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Preskusi požarne odpornosti nenosilnih elementov - 3. del: Obešene fasade - Celotna fasada

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

Feuerwiderstandsprüfungen für nichttragende Bauteile - Teil 3: Vorhangfassaden - Gesamtausführung

Essais de résistance au feu des éléments non-porteurs dans les bâtiments - Partie 3: Murs rideaux

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This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 127.

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

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
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Foreword

This document (prEN 1364-3:2011) has been prepared by Technical Committee CEN/TC 127 “Fire safety in buildings”, the secretariat of which is held by BSI.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 1364-3:2006.

Introduction

CAUTION The attention of all persons concerned with managing and carrying out this fire resistance test is drawn to the fact that fire testing may be hazardous and that there is a possibility that toxic and/or harmful smoke and gases may be evolved during the test. Mechanical and operational hazards may also arise during the construction of the test elements or structures, during their testing and during the 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 curtain walling – full configuration.

This European Standard is used in conjunction with EN 1363-1.

NOTE Annex B gives further information on the test method.

The test method is applicable to curtain walling type B (for definition see 3.3). The test is not appropriate for testing curtain walling type A (for definition see 3.2).

The fire resistance of curtain walling may be determined under internal or external exposure conditions. In the latter case the external fire exposure curve given in EN 1363-2 may be used, subject to deviating national regulations.

Tests on individual parts of a curtain walling (e.g. perimeter seal, infill panel or fixings of the framing system (anchoring) used to attach the curtain walling to the floor element, hereafter referred to as "fixing") or systems with fire resistance requirements only to the spandrel area may be performed using EN 1364-4. For vertical linear gap seals, this standard (EN 1364-3) applies.

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

2 Normative references

The following referenced documents are indispensable for the application 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 1363-1, *Fire resistance tests — Part 1: General requirements*

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

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 13943:2008)*

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
associated wall construction
mechanism of closing the vertical side of the furnace for the required period of fire resistance

3.2
curtain walling type A
curtain walling without fire resistant glazing outside the spandrel area – fire resistant only in the spandrel area

3.3
curtain walling type B
curtain walling with fire resistant glazing outside the spandrel area - fully fire resistant curtain walling

3.4
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

3.5
fire resistant translucent infill panel
Glass product, monolithic, laminated or insulating glass unit, manufactured by a particular manufacturer and intended to be used as infill panel in curtain walling, which is CE marked based on a classification according to EN 13501-2 in minimum one glazed construction

NOTE 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.

3.6
glazing materials
all materials used to glaze the fire resistant translucent infill panel into its frame

3.7
horizontally faceted curtain walling
curtain walling with an angle between the infill panels and the mullions (see Figure 1)

3.8
insulating glass unit (IGU)
glass product according to EN 1279–1

3.9
over-cladding system
protection system fixed to an external wall for weather protection

3.10
overrun time
time of fire resistance in minutes beyond the envisaged classification time, achieved in the test

3.11
simulated wall construction
wall construction, necessary as part of the test specimen in case a vertical linear gap seal between a curtain walling and an abutting wall is to be tested

NOTE The type of wall construction will determine the field of application for the vertical linear gap seal.

3.12
span length
distance between two sequent fixing points of the curtain walling along the direction of a mullion

3.13
vertically faceted curtain walling
curtain walling with a vertical and a sloped part without fixing/bracket at the joint (see Figure 2)

4 Test equipment

4.1 General

In addition to the test equipment specified in EN 1363-1, and if applicable EN 1363-2, the equipment as specified in 4.2 and 4.3 is required for internal or external exposure.

4.2 Internal exposure

The test equipment includes:

— two floors adequately supported by the floor of the laboratory and/or the furnace;

— associated and/or simulated wall constructions which provide an enclosure between the furnace and the specimen.

4.3 External exposure

A supporting frame which supports the specimen and is designed to allow the specimen to be supported and located adjacent to the furnace in case an installation in front of the furnace is used.

5 Test conditions

The heating and pressure conditions and the furnace atmosphere shall conform to those given in EN 1363-1 or, if applicable, EN 1363-2 which are related to the external fire curve.

6 Test specimen

6.1 Size

6.1.1 General

The exposed width and height shall not be less than 3 m.

There shall be a clearance of minimum 50 mm between the floor of the test room (or any other element under the edge of the test specimen to give support) and the bottom edge of the test specimen (see Figures 3 and 4).

6.1.1.1 Internal fire exposure

The test specimen (see Figure 3) shall be of sufficient height to allow:

a) the inclusion of a spandrel area in front of the upper supporting floor as in practice. The spandrel may be cut in height so that it extends minimum 500 mm beyond the top of the upper supporting floor, if applicable.

b) the test specimen to extend 150 mm below the upper surface of the lower supporting floor with the bottom edge unsupported.

If an assessment of a vertical linear gap is required, the test specimen shall then be of sufficient width to allow a minimum of 500 mm of the test specimen to extend beyond the outside of the simulated wall.

6.1.2 External fire exposure

The test specimen shall be of sufficient height to allow the test specimen to extend minimum 150 mm below the upper surface of the lower supporting floor with the bottom edge unsupported in case the specimen is installed in front of the furnace (see Figure 4).

6.2 Number of specimens

Separate tests are necessary for internal and external exposure conditions

Depending on the construction of the curtain walling and the intended field of application additional tests with faceted specimens may be necessary.

6.3 Design

6.3.1 General

The test specimen shall be:

a) either fully representative of the construction intended for use in practice, including fixings, expansion joints, linear gap seals, any surface finishes and fittings which are essential and may influence its behaviour in the test, or

b) be a standard construction as defined in 6.3.2.

6.3.2 Standard configuration

6.3.2.1 General

A straight test specimen shall comprise a section of the curtain walling comprising minimum two mullions and two transoms or two vertical joints between panels in case of systems without a frame or mullions, fully exposed to the fire, see Figure 5. One of the mullions and transoms may be interrupted to allow the inclusion of T-connections. Figure 6 shows an example for the standard configuration of a test specimen including a vertical linear gap seal. Figure 7 shows an example for the standard configuration of a specimen including horizontal and vertical T-connections.

A faceted specimen shall comprise minimum four sections of the curtain walling forming minimum one corner of 90 degrees and two facet 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 8A to 8D for examples. Two such specimens may be combined to a specimen forming two corners of 90 degrees and two facet angles of 135 degrees, see Figures 8E and 8F 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.

6.3.2.2 Internal exposure

The test specimen for internal exposure shall include the curtain walling, the perimeter seals, if required, the vertical linear gap seal with the simulated wall and two supporting floors.

If the vertical linear gap seal is not part of the test specimen, then two associated wall constructions are required.

6.3.2.3 External exposure

The test specimen for external exposure only includes the curtain walling. The supporting floors, the perimeter seal and the vertical linear gap seal may be omitted. For standard configurations see Figure 9.

The vertical edges of the test specimen shall be unrestrained.

In case a test specimen according to Figures 9B and 9C is intended to be used it shall comply with the following:

a) the test specimen shall be rigidly fixed only on top (hanging curtain walling) or at bottom (standing curtain walling);

b) the fixing on the opposite side as well as the adjacent furnace closure shall allow thermal extension of the specimen as in practice;

NOTE A gap of 50 to 100 mm is considered sufficient to allow thermal extension as in practice

6.3.3 Restraint

The test specimen for internal exposure shall be fixed to the top and bottom supporting floor with the type of fixings used in practice. The test specimen for external exposure shall be either fixed to a frame or fixed to the top or the bottom of the furnace as illustrated in Figure 9.

Both vertical edges shall be unrestrained. A suitable furnace closure at the free edge between the associated and/or simulated wall construction and the mullions shall be used that allows unrestrained movement of the mullions (see Figure 10 for options).

Maximum movement of the mullion is achieved when option A for detail D1 in Figure 10 is used.

6.3.4 Surfaces

For definition of the surfaces for the installation of the thermocouples see Figure 3 for internal exposure and Figure 4 for external exposure.

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

6.3.5 Perimeter seal

In case mineral wool is used as backfilling material variations of the mineral wool may be used within one test specimen provided the length of the seal with a particular backfilling material is minimum the same as the distance between two mullions and it is located such that the splice between different backfilling materials is not located in the area of the mullion.

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 at the top end of the curtain walling 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 floors by means of the fixings that are used in practice, see 7.2.

7.2 Supporting floors

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 18). The floor shall be made of reinforced concrete or made of reinforced aerated concrete and shall be restrained at both ends.

NOTE A wider supporting floor may be necessary to avoid failure of the floor for test durations of 90 minutes or more.

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).

7.3 Simulated wall construction

7.3.1 Standard construction

The construction details of standard wall constructions shall be in accordance with EN 1363-1. The method of sealing the vertical linear gap between the test specimen and the simulated wall construction shall be recorded in the test report.

7.3.2 Non-standard construction

Any wall construction as in practise may be used. The result of the test is limited to that construction only (no field of direct application).

7.4 Furnace closure

The furnace closure shall be done with a mineral wool packing of class A1 according to EN 13501-1 to allow the specimen to move to a similar extent as in practice.

8 Conditioning

The test construction shall be conditioned in accordance with EN 1363-1.

9 Application of instrumentation

9.1 Thermocouples

9.1.1 Furnace thermocouples (plate thermometers)

Plate thermometers shall be provided in accordance with EN 1363-1. There shall be at least one for every 1,5 m^2 of the exposed surface area of the test construction, subject to a minimum of four. The plate thermometers shall be oriented so that side 'A' faces the back wall of the furnace. For details of location of plate thermometers in case of faceted specimens see Figures 11 and 12.

9.1.2 Unexposed face thermocouples

9.1.2.1 General

The general rules for the attachment and exclusion of unexposed face thermocouples given in EN 1363-1 shall apply.

For internal exposure, if it is not necessary to evaluate the insulation criteria for Surfaces 2 and 6 then the thermocouples may be omitted.

9.1.2.2 Mean temperature rise

The mean temperature rise shall be measured on each discrete infill / panel area ≥ 0,1 m^2 by means of one thermocouple per 1,5 m^2, subject to minimum two thermocouples per discrete area. The mean temperature rise shall only be measured in the upper spandrel area and the non-spandrel area (e.g. vision glass area). The thermocouples shall be located in two opposite corners at a distance of approximately a third of the width and approximately a third of the length of the discrete area. For illustration see Figure 13. If due to the size of the discrete area a third thermocouple is required it shall be positioned close to the centre of the discrete area. In case more thermocouples are required, one shall be located close to the centre of the infill / panel and the others close to the centre of each quarter section. Records from all discrete areas of the same type shall be used for calculating the mean temperature rise. Thermocouples shall not be positioned closer than 100 mm from any discrete area that is not being evaluated for insulation.

For test specimens which are non-uniform, i.e. those which have surface corrugations or ribs, the temperature of each area/surface type shall be monitored to determine the mean temperature rise.

As there are no evaluation criteria for the perimeter seal, the mean temperature rise is not measured.

9.1.2.3 Maximum temperature rise

9.1.2.3.1 General

Thermocouples for the determination of maximum temperature rise may need to be added or their location be changed for particular constructions other than the ones shown in Figures 5 to 7 (straight specimen) and 17 to 19 (faceted specimen). Clauses 9.1.2.3.2 to 9.1.2.3.6 for the location of thermocouples for determination of maximum temperature rise are obligatory for standard configurations and are given as guidance for non-standard configurations.

The mean temperature rise thermocouples shall also be used to evaluate the maximum temperature rise.

9.1.2.3.2 Surface 1

For the determination of maximum temperature rise, additional thermocouples shall be applied to Surface 1 as follows and given in Figure 14 for straight specimens and Figure 17 for faceted specimens:

— Thermocouple 1A - 20 mm below the upper edge of the visible spandrel panel area at mid width of the panel;

— Thermocouple 1B - on a mullion 20 mm below the upper edge of the visible spandrel panel area;

— Thermocouple 1C - at the junction of a mullion and a transom;

— Thermocouple 1D – at mid height of the edge panel with the maximum height and/or largest area, 150 mm in from the outer panel edge in case of installation according to Figure 9B and 9C or minimum 150 mm in from the inner surface of the furnace wall in case of installation according to Figure 9A;

— Thermocouple 1F - at mid way between two mullions, where possible, at a transom or a horizontal joint between infill panel / infill panel or infill panel / spandrel panel (in the positive pressure zone);

— Thermocouple 1G - at mid way between two transoms, where possible, on a mullion or a vertical joint between infill panel / infill panel (in the positive pressure zone) for each type of infill panel;

— Thermocouple 1H - at mid-height of the panel with the largest area, 20 mm from the mullion for each type of infill panel and spandrel panel. If the largest panel is not the tallest panel, then another thermocouple shall be placed at mid-height of the tallest panel, 20 mm from the mullion or the joint between panel / panel;

— Thermocouple 1I – at mid-width of the panel with the largest area, 20 mm from the transom at the top edge of the panel for each type of infill panel and spandrel panel. If the largest panel is not the widest panel, then another thermocouple shall be placed at mid-width of the widest panel, 20 mm from the transom or the joint between panel / panel at the top edge of the panel. Thermocouples 1I are used when the upper transom of the panel is located in the heated area. If this is not the case, thermocouples 2K are used;

— Thermocouple 1J – in the top corners of the panel with the largest area and additionally in the top corners of the highest placed panel, if this is not the same panel, for each type of infill panel and spandrel panel, 20 mm from the mullion and the transom. Thermocouples 1J are used when the upper transom of the panel is located in the heated area. If this is not the case, thermocouples 2K are used;

— Thermocouple 1K – in the bottom corners of the highest placed non-glazed panel, if there is no upper transom in the heated area, for each type of panel, 20 mm from the mullion and the transom.

9.1.2.3.3 Surfaces 2 and 6

For the determination of maximum temperature rise, additional thermocouples shall be applied as follows and as given in Figures 5 to 7 for straight specimens and Figure 18 for faceted specimens:

— Thermocouple 2A - 20 mm below the soffit of the upper supporting floor at mid width of a spandrel panel (Surface 2);

— Thermocouple 2B - 20 mm below the soffit of the upper supporting floor in line with a mullion (Surface 2);

— Thermocouple 2C - at the junction of a mullion and a transom (Surface 2);

— Thermocouple 2F - at mid way between two mullions, where possible, at a transom or a horizontal joint between infill panel / infill panel or infill panel / spandrel panel (in the positive pressure zone) (Surface 2);

— Thermocouple 2G - at mid way between two transoms, where possible, at a mullion or a vertical joint between infill panel / infill panel (in the positive pressure zone) fore each type of infill panel (Surface 2);

— Thermocouple 2H - at mid-height of the panel with the largest area, 20 mm from the mullion for each type of infill panel and spandrel panel. If the largest panel is not the tallest panel, then another thermocouple

shall be placed at mid-height of the tallest panel, 20 mm from the mullion or the joint between panel / panel (Surface 2);

— Thermocouple 2I – at mid-width of the panel with the largest area, 20 mm from the transom at the top edge of the panel for each type of infill panel and spandrel panel. If the largest panel is not the widest panel, then another thermocouple shall be placed at mid-width of the widest panel, 20 mm from the transom or the joint between panel / panel at the top edge of the panel (Surface 2). Thermocouples 2I are used when the upper transom of the panel is located in the heated area. If this is not the case, thermocouples 2K are used;

— Thermocouple 2J – in the top corners of the panel with the largest area and additionally in the highest placed panel, if this is not the same panel, for each type of infill panel and spandrel panel, 20 mm from the mullion and the transom (Surface 2). Thermocouples 2J are used when the upper transom of the panel is located in the heated area. If this is not the case, thermocouples 2K are used;

— Thermocouple 2K – in the bottom corners of the highest placed non-glazed panel, if there is no upper transom in the heated area, for each type of panel, 20 mm from the mullion and the transom;

— Thermocouple 6A - at the junction of the soffit of the upper supporting floor with the non heated face of the simulated wall construction (Surface 6);

— Thermocouple 6B - 500 mm below thermocouple 6A (Surface 6).

— Thermocouple 6C - 20 mm below the soffit of the upper supporting floor at mid width of the vertical linear gap seal;

— Thermocouple 6D – at mid height and mid width of the vertical linear gap seal.

NOTE Thermocouples on Surface 6 are only required if a vertical linear gap seal is fitted.

9.1.2.3.4 Surfaces 3 and 4

For the determination of maximum temperature rise, additional thermocouples shall be applied as follows and as given in Figure 15 and 16 for straight specimens and Figure 19 for faceted specimens:

— Thermocouple 3A - 20 mm up from top of the upper supporting floor at mid width of the spandrel panel (Surface 3);

— Thermocouple 3B - 20 mm up from top of the upper supporting floor on a mullion surface, parallel to the furnace opening (Surface 3);

— Thermocouple 3C - 20 mm up from top of upper supporting floor on a mullion surface, 90° to the furnace opening (Surface 3);

— Thermocouple 4A - at the junction of the soffit of the upper supporting floor with the non heated face of the simulated wall construction (Surface 4);

NOTE Thermocouple 4A is opposite thermocouple 6A which is on Surface 6.

— Thermocouple 4B - 500 mm below thermocouple 4A (Surface 4).

NOTE Thermocouple 4B is opposite thermocouple 6B which is on Surface 6.

— Thermocouples on Surface 4 are only required if a vertical linear gap seal is part of the test specimen.