case no fixing of the framing system is used for a test of the perimeter seal (standard configuration 5 according to Figure B.5 but without fixing of the framing system) the mullions shall be fixed to a frame at top and bottom. The edges of the spandrel panel shall remain unrestrained.

6.3.4 Surfaces

For definition of the surfaces for the installation of the thermocouples see Figure 5. The numbering of the surfaces is the same as that used in EN 1364-3.

NOTE Surface S2 is the external surface of the curtain walling.

6.3.5 Perimeter seal

6.3.5.1 Test configuration/conditions regarding seal width and depth

6.3.5.1.1 Mineral wool

Where a seal with constant depth but variable joint width is considered, it shall be tested at maximum nominal joint width. The degree of initial compression (%) exerted on the seal by the joint width as well as the direction of the compression (see Figure 17) shall be recorded.

In case mineral wool is used as backing material (e.g. for membrane forming coatings or sealants) variations of the mineral wool may be used within one test specimen provided the length of the seal with a particular backing material is minimum the same as the distance between two mullions and it is located such that the splice between different backing materials is not located in the area of the mullion.

6.3.5.1.2 Membrane forming coatings

The test shall be carried out using the minimum thickness (minimum of tolerance band for the nominal thickness) of the membrane, minimum depth of mineral wool (or other backfilling material), maximum width and minimum overlap at the substrate for the intended fire resistance performance. When a primer is part of the system, it shall be included in the test. Each primer shall be tested separately.

6.3.5.1.3 Compressible strips (including composite)

Where only one seal depth is intended to be specified for all joint widths the maximum intended nominal joint width shall be used. If the seal depth varies with the joint width a test shall be conducted at the maximum nominal joint width for each related seal depth specified by the manufacturer.

6.3.5.1.4 Elastomeric strips

The test shall be carried out using the minimum thickness (minimum of tolerance band for the nominal thickness) of the strip, maximum joint width and minimum overlap at the substrate. When a primer is part of the system it shall be included in the test. Each primer shall be tested separately.

6.3.5.1.5 Sealants

Where only one seal depth, with a specified combination of sealant to backing material thickness, is intended to be specified for all joint widths the maximum intended nominal joint width shall be used. If the thickness of the sealant or the backing material varies with the joint width a test shall be conducted at the maximum nominal joint width for each related seal depth specified by the manufacturer.

6.3.5.2 Test conditions regarding movement

In case movement capability is intended to be considered the fire test shall be commenced at maximum extension/shear of the perimeter seal.

NOTE For further information on test requirements for perimeter seals in case of required movement capability see A.3.4.

6.4 Construction

The test specimen shall be constructed as described in EN 1363-1, subject to deviating rules given in this standard.

In case a component of the curtain walling is cut all open gaps shall be closed using material of class A1 according to EN 13501-1.

6.5 Verification

Verification of the test specimen shall be carried out as described in EN 1363-1.

7 Installation of the test specimen

7.1 General

The test specimen shall be fitted to the supporting floor by means of the fixing of the framing system that are used in practice, see 7.2.

7.2 Supporting floor

7.2.1 Standard supporting floor

The standard supporting floor shall have a minimum thickness of 150 mm and minimum width of 500 mm for straight specimens. For faceted specimens the minimum width shall be 200 mm (see Figure 6). The floor shall be made of reinforced concrete or made of reinforced aerated concrete and shall be restrained at three sides.

7.2.2 Non-standard supporting floor

Any floor construction as in practise may be used. The results of the test are limited to that floor construction only (no field of direct application concerning floor constructions).