

Test methods for determining the contribution to the fire resistance of structural members - Part 1: Horizontal protective membranes

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

See Eesti standard EVS-EN 13381-1:2014 sisaldab Euroopa standardi EN 13381-1:2014 inglisekeelset teksti.	This Estonian standard EVS-EN 13381-1:2014 consists of the English text of the European standard EN 13381-1:2014.
Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas.	This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation.
Euroopa standardimisorganisatsioonid on teinud Euroopa standardi rahvuslikele liikmetele kättesaadavaks 24.09.2014.	Date of Availability of the European standard is 24.09.2014.
Standard on kättesaadav Eesti Standardikeskusest.	The standard is available from the Estonian Centre for Standardisation.

Tagasisidet standardi sisu kohta on võimalik edastada, kasutades EVS-i veebilehel asuvat tagasiside vormi või saates e-kirja meiliaadressile standardiosakond@evs.ee.

ICS 13.220.50

Standardite reprodutseerimise ja levitamise õigus kuulub Eesti Standardikeskusele

Andmete paljundamine, taastekitamine, kopeerimine, salvestamine elektroonsesse süsteemi või edastamine ükskõik millises vormis või millisel teel ilma Eesti Standardikeskuse kirjaliku loata on keelatud.

Kui Teil on küsimusi standardite autorikaitse kohta, võtke palun ühendust Eesti Standardikeskusega:
Aru 10, 10317 Tallinn, Eesti; www.evs.ee; telefon 605 5050; e-post info@evs.ee

The right to reproduce and distribute standards belongs to the Estonian Centre for Standardisation

No part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying, without a written permission from the Estonian Centre for Standardisation.

If you have any questions about copyright, please contact Estonian Centre for Standardisation:
Aru 10, 10317 Tallinn, Estonia; www.evs.ee; phone 605 5050; e-mail info@evs.ee

English Version

**Test methods for determining the contribution to the fire
resistance of structural members - Part 1: Horizontal protective
membranes**

Méthodes d'essai pour déterminer la contribution à la
résistance au feu des éléments de construction - Partie 1:
Membranes de protection horizontales

Prüfverfahren zur Bestimmung des Beitrages zum
Feuerwiderstand von tragenden Bauteilen - Teil 1:
Horizontal 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.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of 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 United Kingdom.



EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

Contents

Page

Foreword.....	5
1 Scope	7
2 Normative references	7
3 Terms and definitions, symbols and units.....	8
3.1 Terms and definitions	8
3.2 Symbols and units.....	9
4 Test equipment	9
4.1 General.....	9
4.2 Furnace.....	9
4.3 Loading equipment.....	9
5 Test conditions	10
5.1 General.....	10
5.2 Support and restraint conditions.....	10
5.2.1 Standard conditions	10
5.2.2 Other support and restraint conditions.....	10
5.3 Loading conditions.....	10
6 Test specimens.....	11
6.1 General.....	11
6.2 Fixtures and fittings	11
6.3 Horizontal protective membranes.....	11
6.4 Structural building members supporting horizontal protective membranes.....	12
6.4.1 General principles	12
6.4.2 Standard horizontal structural building members	12
6.5 Properties of test materials	13
6.6 Verification of the test specimen	14
6.7 Optional and additional plate thermometers within the cavity	14
7 Installation of the test construction.....	14
8 Conditioning.....	14
9 Application of instrumentation	15
9.1 General.....	15
9.2 Instrumentation for measurement of furnace temperature.....	15
9.3 Instrumentation for measurement of specimen temperature	15
9.3.1 General.....	15
9.3.2 Instrumentation for measuring cavity temperature	15
9.3.3 Instrumentation for measuring surface temperatures.....	15
9.3.4 Optional and supplementary instrumentation for measuring temperature.....	16
9.4 Instrumentation for measurement of pressure	17
9.5 Instrumentation for measurement of deflection.....	17
9.6 Instrumentation for measurement of applied load.....	17
10 Test procedure	17
10.1 General.....	17
10.2 Furnace temperature and pressure	17
10.3 Application and control of load.....	17
10.4 Temperatures of test specimen	17
10.5 Deflection	17
10.6 Observations.....	18
10.7 Termination of the test	18

11	Test results	18
11.1	Acceptability of test results	18
11.2	Presentation of test results	18
12	Test report	19
13	Assessment	19
13.1	General	19
13.2	Assessment of loadbearing capacity	19
13.2.1	General	19
13.2.2	Characteristic temperature curve: cavity temperatures	20
13.2.3	Characteristic temperature curve: surface temperatures (steel beams or steel/concrete slabs)	20
13.2.4	Application of method of limiting temperatures	20
13.3	Assessment of data for calculation purposes	21
14	Report of the assessment	21
15	Limits of applicability of the results of the assessment	22
15.1	Type of structural building member	22
15.2	Type of concrete	29
15.3	Type of steel beam	30
15.4	Type of steel/concrete composite structures	30
15.5	Type of timber structure	30
15.6	Height of the cavity	31
15.7	Exposed width of test specimen	31
15.8	Properties of the horizontal protective membrane	31
15.9	Size of panels within the horizontal protective membrane	31
15.10	Fixtures and fittings	31
15.11	Gaps between grid members and test frame or walls	31
Annex A	(normative) Exposure to a semi-natural fire	38
A.1	General	38
A.2	Semi-natural fire source	38
A.3	Test equipment	38
A.4	Test conditions	39
A.5	Test specimen	39
A.6	Installation of the test specimen	40
A.7	Conditioning	40
A.8	Application of instrumentation	40
A.9	Test procedure	40
A.10	Test results	40
A.11	Test report	40
A.12	The assessment	40
A.13	The assessment report	40
Annex B	(normative) Measurement of properties of horizontal protective membranes and components	42
B.1	General	42
B.2	Thickness of horizontal protective membrane and its components	42
B.3	Density of horizontal protective membranes and components thereof	43
B.4	Moisture content of horizontal protective membrane and components thereof	44
Annex C	(normative) Test method to the smouldering fire (slow heating curve)	45

C.1	Introduction.....	45
C.2	Test equipment	45
C.3	Test specimens.....	45
C.4	Termination of test	45
C.5	Evaluation of the results	45
	Bibliography.....	47

Foreword

This document (EN 13381-1:2014) 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 CEN/TS 13381-1:2005.

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

Clarifications regarding the following items:

- a) preparation of the test specimen (no more opening within the floor);
- b) instrumentation of the test specimen (no more steel plate within the cavity);
- c) limits of applicability (several tables depending on the tested configuration).

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

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

- *Part 2: Vertical protective membranes,*
- *Part 3: Applied protection to concrete members,*
- *Part 4: Applied passive 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 horizontal protective membrane can be nullified by the presence of combustible materials in the cavity above 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 European Standard shall be followed.

WARNING: When performing this test method, laboratories shall expect that there may be significant quantities of smoke released. This smoke release is expected to be very significant where the fire test involves timber and timber based components. Laboratories shall ensure that appropriate smoke extraction facilities are provided.

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.

1 Scope

This European Standard specifies a test method for determining the ability of a horizontal protective membrane, when used as a fire resistant barrier, to contribute to the fire resistance of standard horizontal structural building members as defined in 6.4.2.

Test of horizontal protective membrane installed under a specific non-standard floor should be tested according to EN 1365-2.

This European Standard contains the fire test which specifies the tests which are carried out whereby the horizontal protective membrane, together with the structural member to be protected, is exposed to a fire test according to the procedures defined herein. The fire exposure, to the temperature/time curve given in EN 1363-1, is applied from below the membrane itself.

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 within 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 horizontal structural member.

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 C.

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.

This European Standard applies only where there is a gap and a cavity between the horizontal protective membrane and the structural building member. Otherwise, the test methods in prEN 13381-3, EN 13381-4 or prEN 13381-5, as appropriate, apply.

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

Annex A gives details of assessing the performance of the ceiling when exposed to a semi-natural fire.

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 1363-1:2012, *Fire resistance tests - Part 1: General Requirements*

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

EN 1992-1-1, *Eurocode 2: Design of concrete structures - Part 1-1: General rules and rules for buildings*

EN 1992-1-2:2004, *Eurocode 2: Design of concrete structures - Part 1-2: General rules - Structural fire design*

EN 1993-1-1, *Eurocode 3: Design of steel structures - Part 1-1: General rules and rules for buildings*

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

EN 1994-1-1, *Eurocode 4: Design of composite steel and concrete structures - Part 1-1: General rules and rules for buildings*

EN 1994-1-2, *Eurocode 4 - Design of composite steel and concrete structures - Part 1-2: General rules - Structural fire design*

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

EN 1995-1-2:2004, *Eurocode 5: Design of timber structures - Part 1-2: General - Structural fire design*

EN 312, *Particleboards - Specifications*

EN 823, *Thermal insulating products for building applications - Determination of thickness*

EN 12467, *Fibre-cement flat sheets - Product specification and test methods*

EN 13381-4, *Test methods for determining the contribution to the fire resistance of structural members - Part 4: Applied passive protection to steel members*

prEN 13381-5, *Test methods for determining the contribution to the fire resistance of structural members - Part 5: Applied protection to concrete/profiled sheet steel composite member*

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

horizontal structural building member

horizontal structural element of building construction which is loadbearing, separating and which is fabricated from concrete, steel, steel/concrete composite or timber

3.1.2

horizontal protective membrane

any horizontal membrane or ceiling lining that does not form any part of any loadbearing part of the structure and can comprise multiple layers of materials, together with any supporting framework, hangers, fixings and any insulation materials which is either suspended from or attached directly to a structural building member, or is self-supporting and fixed beneath a structural building member, and which is intended to give additional fire resistance to that structural building member, as for example ceiling tiles resting on a light supporting frame, ceiling boards, metal trays, plastered and similar ceilings not directly applied to the underside of the structural member

3.1.3

separating gap

distance between the non-exposed surface of the horizontal protective membrane and the lowest surface of the exposed side of the structural building member