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Test methods for determining the contribution to the fire resistance of structural members
- Part 2: Vertical protective membranes

Prüfverfahren zur Bestimmung des Beitrages zum Feuerwiderstand von tragenden
Bauteilen - Teil 2: Vertikal angeordnete Brandschutzbekleidungen

Méthodes d'essai pour déterminer la contribution à la résistance au feu des éléments de
construction - Partie 2: Membranes de protection verticales

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Ta slovenski standard je istoveten z: prEN 13381-2

ICS:

13.220.50	Požarna odpornost gradbenih materialov in elementov	Fire-resistance of building materials and elements
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Test methods for determining the contribution to the fire resistance of structural members - Part 2: Vertical protective membranes

Méthodes d'essai pour déterminer la contribution à la résistance au feu des éléments de construction - Partie 2: Membranes de protection verticales

Prüfverfahren zur Bestimmung des Beitrages zum Feuerwiderstand von tragenden Bauteilen - Teil 2: Vertikal angeordnete Brandschutzbekleidungen

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

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Contents

Page

Foreword.....	4
1 Scope.....	5
2 Normative references	5
3 Terms and definitions, symbols and units	6
3.1 Terms and definitions.....	6
3.2 Symbols and units	7
4 Test equipment.....	7
4.1 General	7
4.2 Furnace	7
4.3 Test frame	7
4.4 Supporting construction	8
4.5 Furnace closure	8
5 Test conditions.....	9
5.1 General.....	9
5.2 Support and restraint.....	9
5.2.1 Standard conditions	9
5.2.2 Other support and restraint conditions	9
6 Test specimens	9
6.1 General	9
6.2 Number of tests.....	10
6.3 Size of test specimen.....	10
6.4 Structural building members.....	10
6.4.1 Standard vertical structural building members	10
6.4.2 Practical vertical structural members.....	12
6.5 Properties of test materials.....	12
6.6 Verification of the test specimen.....	12
6.7 Optional and additional steel plates within the cavity	13
7 Installation of the test construction	13
8 Conditioning.....	13
9 Application of instrumentation.....	14
9.1 General	14
9.2 Instrumentation for measurement of furnace temperature	14
9.3 Instrumentation for measurement of specimen temperature.....	14
9.3.1 General.....	14
9.3.2 Instrumentation for measuring cavity temperature.....	14
9.3.3 Instrumentation for measuring surface temperatures	14
9.3.4 Optional and supplementary instrumentation for measuring temperature	15
9.4 Instrumentation for measurement of pressure	16
10 Test procedure	16
10.1 General.....	16
10.2 Furnace temperature and pressure.....	16
10.3 Temperatures of the test specimen	16
10.4 Observations	16
10.5 Termination of the test	16
11 Test results	16
11.1 Acceptability of test results	16

11.2	Presentation of test results.....	17
12	Test report	17
13	Assessment	18
13.1	General.....	18
13.2	Assessment of loadbearing capacity.....	18
13.2.1	General.....	18
13.2.2	Reference temperature curve : cavity temperatures.....	18
13.2.3	Reference temperature curve: surface temperatures (steel or concrete or composite columns)	18
13.2.4	Application of method of limiting temperatures	19
13.3	Assessment of insulation	19
13.4	Assessment of data for calculation purposes	19
13.5	Combustible materials in the cavity.....	21
14	Report of the assessment	21
15	Limits of applicability of the results of the assessment.....	22
15.1	Type of vertical structural building member.....	22
15.2	Type of steel column	24
15.3	Type of concrete column.....	24
15.4	Type of concrete filled hollow steel composite column	24
15.5	Type of concrete	25
15.6	Timber column	25
15.7	Depth of the cavity	25
15.8	Type of closure opposite to the vertical protective membrane	25
15.9	Properties of the vertical protective membrane	25
15.10	Size of panels within the vertical protective membrane.....	25
15.11	Fixtures and fittings.....	25
15.12	Applicability of results from test columns to beams or combined column / beam structural building members	26
Annex A (normative)	Measurement of properties of vertical protective membranes and components.....	30
A.1	General.....	30
A.2	Thickness of vertical protective membrane and components thereof.....	30
A.3	Density of vertical protective membranes and components thereof	31
A.3.1	General.....	31
A.4	Moisture content of vertical protective membrane and components thereof	32
	Bibliography	33

Foreword

This document (prEN 13381-2:2008) 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 ENV 13381-2:2002.

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 89/106/EEC.

This European Standard is one of a series of standards for evaluating the contribution to the fire resistance of structural members by applied fire protection materials. Other parts of the standard are:

Part 1: Horizontal protective membranes.

Part 3: Applied protection to concrete members.

Part 4: Applied protection to steel members.

Part 5: Applied protection to concrete / profiled sheet steel composite members.

Part 6: Applied protection to concrete filled hollow steel columns.

Part 7: Applied protection to timber members.

The fire protection provided by the vertical protective membrane can be nullified by the presence of combustible materials in the cavity behind the membrane. The assessment methodology can be modified according to the quantity and position of such materials within that cavity.

Annex A is normative.

Caution

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 evolved during the test. Mechanical and operational hazards can also arise during the construction of test elements or structures, their testing and the disposal of test residues.

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

The specific health and safety instructions contained within this Standard shall be followed.

When testing concrete filled hollow steel composite columns steam release holes shall be provided for the release of steam from the column, during the test, as specified in prEN 13381-6.

1 Scope

This part of this European Standard specifies a test method for determining the ability of a vertical protective membrane, when used as a fire resistant barrier, to contribute to the fire resistance of loadbearing vertical structural building members fabricated from steel, concrete, steel/concrete composites or timber. The method described is applicable to any type of vertical protective membrane, which can be associated with a separate bracing membrane.

The vertical protective membrane can be separate from the structural building member and be self-supporting or can be attached to the structural building member and can form part of any load bearing structure. This test method is applicable to vertical protective membranes where there is a separating gap of at least 5 mm size between the vertical protective membrane and the structural building member, otherwise alternative test methods prEN 13381-3, prEN 13381-4, prEN 13381-6 or prEN 13381-7 shall be used as appropriate

This test method and assessment is not applicable to the following:

- a) all situations where the cavity behind the vertical protective membrane contains more than a specified amount of combustible materials, e.g. electrical cables and pipes, other than where timber structural members themselves are required;
- b) all situations where the cavity is to be used as a service or ventilation shaft;
- c) all situations where the vertical protective membrane acts as a bracing membrane.

This European Standard contains the fire test which specifies the tests which shall be carried out whereby the vertical protective membrane together with the structural member to be protected is exposed to the specified fire. The fire exposure, to the standard temperature/time curve given in EN 1363-1, is applied to the side which would be exposed in practice.

The test method makes provision, through specified optional additional procedures, for the collection of data which can be used as direct input to the calculation of fire resistance according to the processes given in EN 1992-1-2, EN 1993-1-2, EN 1994-1-2 and EN 1995-1-2.

This European Standard also contains the assessment which provides information relative to the analysis of the test data and gives guidance for the interpretation of the results of the fire test, in terms of loadbearing capacity criteria of the protected vertical structural member.

The results of the fire test and the assessment can be applied, with certain defined provisions, to vertical structural building members which can be beams, columns or a combination of both and / or which could form part of a separating element or partition.

The limits of applicability of the results of the assessment arising from the fire test are defined, together with permitted direct application of the results to different structures, membranes and fittings.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text, and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 1363-1, *Fire Resistance tests – Part 1: General requirements*

prEN 13381-2:2008 (E)

EN 206-1, *Concrete – Part 1: Specification, performance, production and conformity*

EN 1992-1-2, *Eurocode 2: Design of concrete structures – Part 1-2: General rules – Structural fire design*

EN 1993-1-2, *Eurocode 3: Design of steel structures – Part 1-2: General rules – Structural fire design*

EN 1994-1-2, *Eurocode 4: Design of composite steel and concrete structures – Part 1-2: General rules - Structural fire design (including Technical Corrigendum 1:1995)*

EN 1995-1-2, *Eurocode 5: Design of timber structures – Part 1-2 General rules – Structural fire design*

EN 10025, *Hot rolled products of non-alloy structural steels – Technical delivery conditions*

EN 10080, *Steel for the reinforcement of concrete – Weldable ribbed reinforcing steel B 500 – Technical delivery conditions for bars, coils and welded fabric*

EN 10113, *Hot rolled products in weldable fine grade structural steels*

prEN 13381-3, *Test methods for determining the contribution to the fire resistance of structural members Part 3: Applied protection to concrete members*

prEN 13381-6, *Test methods for determining the contribution to the fire resistance of structural members – Part 6: Applied protection to concrete filled hollow steel columns*

prEN 13381-7, *Test methods for determining the contribution to the fire resistance of structural members – Part 7: Applied protection to timber members*

ISO 8421-2, *Fire Protection – Vocabulary – Part 2: Structural fire protection*

EN ISO 13943, *Fire safety – Vocabulary (ISO 13943:1999)*
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3 Terms and definitions, symbols and units

3.1 Terms and definitions

For the purposes of this European Standard, the terms and definitions given in EN 1363-1, EN ISO 13943 and ISO 8421-2 and the following apply.

3.1.1

vertical structural building member

vertical loadbearing structural element of building construction, which may be a column, a beam or a combination of both, and / or which might form part of a separating element or partition and which is fabricated from either concrete, steel, steel/concrete composite or timber

3.1.2

vertical protective membrane

material or construction which is installed in front of a vertical structural building member and which is intended to give additional fire resistance to that member

The vertical protective membrane may comprise multiple layers of materials.

3.1.3

structural building member test column

test column, representing the loadbearing structural building member to be protected in practice, in front of which the vertical protective membrane test specimen is installed for the purposes of the test

3.1.4**vertical protective membrane test specimen**

full vertical protective membrane assembly submitted for test, including typical fixing equipment and methods and typical features such as insulating materials, light fittings, ventilation ducts

3.1.5**furnace closure**

fire resistant vertical construction designed to close the furnace and with the vertical protective membrane create a cavity within which the test column is placed

3.1.6**separating gap**

distance between the rear face of the vertical protective membrane and the closest surface of the structural building member test column

3.1.7**cavity**

whole void between the rear face of the vertical protective membrane and the furnace closure

3.1.8**fire protection**

protection afforded to the structural building member by the vertical protective membrane such that the temperature on the surface of the test column and within the cavity is limited throughout the period of exposure to fire

3.2 Symbols and units

Symbol	Unit	Designation
A_m/V	m^{-1}	Section factor of unprotected steel column (see prEN 13381-4).

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4 Test equipment**4.1 General**

The furnace and test equipment shall be as specified in EN 1363-1.

4.2 Furnace

The furnace shall be designed to permit the dimensions of the test specimen to be exposed to heating to be as specified in 6.3 and its installation to be as described in Clause 7.

4.3 Test frame

The vertical protective membrane test specimen, the test column and the furnace closure shall be mounted in a test frame which shall be designed such that it possesses sufficient stiffness appropriate to the test construction. A suitable frame for this purpose shall have head and side members constructed from steel section protected with refractory concrete having a nominal density of at least 2 000 kg/m³.

prEN 13381-2:2008 (E)

The dimensions of the test frame shall be such that the furnace closure, the test column and the vertical protective membrane test specimen, together with any supporting construction, may be installed within it (see Figure 1) and permit the size of the test construction exposed to heating to be as specified in 6.3.

4.4 Supporting construction

If the size of the vertical protective membrane test specimen is smaller than the test frame of the laboratory then the test frame opening shall be reduced in size, whilst still fulfilling the general requirements for test frames, by the following which may be provided to accommodate the test specimen:

- a) where the height is smaller, a plinth shall be provided to adjust the opening to the required size;
- b) where the overall dimensions are smaller, a supporting construction shall be built in the test frame.

If the vertical protective membrane is required in practice to be used together with any supporting construction then the test construction shall include that supporting construction, otherwise, a standard construction made of aerated concrete slabs or blocks of density $(650 \pm 200) \text{ kg/m}^3$ and thickness $(100 \pm 10) \text{ mm}$, bonded with sand / cement mortar or other fire resistant material shall be used.

4.5 Furnace closure

The fire resistant furnace closure is designed to close the furnace and to create, together with the vertical protective membrane test specimen, a cavity to contain the test column.

The normal furnace closure shall comprise a wall built within the test frame comprising aerated concrete slabs or blocks of density $(650 \pm 200) \text{ kg/m}^3$ and thickness $(100 \pm 10) \text{ mm}$, bonded with sand/cement mortar or other appropriate fire resistant material.

Where the vertical protective membrane is to be used on all sides of the structural building member, and where exposure to fire might be expected to occur from any side, then the furnace closure shall comprise the same vertical protective membrane system. This type of furnace closure shall be sealed into the test frame by the same method as would be used for the vertical protective membrane in use. The applicability of the result shall be restricted in this case (see 15.8).

At the request of the sponsor, insulation material of lower insulation performance than that normally required, representing a high heat loss external or internal wall or open cavity situation (remote from the fire exposure side) may be used. The choice of such materials shall be made by the sponsor. The laboratory shall ensure that they are inserted into the test frame and all joints sealed, both within the closure and around its edges, such that leakage of gases from the cavity cannot occur. The applicability of the result shall be restricted in this case (see 15.8).

If the vertical protective membrane is to be used in a situation where it forms a ventilated cavity in which the building member it protects is situated, then the test cavity shall be ventilated in a manner representative of practice. The applicability of the result shall be restricted in this case (see 15.8).

5 Test conditions

5.1 General

A loadbearing vertical structural building member represented by an unloaded test column is protected against fire by a vertical protective membrane and subjected to the fire test defined herein. The temperature within the cavity and the surface temperature of the test column are measured throughout the test.

It is recommended that the test is continued until the mean temperature recorded by all thermocouples within the cavity, reaches the appropriate limiting temperature for the test columns used or until any individual temperature recorded within the cavity, rises to 750 °C for steel, concrete or concrete filled hollow steel columns and 500 °C for timber columns.

The procedures given in EN 1363-1 shall be followed in the performance of this test method unless otherwise stated in this European Standard.

5.2 Support and restraint

5.2.1 Standard conditions

Where the vertical protective membrane test specimen in practice is not larger than the furnace opening, the edges of the specimen shall be installed and restrained as in practice.

Where the vertical protective membrane test specimen in practice is larger than the furnace opening then it shall be installed as in practice, but with one vertical edge unrestrained and having freedom of movement, the remaining edges being restrained as in practice.

Any unrestrained edges shall be sealed with fire resistant material which shall accommodate movement of those edges and yet not restrict that movement, or allow furnace gases to leak into the cavity. The distance between the exposed face of the vertical protective membrane and the forward edge of the test frame shall be sufficient to accommodate any bowing of the membrane, without allowing furnace gases to leak into the cavity. The sponsor shall define expected bowing, where possible.

5.2.2 Other support and restraint conditions

Support and restraint conditions differing from the standard conditions specified in 5.2.1 shall be described in the test report and the validity of the results restricted to that tested.

6 Test specimens

6.1 General

The structural building member to be used in the test shall be as given in 6.3 and be chosen from those standard members described in 6.4.1 and be representative of that to be used in practice. Alternatively an actual practical structural vertical building member may be used according to 6.4.2.

Vertical protective membranes would typically be board or panel type partitions or membranes, comprising timber, plaster, mineral wool or similar materials. They shall be installed in front of the test column by the procedures given in the installation manual or other written instructions provided by the sponsor. The means of connection and use of insulation between the membrane and the test frame shall be defined by the sponsor.

prEN 13381-2:2008 (E)

Where the vertical protective membrane is expected to include joints or a gap (or gaps) for design purposes or in practice these shall be included within the vertical protective membrane test specimen and be included in a manner representative of practice, in both vertical and horizontal directions.

All fixtures and fittings expected to be installed shall be included in the vertical protective membrane test specimen and the spacing of these shall be representative of practice. Such fixtures and fittings shall not be installed within the test specimen at a distance of less than 500 mm from any of its edges.

Any combustible materials required to be present in the cavity, representing the practical situation, shall be identified and their fire load density calculated.

6.2 Number of tests

Normally for a vertical protective membrane designed for one sided protection of a vertical structural building member only one test shall be carried out.

Where a vertical protective membrane is manufactured with elements or components of variable size or may be installed by different procedures, then a unique test shall be carried out on elements or components at maximum and minimum size and with every expected installation procedure for which the sponsor requires approval.

Where a vertical protective membrane is designed to protect two or more sides of a structural building member and the vertical protective membrane is the same on all sides then one test only shall be required. In this test the furnace closure shall be the vertical protective membrane itself as given in 4.5.

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Where a vertical protective membrane is designed to protect two or more sides of a structural building member and the vertical protective membrane is not the same on all sides then unique tests shall be required for each type of membrane, with each in turn presented to the furnace. Each test result shall be treated separately for field of direct application purposes.

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6.3 Size of test specimen

The size of the test construction and furnace aperture shall be at least 3 000 mm × 3 000 mm. The whole area of the test construction shall be exposed to the furnace conditions.

If the vertical protective membrane in practice is less than 3 000 mm × 3 000 mm then the test specimen shall be brought up to this size by the use of a supporting construction.

When the actual size is larger than can be accommodated in the furnace then a reduced size test specimen, of size not less than 3 000 mm × 3 000 mm, including representative joints in both horizontal and vertical directions, shall be used.

6.4 Structural building members**6.4.1 Standard vertical structural building members**

Each test construction shall include at least two, possibly three, standard test columns, representing loadbearing vertical structural building members.

The test column or columns, chosen by the sponsor, may be steel, concrete, concrete filled hollow steel or timber according to the sponsor's wishes and the desired applicability of the test result (see Table 2). They may be tested separately or different types of columns tested together.

When timber test columns are used together with other types of column, the final termination temperature shall be that appropriate to the timber test column. Timber test columns will normally be tested separately for this reason.