



SLOVENSKI STANDARD

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Preskusne metode za ugotavljanje prispevka k požarni odpornosti konstrukcijskih elementov - 2. del: Navpične zaščitne membrane

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

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

This European Standard was approved by CEN on 25 July 2014.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

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EN 13381-2:2014 (E)**Foreword**

This document (EN 13381-2:2014) 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of an identical text or by endorsement, at the latest by March 2015 and conflicting national standards shall be withdrawn at the latest by March 2015.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 ENV 13381-2:2002.

The main changes with respect to the previous edition are listed below:

Clarifications regarding the following items:

- a) preparation of the test specimen;
- b) instrumentation of the test specimen (no more steel plate within the cavity);
- c) limits of applicability.

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This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

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,*
- *Part 8: Applied reactive protection to steel members.*

The fire protection capacity of the vertical protective membrane can be nullified by the presence of combustible materials in the cavity behind the membrane. The applicability of the results of the assessment is limited according to the quantity and position of such combustible materials within that cavity. The amount of combustible material permissible in the cavity should be given in national regulations.

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 EN 13381-6.

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.

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EN 13381-2:2014 (E)**1 Scope**

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 (loadbearing capacity R) 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 either separated from or attached to the structural building member and is self-supporting. This test method is applicable to vertical protective membranes where there is a gap and a cavity between the vertical protective membrane and the structural building member, otherwise alternative test methods prEN 13381-3, EN 13381-4, EN 13381-6 or prEN 13381-7 should be used as appropriate.

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

- a) all situations where the cavity is to be used as a service or ventilation shaft;
- b) 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.

In special circumstances, where specified in national building regulations, there can be a need to subject the protection material to a smouldering curve. The test for this and the special circumstances for its use are detailed in Annex B.

Tests should be carried out without additional combustible materials in the cavity.

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 206, *Concrete - Specification, performance, production and conformity*

- EN 1363-1, *Fire resistance tests - Part 1: General Requirements*
- EN 1363-2, *Fire resistance tests - Part 2: Alternative and additional procedures*
- EN 1364-1, *Fire resistance tests for non-loadbearing elements - Part 1: Walls*
- EN 1365-1, *Fire resistance tests for loadbearing elements - Part 1: Walls*
- 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*
- EN 1995-1-2:2004, *Eurocode 5: Design of timber structures - Part 1-2: General - Structural fire design*
- EN 10025-1, *Hot rolled products of structural steels – Part 1: General technical delivery conditions*
- EN 10080, *Steel for the reinforcement of concrete - Weldable reinforcing steel - General*
- EN 10210-1, *Hot finished structural hollow sections of non-alloy and fine grain steels - Part 1: Technical delivery conditions*
- prEN 13381-3, *Test methods for determining the contribution to the fire resistance of structural members - Part 3: Applied protection to concrete members*
- EN 13381-4, *Test methods for determining the contribution to the fire resistance of structural members - Part 4: Applied passive protection to steel members*
- EN 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*
- EN ISO 13943, *Fire safety - Vocabulary (ISO 13943)*
- ISO 8421-2, *Fire protection - Vocabulary - Part 2: Structural fire protection*

3 Terms and definitions, symbols and units

3.1 Terms and definitions

For the purposes of this document, 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

EN 13381-2:2014 (E)**3.1.2****vertical protective membrane**

material or construction that may comprise multiple layers of materials, which is installed in front of a vertical structural building member and which is intended to give additional fire resistance to that member

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

3.1.9**characteristic temperature**

the average of the mean temperature and the maximum individual temperature $[(\text{mean} + \text{maximum})/2]$ for a group of thermocouples

3.2 Symbols and units

Symbol	Unit	Designation
Am/V	m ⁻¹	Section factor of unprotected steel column (see EN 13381-4).

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 at least 3 x 3 m (height x width) and 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 in accordance with EN 1363-1.

An example of 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 or can be a frame made of reinforced concrete having a nominal density of at least 2 000 kg/m³.

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 by building a supporting construction 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 ± 200) kg/m³ and suitable thickness to accommodate the furnace closure, the columns and the vertical protective membrane, bonded with sand / cement mortar or other fire resistant material shall be used.

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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 standard furnace closure shall comprise a wall built within the test frame comprising aerated concrete slabs or blocks of density (650 ± 200) kg/m³ and thickness (100 ± 10) mm, bonded with sand/cement mortar or other appropriate fire resistant material.

Where the vertical protective membrane is to be used on both sides of the structural building member, 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 of such non-standard furnace closure 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).

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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.