

Test methods for determining the contribution to the fire resistance of structural members - Part 9: Applied fire protection systems to steel beams with web openings

## EESTI STANDARDI EESSÕNA

## NATIONAL FOREWORD

See Eesti standard EVS-EN 13381-9:2015 sisaldab Euroopa standardi EN 13381-9:2015 ingliskeelset teksti.	This Estonian standard EVS-EN 13381-9:2015 consists of the English text of the European standard EN 13381-9:2015.
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.
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ICS 13.220.50, 91.080.10

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ICS 13.220.50; 91.080.10

English Version

**Test methods for determining the contribution to the fire  
resistance of structural members - Part 9: Applied fire protection  
systems to steel beams with web openings**

Méthodes d'essai pour déterminer la contribution à la  
résistance au feu des éléments de construction - Partie 9:  
Systèmes de protection au feu appliqués aux poutres  
alvéolaires en acier

Prüfverfahren zur Bestimmung des Beitrages zum  
Feuerwiderstand von tragenden Bauteilen - Teil 9:  
Brandschutzmaßnahmen für Stahlträger mit Stegöffnungen

This European Standard was approved by CEN on 20 May 2015.

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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.

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## Foreword

This document (EN 13381-9:2015) 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of an identical text or by endorsement, at the latest by December 2015, and conflicting national standards shall be withdrawn at the latest by December 2015.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 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 this series are:

- *Part 1: Horizontal protective membranes;*
- *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 member;*
- *Part 6: Applied protection to concrete filled hollow steel columns;*
- *Part 7: Applied protection to timber members [currently at Enquiry stage];*
- *Part 8: Applied reactive protection to steel members.*

The document adopts the principle of establishing ratios of temperatures between and around openings in the web of a beam with the temperatures of a solid portion of that beam. This is with the intention that this data can be utilized within a structural model to derive the value and location of the associated limiting temperature of the beam at the fire limit state. This can then be used in conjunction with data for the fire protection material determined from either EN 13381-4 or EN 13381-8, as appropriate to determine the necessary thickness of fire protection.

According to the CEN/CENELEC Internal Regulations, the national standards organisations 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.

## Introduction

The European Committee for Standardization (CEN) draws attention to the fact that it is claimed that compliance with this document may involve the use of a patent concerning the method of designing a fire resistant structural beam.

CEN takes no position concerning the evidence, validity and scope of this patent right.

The holder of this patent right has ensured CEN that, through appropriate declaration, he/she agrees to publically disclose the relevant part of their patent in RT1356 or EN 13381-9 and renounce to challenge the same and all subsequent European standards on the basis of infringement of their patent. In this respect, the statement of the holder of this patent right is registered with CEN. Information may be obtained from:

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### 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.

## 1 Scope

This European Standard specifies a test and assessment method for determining the contribution made by fire protection systems to the fire resistance of structural steel beam I and H members in the horizontal plane containing openings in the web which may affect the structural performance of the beam. This European Standard applies to beams subject to 3 or 4 sided fire exposure.

For any beam with a single web opening or where the web openings are considered to be of small diameter in relation to the web depth the applicability of this European Standard needs to be determined by a structural engineer.

This European Standard applies to fire protection materials that have already been tested and assessed in accordance with EN 13381-4 or EN 13381-8. i.e. this European Standard cannot be used in isolation. Use of this European Standard requires the multi-temperature analysis (MTA) derived from EN 13381-4 or EN 13381-8 as the basis for determining thickness for beams with web openings. This MTA needs to be carried out on the web and bottom flange separately generating an elemental multi-temperature analysis (EMTA). The bottom flange EMTA may be used as the top flange EMTA when a beam is subject to 4 sided exposure.

This European Standard contains the fire test methodology, which specifies the tests which need to be carried out to provide data on the thermal characteristics of the fire protection system, when exposed to the standard temperature/time curve specified in EN 1363-1.

This European standard also contains the assessment, which prescribes how the analysis of the test data should be made and gives guidance on the procedures which should be undertaken.

The assessment procedure is used to establish:

- a) on the basis of the temperature data derived from testing unloaded steel sections, the thermal response of the fire protection system on cellular beams (the thermal performance);
- b) the temperature ratio between the web post and the web reference temperature, which will vary depending on the web post width;
- c) the temperature ratio between points around the web openings and the web reference area;
- d) the elemental multi temperature analysis from either EN 13381-4 or EN 13381-8 needs to be reassessed and reported against elemental A/V for each fire resistance period;
- e) a structural model needs to be used to derive limiting temperatures for cellular beams using the data from b), c) and d) above.



## 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, *Fire resistance tests - Part 1: General Requirements*

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 10025-1, *Hot rolled products of structural steels - Part 1: General technical delivery conditions*

EN 13381-4:2013, *Test methods for determining the contribution to the fire resistance of structural members - Part 4: Applied passive protection to steel members*

EN 13381-8:2013, *Test methods for determining the contribution to the fire resistance of structural members - Part 8: Applied reactive protection to steel members*

EN ISO 13943, *Fire safety - Vocabulary (ISO 13943)*

EN ISO 15614-1, *Specification and qualification of welding procedures for metallic materials - Welding procedure test - Part 1: Arc and gas welding of steels and arc welding of nickel and nickel alloys (ISO 15614-1)*

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

##### **cellular beam(s)**

structural steel beams with web opening(s)

#### 3.1.2

##### **fire protection material**

#### 3.1.2.1

##### **reactive materials**

materials that 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 insulative and cooling effects