

Test methods for determining the contribution to the fire resistance of structural members - Part 3: applied protection to concrete members

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

See Eesti standard EVS-EN 13381-3:2015 sisaldab Euroopa standardi EN 13381-3:2015 ingliskeelset teksti.	This Estonian standard EVS-EN 13381-3:2015 consists of the English text of the European standard EN 13381-3:2015.
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English Version

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

Méthodes d'essai pour déterminer la contribution à la
résistance au feu des éléments de construction - Partie 3:
Protection appliquée aux éléments en béton

Prüfverfahren zur Bestimmung des Beitrages zum
Feuerwiderstand von tragenden Bauteilen - Teil 3:
Brandschutzmaßnahmen für Betonbauteile

This European Standard was approved by CEN on 8 November 2014.

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Foreword

This document (EN 13381-3:2015) 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of an identical text or by endorsement, at the latest by October 2015 and conflicting national standards shall be withdrawn at the latest by October 2015.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 13381-3:2002.

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.

The dimension tolerances regarding the manufacturing of the specimen indicated in the ENV 13381-3:2002 led to tensile stress values of $290 \pm 30 \text{ N/mm}^2$ in the reinforcement bars depending on the type of structural member. In order to harmonize the mechanical constraint applied on the structural member, the bending moment has been modified to produce the same tensile stress on reinforcement bars equal to 300 N/mm^2 . This value is corresponding to 60 % of the grade of the steel to be used. Due to this approach, the result of tests carried out according to ENV 13381-3:2002 can be taken into account for assessment according to the present document.

In comparison with ENV 13381-3:2002, the following significant changes have been made:

- the bending moment has been modified to be adapted to the thickness of the slab;
- the location of thermocouple used within beams for the calculation of equivalent thickness of concrete is now at 25 mm away from the beam bottom corner instead of 55 mm;
- the graphs to be used for the determination of equivalent concrete thickness for slabs has been improved and extended and is directly available in the standard.

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. The other parts of this standard are:

- *Part 1: Horizontal protective membranes*
- *Part 2: Vertical protective membranes*
- *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*

Annexes A, B and C are 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 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.

The specific health and safety instructions contained within this standard should be followed.

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 contribution of fire protection systems to the fire resistance of structural concrete members, for instance slabs, floors, roofs and walls and which can include integral beams and columns. The concrete can be lightweight, normal weight or heavyweight concrete and of all strength classes (e.g. 20/25 to 50/60 for normal strength concrete and for high strength concrete 55/67 to 90/105). The member is to contain steel reinforcing bars.

The test method is applicable to all fire protection materials used for the protection of concrete members and includes sprayed materials, reactive coatings, cladding protection systems and multi-layer or composite fire protection materials, with or without a gap between the fire protection material and the concrete member

This European Standard specifies the tests which are to be carried out to determine the ability of the fire protection material to remain coherent and fixed to the concrete and to provide data on the temperature distribution throughout the protected concrete member, when exposed to the standard temperature time curve.

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 A.

The fire test methodology makes provision for the collection and presentation of data which can be used as direct input to the calculation of fire resistance of concrete members in accordance with the procedures given in EN 1992-1-2.

This European Standard also contains the assessment which prescribes how the analysis of the test data is to be made and gives guidance to the procedures by which interpolation is to be undertaken.

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 concrete structures, densities, strengths, thicknesses and production techniques over the range of thicknesses of the applied fire protection system tested.

The test method, the test results and the assessment method are not applicable to structural hollow concrete members.

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

EN 1363-1, *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, *Eurocode 2: Design of concrete structures - Part 1-2: General rules - Structural fire design*

EN 10080, *Steel for the reinforcement of concrete - Weldable reinforcing steel - General*

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

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, ISO 8421-2 and EN 206 and the following apply.

3.1.1

concrete member

element of building construction which is loadbearing and is fabricated from concrete, defined according to EN 206 and shall contain steel reinforcing bars

3.1.2

fire protection material

material or combination of materials applied to the surface of a concrete member for the purpose of increasing its fire resistance

3.1.3

passive fire protection materials

materials which do not change their physical form upon heating and which provide fire protection by virtue of their physical or thermal properties and may include materials containing water which, on heating, evaporates to produce cooling effects

3.1.4

reactive fire protection materials

materials which are specifically formulated to provide a chemical reaction upon heating such that their physical form changes and in so doing provide fire protection by thermal insulation and cooling effects

3.1.5

fire protection system

fire protection material together with a prescribed method of attachment to the concrete member

3.1.6

fire protection

protection afforded to the concrete member by the fire protection system such that the temperature throughout the depth of the structural member and upon any steel reinforcing bars within it is limited throughout the period of exposure to fire

3.1.7

test specimen

concrete slab or beam test member plus the fire protection system under test

3.1.8

fire protection thickness

thickness of a single layer fire protection system or the combined thickness of all layers of a multilayer fire protection system, excluding the width or height of supporting profiles, clips and other fixings