

STN	Skúšobné metódy na zisťovanie zvýšenia požiarnej odolnosti konštrukčných prvkov Časť 11: Protipožiarna ochrana aplikovaná na ťahané ocelové prúty s plným prierezom, hodnotená na základe požiarnych skúšok s mechanickým zaťažením	STN EN 13381-11 92 0814
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Test methods for determining the contribution to the fire resistance of structural members - Part 11: Applied reactive protection to solid steel bars in tension based on mechanically loaded fire tests

Táto norma obsahuje anglickú verziu európskej normy.

This standard includes the English version of the European Standard.

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English Version

Test methods for determining the contribution to the fire resistance of structural members - Part 11: Applied reactive protection to solid steel bars in tension based on mechanically loaded fire tests

Méthodes d'essai pour déterminer la contribution à la résistance au feu des éléments de construction - Partie 11: Protection réactive appliquée aux barres d'acier pleines précontraintes (tirants) basé sur des essais de feu soumis à des contraintes mécaniques

Prüfverfahren zur Bestimmung des Beitrages zum Feuerwiderstand von tragenden Bauteilen - Teil 11: Brandschutzmaßnahmen für Stahl-Vollstäbe unter Zugbeanspruchung basierend auf einer Brandprüfung unter mechanischer Belastung

This European Standard was approved by CEN on 13 March 2026.

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

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

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European foreword

This document (EN 13381-11:2026) has been prepared by Working Group 1 ‘Structural and separating elements’ under 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of an identical text or by endorsement, at the latest by October 2026, and conflicting national standards shall be withdrawn at the latest by October 2026.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document has been prepared under a standardization request addressed to CEN by the European Commission. The Standing Committee of the EFTA States subsequently approves these requests for its Member States.

This document 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 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.
- Part 9: Applied fire protection systems to steel beams with web openings.
- Part 10: Applied protection to solid steel bar in tension.

Any feedback and questions on this document should be directed to the users’ national standards body. A complete listing of these bodies can be found on the CEN website.

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, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Türkiye and the United Kingdom.

EN 13381-11:2026 (E)**Introduction**

The evaluation of a system's capability to provide fire protection performance to beams and/or columns with I- or H-section as well as hollow section is undertaken by test and assessment procedures detailed in EN 13381-8 for reactive (intumescent) fire protection systems. The scope of the above standard excludes the assessment of solid steel bars used as tension bars.

In general, it is not possible to use the results of fire protection systems tested according to EN 13381-8 on beams or columns with open or closed profile to steel tension bars with solid section. This has several reasons:

- a) the profiles used for steel bars are usually much slenderer than the profiles used for beams or columns. Consequently, to achieve the same fire resistance usually higher dry film thicknesses of the reactive fire protection system are required;
- b) due to the different profile shape, there is an altered foaming and cracking behaviour of reactive fire protection systems. On the predominantly flat surfaces of a beam with open profile, reactive fire protection systems behave differently than on highly convex curved surface of steel bars with circular solid section;
- c) because the tensile stresses in a steel bar are equal along the entire bar length and within the cross-section, the failure occurs at the position, where the highest steel temperature is present. Therefore, tensile bars are vulnerable to local defects, e.g. cracks or ununiform foam thicknesses of reactive fire protection systems. Furthermore, beams have the possibility of cross-sectional plasticisation. Due to the resulting stress redistribution and the activation of additional load capacity reserves, in fire tests beams suffer lower strains compared to a bar in pure tension. This is also clear from the fact that the tests of a steel bar usually end with the breakage. In mechanically loaded beam tests such a high strain is usually not achieved;
- d) columns are not suitable for a comparison with steel bars, because the cross-sections are much bigger as well as the thermal and mechanical strains are acting in opposite direction;
- e) in contrast to beams, which are generally used in a horizontal position, steel bars are used in different orientations. This can influence the thermal protection performance of the reactive fire protection system.

For reactive fire protection systems that have already been successfully tested and assessed according to EN 13381-8, the test standard EN 13381-10 offers under certain conditions the possibility to extend the scope of application to steel tension bars with solid sections. The fire tests in EN 13381-10 are based upon unloaded specimens. Because this approach contradicts to the German national safety level, where the fire resistance of structural members need to be tested under mechanical load, an A-Deviation was granted, meaning that it is not possible to apply EN 13381-10 in Germany. In addition, recent research and testing on loaded and unloaded steel bars protected with reactive fire protection coatings has shown the need for mechanically loaded fire testing.

This document provides a test and assessment procedure to cover a reactive fire protection system's scope of application to solid circular or rectangular steel bars used as tension bars based on mechanically loaded fire tests. This document is a stand-alone test standard and does not require a successful completion of the test procedure according to EN 13381-8. This document has been created to cover a testing and assessment procedure based primarily upon mechanically loaded fire tests. Across a range of solid circular and/or rectangular bars fire tests on mechanically loaded specimens are carried out. Unloaded specimens may be used to assess additional aspects, such as the influence of the bar orientation as well as smouldering fire behaviour. The assessment procedure described in this document aims to determine the reactive fire protection system's thermal protection performance.

1 Scope

This document describes the test and assessment procedure for determining the contribution of reactive fire protection systems to the fire resistance of solid steel bars used as tension bars, when exposed to the standard temperature/time curve specified in EN 1363-1. In special circumstances, where specified in National Building Regulations, there can be a need to subject reactive fire protection systems to a slow heating curve (smouldering fire) as defined in EN 1363-2. The corresponding test and assessment procedure are described in Annex E. The fire protection performance is determined by mechanically loaded steel bars usually fire tested in horizontal orientation. Information regarding the testing of additional unloaded specimens is given to assess the influence of the bar orientation and smouldering fire behaviour.

The principles of the testing and assessment procedure can also be applied for other profile types. This document does not include steel bars used as reinforcement in concrete construction.

This document is applicable to steel bars up to a maximum diameter of 130 mm. In the case of rectangular bars, the maximum edge length is limited to 130 mm with a maximum aspect ratio of 2:1 against the shorter edge length.

The test programme and the assessment are designed to cover:

- a range of fire protection classification periods;
- a range of thickness of the applied reactive fire protection system;
- a range of steel bar dimensions and profiles;
- a range of specified design temperatures;
- a range of load utilization factors in case of fire;
- a range of bar orientation.

This document also provides the assessment procedure, which prescribes how the analysis of the test data are made and gives guidance on the procedures by which interpolation is undertaken. The assessment procedure is used to establish:

- a) on the basis of data derived from mechanically loaded testing steel bar, any practical constraints on the use of the reactive fire protection system under fire test conditions (the mechanical performance);
- b) on the basis of the temperature data derived from testing steel bar the thermal properties of the reactive fire protection system (the thermal performance).

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 steel grades, steel types and profile dimensions over the range of dry film thicknesses of the applied reactive fire protection system tested.

EN 13381-11:2026 (E)**2 Normative references**

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EAD 350402-00-1106, *Reactive coatings for fire protection of steel elements*

EN 1363-1:2020, *Fire resistance tests — Part 1: General requirements*

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

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

EN 10204, *Metallic products — Types of inspection documents*

EN 60584-1, *Thermocouples - Part 1: EMF specifications and tolerances (IEC 60584-1)*

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

EN ISO 6892-1, *Metallic materials — Tensile testing — Part 1: Method of test at room temperature (ISO 6892-1)*

EN ISO 7500-1, *Metallic materials — Calibration and verification of static uniaxial testing machines — Part 1: Tension/compression testing machines — Calibration and verification of the force-measuring system (ISO 7500-1)*

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

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