SLOVENSKI STANDARD
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Preskusne metode za ugotavljanje prispevka k požarni odpornosti konstrukcijskih elementov - 7. del: Zaščita lesenih elementov

Test methods for determining the contribution to the fire resistance of structural members - Part 7: Applied protection to timber members

Prüfverfahren zur Bestimmung des Beitrages zum Feuerwiderstand von tragenden Bauteilen - Brandschutzmaßnahmen für Holzbauteile

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Méthodes d'essai pour déterminer la contribution à la résistance au feu des éléments de construction - Partie 7: Protection appliquée aux éléments en bois

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ICS:

13.220.50	Požarna odpornost gradbenih materialov in elementov	Fire-resistance of building materials and elements
91.080.20	Lesene konstrukcije	Timber structures

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2003-01.Slovenski inštitut za standardizacijo. Razmnoževanje celote ali delov tega standarda ni dovoljeno.

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EUROPEAN STANDARD
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English Version

Test methods for determining the contribution to the fire resistance of structural members - Part 7: Applied protection to timber members

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This European Standard was approved by CEN on 26 November 2018.

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SIST EN 13381-7:2019

Contents

Page

iTeh STANDARD PREVIEW
(standards.iteh.ai)
SIST EN 13381-7:2019
https://standards.iteh.ai/catalog/standards/sist/6e236f98-c770-4fac-929d-027ec400be97/sist-en-13381-7-2019

SIST EN 13381-7:2019

iTeh STANDARD PREVIEW
(standards.iteh.ai)
SIST EN 13381-7:2019
https://standards.iteh.ai/catalog/standards/sist/6e236f98-c770-4fae-929d-027ec400be97/sist-en-13381-7-2019

SIST EN 13381-7:2019

iTeh STANDARD PREVIEW
(standards.iteh.ai)
SIST EN 13381-7:2019
https://standards.iteh.ai/catalog/standards/sist/6e236f98-c770-4fae-929d-[illegible]/sist-en-13381-7-2019

SIST EN 13381-7:2019

iTeh STANDARD PREVIEW
(standards.iteh.ai)
SIST EN 13381-7:2019
https://standards.iteh.ai/catalog/standards/sist/6e236f98-c770-4fae-929d-027ec400be97/sist-en-13381-7-2019

SIST EN 13381-7:2019

European foreword

This document (EN 13381-7:2019) 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 2019, and conflicting national standards shall be withdrawn at the latest by March 2021.

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 supersedes ENV 13381-7:2002.

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 standard are:

Part 1: Horizontal protective membranes.

Part 2: Vertical 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 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 rods.

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SIST EN 13381-7:2019
https://standards.iteh.ai/catalog/standards/sist/6e236f98-c770-4fae-929d-027ec400be97/sist-en-13381-7-2019

The main changes compared to ENV 13381-7:2002 are:

a) New test procedures have been introduced to address the different fields of applications of fire protection systems on solid timber products and timber frame assemblies in horizontal and vertical position and the design models available in EN 1995-1-2.

b) Loaded tests are performed using large-scale test specimens depending on their intended use on walls or ceilings.

c) The start of charring and the stickability is measured with thermocouples on the timber member(s) surface of a beam specimen or a timber frame specimen.

d) Charring behind a fire protection system is measured using charring specimens embedded in the cavity insulation of a timber frame specimen.

e) Interpolation of results for different thicknesses of fire protection system is not allowed.

SIST EN 13381-7:2019

f) The use of test results for different orientations obtained in tests in one orientation is specified.

WARNING - The attention of all persons concerned with managing and carrying out this fire resistance test, is drawn to 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.

This document has been prepared under a standardization request given to CEN/CENELEC by the European Commission and the European Free Trade Association.

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, Turkey and the United Kingdom.

iTeh STANDARD PREVIEW
(standards.iteh.ai)
SIST EN 13381-7:2019
https://standards.iteh.ai/catalog/standards/sist/6e236f98-c770-4fae-929d-027ec400be97/sist-en-13381-7-2019

SIST EN 13381-7:2019

1 Scope

This document specifies test methods for determining the contribution of fire protection kits to the fire resistance of structural timber members.

Such fire protection kits include claddings, sprayed fire protection and reactive coatings.

The method is applicable to all fire protection kits used for the protection of timber members. These can be fixed directly, totally or in part, to the timber member and can include an air gap between the fire protectionkit and the timber member, as an integral part of its design.

Evaluation of timber constructions protected by horizontal or vertical protective membranes are the subject of EN 13381-1 or EN 13381-2 respectively.

The test method is applicable to the determination of the contribution of fire protection kits to the fire resistance of loadbearing timber structural members including floors, roofs, walls, beams and columns.

This document contains the fire test which specifies the test to be carried out to determine the ability of the fire protection kit at a specified thickness to delay the temperature rise throughout the timber member, to determine the ability of the fire protection kit at a specified thickness to remain coherent and fixed to the timber member and to provide data for determining the charring rate of the protected test member, when exposed to the standard temperature/time curve according to the procedures defined herein. This document is not appropriated to classify the tested assembly according to EN 13501-2.

The test to subject reactive protection material to a smouldering temperature time fire curve and the special circumstances for this are detailed in Annex G.

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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 timber members in accordance with the procedures given in EN 1995-1-2.

SIST EN 13381-7:2019
https://standards.iteh.ai/catalog/standards/sist/6e236f98-c770-4fae-929d-027ec400be97/sist-en-13381-7-2019

A description of the relationship of this test method and the assessment of the results obtained therefrom to EN 1995-1-2 and guidelines for the use of this test method in accordance with that standard are given in Annex B.

This document also contains the assessment which indicates how the analysis of the test data should be made and gives guidance to the procedures by which interpolation should be undertaken.

The limits of applicability of the results of the assessment arising from the fire test are defined, together with the direct application of the results to different timber constructions with the specified thickness and fixation of the applied fire protection kit tested.

SIST EN 13381-7:2019

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.

EN 301, *Adhesives, phenolic and aminoplastic, for load-bearing timber structures — Classification and performance requirements*

EN 338, *Structural timber — Strength classes*

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

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

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

iTeh STANDARD PREVIEW

EN 1365-1, *Fire resistance tests for loadbearing elements — Part 1: Walls*

(standards.iteh.ai)

EN 1365-2, *Fire resistance tests for loadbearing elements — Part 2: Floors and roofs*

SIST EN 13381-7:2019

EN 1365-3, *Fire resistance tests for loadbearing elements — Part 3: Beams*

https://standards.iteh.ai/catalog/standards/sist/6e236d8-e770-4ac-929d-027ec400be97/sist-en-13381-7-2019

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

EN 13162, *Thermal insulation products for buildings — Factory made mineral wool (MW) products — Specification*

EN 13381-1, *Test methods for determining the contribution to the fire resistance of structural members — Part 1: Horizontal protective membranes*

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

EN 14080, *Timber structures - Glued laminated timber and glued solid timber — Requirements*

EN 14081-1, *Timber structures — Strength graded structural timber with rectangular cross section — Part 1: General requirements*

EN 15425, *Adhesives — One component polyurethane (PUR) for load-bearing timber structures — Classification and performance requirements*

EN ISO 2808, *Paints and varnishes — Determination of film thickness (ISO 2808)*

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

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

SIST EN 13381-7:2019

ISO 834-12, *Fire resistance tests — Elements of building construction — Part 12: Specific requirements for separating elements evaluated on less than full scale furnaces*

3 Terms, 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, together with the following, apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

3.1.1
board
part of a building assembly of typically not reactive material, used as a part or as fire protection material

3.1.2
cavity insulation
stone wool insulation in batts of reaction to fire class A1 and a density of 30 KG/m³ (±5 KG/m³) to be placed between timber joists or studs over their full depth in timber frame assemblies tested according this standard to achieve a loading of and heat accumulation in the fire exposed fire protection kit

iTeh STANDARD PREVIEW
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SIST EN 13381-7:2019
https://standards.iteh.ai/catalog/standards/sist/6e236f98-c770-4fae-929d-027ec400be97/sist-en-13381-7-2019

3.1.3
char line
border-line between char layer and the residual cross section assumed to be equal with the position of the 300 degree Celsius isotherm

3.1.4
charring depth
distance from the original surface of the timber member to the char line

3.1.5
charring specimen
non-load bearing, instrumented, laminated timber specimen containing one temperature measurement station incorporated into a large scale test specimen, into a large scale test or a model scale test specimen to follow the charring behind a fire protection kit

3.1.6
failure time
time at which failure of the fire protection kit occurs, due to detachment of a significant area or sudden significant temperature rise upon the initially protected timber surface

3.1.7
fire protection material
material or combination of materials applied to the surface of a timber structural member for the purpose of increasing its fire resistance

SIST EN 13381-7:2019

3.1.8
fire protection kit
fire protection material together with a prescribed method of attachment to a timber structural member for which the fire protection kit may include multiple layers of materials and multiple combinations of materials

3.1.9
model scale test
test to determine the charring rate during the protected charring phase on a furnace of full scale or less than full scale depending on the dimension of the model scale test specimen

3.1.10
passive fire protection materials
materials which do not change their physical form upon heating, provide fire protection by virtue of their physical or thermal properties, and they may include materials containing water which, on heating, is removed to produce cooling effects

3.1.11
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 insulative and cooling effects

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3.1.12
timber structural member
element of building construction which may be loadbearing or non-loadbearing and which is mainly constructed from solid timber and/or other wood based products

SIST EN 13381-7:2019
https://standards.iteh.ai/catalog/standards/sist/6e236f98-c770-4fae-929d-027ec400be97/sist-en-13381-7-2019

3.1.13
fire protection
protection afforded to the timber member by the fire protection kit such that the rise of temperature of the timber and fixings is limited or delayed throughout the period of exposure to fire

3.1.14
stickability
ability of a fire protection material to remain sufficiently coherent and in position without failure due to detachment of a significant area or sudden significant temperature rise upon the initially protected timber surface

3.1.15
temperature measurement station
number of thermocouples in different depths which are installed within the charring specimen and are representative for a limited area

3.1.16
test specimen
assembly of the timber or wood based test member with its fire protection kit

3.1.17
spreader beam
stiff beam with a height width ratio of equal or less than 1,0 used in large scale tests to distribute the load uniformly placed on the top of the large scale floor test specimen or the large scale wall test specimen over the whole width of the specimen

SIST EN 13381-7:2019

3.1.18
start of charring
point in time when the temperature measurement at an initially fire protected timber surface reaches or exceeds 300 °C

3.1.19
wood defect
knot, bark pocket, resin pocket, pith or crack

3.1.20
large scale test
loaded test to determine the start of charring behind the fire protection kit and the stickability of a fire protection kit (applied to a horizontal or vertical timber framed assembly or to a timber beam) on a full scale furnace

3.2 Symbols and units

For the purposes of this document, the following symbols and units apply.

Symbol	Unit	Description
A	mm^2	Area
$E_{0.05}$	N/mm^2	Fifth percentile value of modulus of elasticity
I_z	mm^4	Second Moment of area about the z-axis
L_{exp}	mm	Length of the specimen exposed to the heating
L_{sup}	mm	Length of the specimen between centres of supports
T	°C	Temperature
TC		Thermocouple
b	mm	Width of the large scale test specimen
c	mm	Centre distance of loaded joists
d	mm	Vertical distance between horizontal joints
d_{char}	mm	Charring depth
d_{TC}	mm	Distance of the thermocouple from the exposed side of the timber member
$f_{c,0,d}$	N/mm^2	Design compressive strength along the grain
$f_{c,0,k}$	N/mm^2	Characteristic compressive strength along the grain
h	mm	Depth of the timber member; The height of a large scale test specimen; The depth of the model scale test specimen; The height of the joists in a large scale wall test
h_c	mm	Depth of the aerated concrete member
h_D	mm	Thickness of the decking of the large floor element
h_p	mm	Thickness of the fire protection kit. In the case of two or more layers of fire protection material h_p is the sum of the thicknesses.
h_D	mm	Thickness of the decking at the non-exposed side for large scale wall test specimens and large scale floor test specimens

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SIST EN 13381-7:2019
https://standards.iteh.ai/catalog/standards/sist/6e236f98-c770-4fae-929d-02bc400be97/sist-en-13381-7-2019

SIST EN 13381-7:2019

Symbol	Unit	Description
i_z	mm	Radius of inertia about the z-axis
k_{mod}		Modification factor for duration of load and moisture content
k_2		Protection coefficient
l	mm	Length of the large scale wall specimen
l_c	mm	Length of the aerated concrete members
l_a	mm	Length of the mechanical fixation penetrating in the virgin wood
$l_{a,0}$	mm	Anchorage length of the mechanical fixation in the wood at $t = 0$
l_m	mm	Measurement length. Length where thermocouples are distributed
$l_{m,i}$	mm	Measurement length where thermocouples of one temperature measurement station are distributed; i from 1 to 3
l_s	mm	Length of the model scale test specimen
s	mm	Distance between thermocouples
s_f	mm	Minimum distance to the furnace walls
t	min	Time
t_{ch}	min	Start of charring at the surface of a timber member
$t_{ch,model}$	min	Time when the average temperature of the surface TC attached to the model scale specimen reaches 300 °C
$t_{ch,1}$	min	Assumed start of charring based to calculate the charring depth specimen depth and the number of thermocouples needed
t_{300}	min	Time at which the temperature indicated by a thermocouple placed at the surface of the timber test member or at a specified point within a protected. timber test member, reaches 300 °C
t_f	min	Failure time of the protection for stickability
t_{test}	min	Time of termination of test
w_c	mm	Width of the aerated concrete members
w_f	mm	Width of the opening to which the tested element is mounted
w_s	mm	Width of the charring specimen
x	mm	Centre distance between first 2 outer joists or studs of a large scale wall test specimen or a large scale floor test specimen Length of a defect
β	mm/min	charring rate
β_o	mm/min	One-dimensional charring rate according to EN 1995–1-2
β_n	mm/min	Notional charring rate according to EN 1995–1-2
β_2	mm/min	Charring rate behind a fire protection kit according to EN 1995–1-2
γ_M		Partial factor for material properties, also accounting for model uncertainties and dimensional variations

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SIST EN 13381-7:2019
https://standards.iteh.ai/catalog/standards/sist/6e236f98-c770-4fac-929d-027ec400be97/sist-en-13381-7-2019