
DfYg_i gbY'a YfcXY'nUi [cHj `Ub`Ydf]gdYj _U_ `dcÿUfb]`cXdcfbcgh]`_cbglfi _W'g_]`
Y'Ya Ybfcj `!'+`"XY.`NUÿ]HJ`YgYb]` Y'Ya Ybfcj

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 - Teil 7: Brandschutzmaßnahmen für Holzbauteile

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

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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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PRÉNORME EUROPÉENNE
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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

This European Prestandard (ENV) was approved by CEN on 1 March 2002 as a prospective standard for provisional application.

The period of validity of this ENV is limited initially to three years. After two years the members of CEN will be requested to submit their comments, particularly on the question whether the ENV can be converted into a European Standard.

CEN members are required to announce the existence of this ENV in the same way as for an EN and to make the ENV available promptly at national level in an appropriate form. It is permissible to keep conflicting national standards in force (in parallel to the ENV) until the final decision about the possible conversion of the ENV into an EN is reached.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
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Foreword

This document ENV 13381-7:2002 has been prepared by Technical Committee CEN/TC127 "Fire safety in buildings", the secretariat of which is held by BSI.

This document has been prepared under the mandate given to CEN/TC127 by the Commission and the European Free Trade Association.

As there was little experience in carrying out these tests in Europe CEN/TC127 agreed that more experience should be built up during a prestandardization period before agreeing text as European Standards. Consequently all parts are being prepared as European Prestandards.

This European Prestandard 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 ENV 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.

Annexes A and C are normative. Annexes B and D are informative.

Caution

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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 prestandard should be followed.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to announce this European Prestandard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

1 Scope

This Part of this European Prestandard specifies a test method to be followed for determining the contribution of fire protection systems to the fire resistance of structural timber members.

Such fire protection systems include claddings, sprayed fire protection and coatings.

The method is applicable to all fire protection systems 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 protection system 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 ENV 13381-1 or ENV 13381-2 respectively.

The test method is applicable to the determination of the contribution of fire protection systems to the fire resistance of loadbearing timber structural members and non-loadbearing parts of the works, including floors, roofs, walls, beams and columns. It is also applicable to timber structural members incorporating insulating materials between the timber members, e.g. between timber joists in floor constructions.

The test method and its assessment procedure is designed to permit direct application of the results to cover a range of thicknesses of the applied fire protection material.

This European Prestandard contains the fire test which specifies the test to be carried out to determine the ability of the fire protection system to delay the temperature rise throughout the timber member, to determine the ability of the fire protection system to remain coherent and fixed to the timber member and to provide data of the temperature profile throughout the timber test member, when exposed to the standard temperature/time curve according to the procedures defined herein.

In special circumstances, where specified in national building regulations, there can be a need to subject reactive 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 timber members in accordance with the procedures given in ENV 1995-1-2.

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

This European Prestandard also contains the assessment which prescribes 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 permitted direct application of the results to different timber constructions over the range of thicknesses of the applied fire protection system tested.

2 Normative references

This European Prestandard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text, and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Prestandard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 1363-1	Fire resistance tests - Part 1: General requirements.
EN 1363-2	Fire resistance tests - Part 2: Alternative and additional procedures.
EN 1365-1	Fire resistance tests for loadbearing elements - Part 1: Walls.
EN 1365-2	Fire resistance tests for loadbearing elements - Part 2: Floors and roofs.
EN 1365-3	Fire resistance tests for loadbearing elements - Part 3: Beams.
EN 1365-4	Fire resistance tests for loadbearing elements - Part 4: Columns.
ENV 1995-1-2	Eurocode 5: Design of timber structures Part 1-2: General rules - Structural fire design.
EN 338	Structural timber - Strength classes.
EN 312	Particleboards - Specifications.
ISO 8421-2	Fire protection - Vocabulary - Part 2: Structural fire protection.
ISO 13943	Fire safety - Vocabulary (ISO 13943:1999).

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3 Terms and definitions, symbols and units

3.1 Terms and definitions

For the purposes of this European Prestandard, the terms and definitions given in EN 1363-1, EN ISO 13943 and ISO 8421-2, together with the following, apply.

3.1.1

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

3.1.2

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

3.1.3

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. They may include materials containing water which, on heating, is removed 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 insulative and cooling effects

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3.1.5

fire protection system

fire protection material together with a prescribed method of attachment to a timber structural member. The fire protection system may include multiple layers of materials and multiple combinations of materials

3.1.6

fire protection

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

3.1.7

test specimen

complete assembly of the timber test member plus the fire protection system under test. Within this test method, several timber beams representative of timber in various constructional environments in a structural building member, may be combined into a single test specimen

3.1.8

stickability

ability of a fire protection material to remain sufficiently coherent and in position for a well defined range of deformations, and furnace and test specimen surface temperatures, such that its ability to provide fire protection is not significantly impaired

3.1.9

charring depth

distance from the original surface of the timber member to the char line. The char line is the border-line between char layer and the residual cross section

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3.2 Symbols and units

Symbol	Unit	Designation
t	min	Time
t_{pr}	min	The failure time of the fire protection system, i.e. the time when the temperature on the surface of the timber test member (interface between timber and fire protection or air gap beneath the fire protection) reaches 300 °C.
$t_{300,prot}$	min	Time at which the temperature indicated by a thermocouple placed at the interface between the timber test member and the fire protection system, or at a specified point within a protected timber test member, reaches 300 °C.
$t_{300,unprot}$	min	Time at which the temperature indicated by a thermocouple on the surface of an unprotected timber test member, or at a specified point within an unprotected timber test member, reaches 300 °C.
t_{test}	min	Time of termination of test.
d_p	mm	Thickness of the fire protection system. In the case of two or more layers of fire protection material d_p is the sum of the thicknesses.
d_{char}	mm	Charring depth.
β	mm/min	Notional charring rate from ENV 1995-1-2 excluding the effect of roundings at arrises.
β_o	mm/min	Notional charring rate from ENV 1995-1-2 including the effect of roundings at arrises.
β'	mm/min	Actual unprotected charring rate determined by testing.

β'' mm/min Actual protected charring rate determined by testing.

4 Test equipment

4.1 General

The furnace and test equipment shall be as specified in EN 1363-1.

4.2 Furnace

The furnace shall be designed to permit the dimensions of the test specimen to be exposed to heating to be as specified in 6.2 and its installation to be as specified in clause 7.

4.3 Loading equipment

Loading equipment shall conform to that specified in EN 1363-1. The loading system shall permit loading of the magnitude defined in 5.3 to be applied.

5 Test conditions

5.1 General

The tests shall be carried out as described in EN 1363-1 unless otherwise stated.

For a fire protection system to be applied to timber floors, walls, beams and columns, both floor and beam tests shall be performed according to EN 1365-2 and EN 1365-3 respectively.

For a fire protection system to be applied only to timber floors and walls, then floor tests shall be performed according to EN 1365-2.

For a fire protection system to be applied only to timber beams and columns, then beam tests shall be performed according to EN 1365-3.

This test method is written in terms of this universal application to all constructions.

Wall or column tests only may be performed (according to EN 1365-1 or EN 1365-4 respectively) but the results shall be restricted to that tested.

The EN 1365 test methods shall be slightly modified for the purposes of this test in order that the following information may be obtained and monitored:

- the behaviour of the fire protection system and its stickability;
- the temperature of the timber behind the fire protection system and the temperature throughout the depth of the timber.

5.1.1 The modified prEN 1365 large scale test

The EN 1365 test method(s) and test specimen(s) appropriate to the use of the fire protection material, specified by the sponsor, shall be followed.

The temperature performance, stickability and general behaviour of the fire protection system, under load shall be examined by incorporation into the test specimen an assembly or assemblies comprising particleboard laminate together with additional instrumentation.

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5.1.2 The small scale test

Small scale tests shall be performed upon scaled down test assemblies from that given in 5.1.1.

Small scale tests shall be carried out on the same furnace as that used for the large scale tests in 5.1.1 and in horizontal orientation, unless the result is to be restricted (see 5.1).

Such tests shall be used to give correlation between protected and unprotected timber structures and to provide additional information.

5.2 Support and restraint conditions

Test specimens shall be supported according to the relevant large scale test.

5.3 Loading conditions

Loading shall be applied to full size test specimens according to the relevant large scale test.

The magnitude of the load shall be calculated, taking account of the differing strength and deformation properties induced by included particle board laminates, to be that required to give the necessary deflection according to the appropriate EN 1365 test.

The small scale test shall be performed unloaded.

6 Test specimens**6.1 Number****6.1.1 General**

The appropriate test or tests to be carried out shall be as given in 5.1. For each EN 1365 test method to be used, if the fire protection material is available in more than one thickness then following shall be carried out:

- a) Test result to be applicable to floors and beams according to EN 1365-2 and EN 1365-3 (and therefore to walls and columns according to 5.1).
- one large floor test at minimum thickness
 - one large floor test at maximum thickness
 - one large beam test at minimum thickness
 - one large beam test at maximum thickness
 - one small floor test at minimum thickness
 - one small floor test at maximum thickness
 - one unprotected small scale test.
- b) Test result to be applicable only to floors according to EN 1365-2 (and therefore to walls according to 5.1).
- one large floor test at minimum thickness
 - one large floor test at maximum thickness
 - one small floor test at minimum thickness
 - one small floor test at maximum thickness
 - one unprotected small scale test.
- c) Test result to be applicable only to beams according to EN 1365-3 (and therefore to columns according to 5.1).

- one large beam test at minimum thickness
- one large beam test at maximum thickness
- one small floor test at minimum thickness
- one small floor test at maximum thickness
- one unprotected small scale test.

For very restricted application to walls or columns (see 5.1) the same numbers of tests shall be carried out with walls or columns replacing floors or beams.

For each EN 1365 test method to be used, if the fire protection material is available in one thickness or if the sponsor specifies limitation to one commercially appropriate thickness only, then the two tests at maximum and minimum thickness shall be replaced by a single test at that thickness. The results of the assessment shall be restricted to that tested.

Test constructions carrying particleboard test specimens shall be built according to 6.3 and installed according to clause 7.

6.1.2 Fire protection system variations

Additional particleboard test specimens shall be tested to provide further test data for the fire protection system when it is required to consider:

- different construction and fixing variables: One particleboard specimen per variable shall be tested in both large and small scale tests at maximum fire protection thickness;
- multilayer fire protection systems: One particleboard specimen per variable shall be tested in both large and small scale tests;
- other intermediate fire protection thicknesses between maximum and minimum thickness. One small scale test per thickness variable to be considered; 7:2003
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- alternative and intermediate thicknesses of multiple layer combinations. One small scale test per combination and combination thickness to be considered;
- the test to the smouldering curve (see annex A). One small scale test for maximum and minimum thickness tested on the large scale.

Test constructions carrying particleboard test specimens shall be built according to 6.3

The additional particleboard specimens given in 6.1.2 may be incorporated into the tests defined in 6.1.1 or tested separately, providing the requirements of clause 7 are satisfied.

6.2 Size

6.2.1 Large scale test specimen

For each EN 1365 test method to be carried out, as given in 5.1, the size of the large scale test construction to carry the particleboard test specimen shall be that specified in that method, i.e.:

- Floors: the exposed dimensions of the floor shall be at least 4 000 mm length and 2 000 mm width according to EN 1365-2.
- Beams: the exposed length of the beam shall be at least 4 000 mm according to EN 1365-3.
- Walls: the exposed dimensions of the wall shall be as specified in EN 1365-1.
- Columns: the exposed height of the column shall be as specified in EN 1365-4.

6.2.2 Small scale test specimen

The size of the small floor test construction to carry the particleboard test specimen shall be such that its exposed length is 2 000 mm and its exposed width 1 000 mm.

6.3 Construction

6.3.1 Construction of timber test specimens

The test constructions to carry the particleboard laminate test specimens shall be made according to the EN 1365 test(s) under consideration.

6.3.1.1 Particle board laminate test specimens

Loaded large floor - A particle board laminate, comprising 10 layers of 10 mm thick particleboard, of width equal to the spacing between the floor joists and length equal to the exposed length of the floor, is rigidly fixed between and to the joists such that the deflection applied to the floor is transferred to the particleboard. This fixing is made from above by use of appropriate brackets or fixings. The lower face of the particleboard laminate shall be flush with the lower face of the joists.

Thermocouples shall be inserted between the layers as defined in 9.3.

Depending upon the width of the floor, the spacing of the joists etc, more than one particleboard test specimen may be incorporated into a test floor to permit more than one variable to be examined per furnace test, providing the limitations of 6.1.2 and clause 7 are followed. Multiple specimens shall be symmetrically distributed.

Loaded beams - The beam is covered with particleboard laminate, comprising 5 layers of 10 mm thick particleboard, applied round the beam on all exposed sides. The particleboard laminate is rigidly fixed to the beam such that the deflection applied to the beam is transferred to the particleboard.

Thermocouples shall be inserted between the layers as defined in 9.3.

An alternative construction for loaded beam testing is given in annex D.

6.3.1.2 Small scale tests

Unloaded floor test specimens: shall comprise particleboard laminates made up from 10 layers of 10 mm thick particleboard, adhesive laminated, size 2000 mm × 1000 mm. Thermocouples shall be inserted between the layers as defined in 9.3.

6.3.2 Application of the fire protection materials to the timber test specimen

Fire protection systems comprising boards (or panels), for the fire protection of flat, two dimensional, timber structures shall be arranged such that boards of the largest practical size are used and that at least one longitudinal joint and one transverse joint, where applicable, are tested within the furnace.

Fire protection systems comprising boards (or panels), for the protection of beams and columns shall be arranged such that boards of the largest practical size are used and that at least one longitudinal joint, one transverse joint and one horizontal joint, where applicable, are tested within the furnace.

For multiple layer fire protection systems each layer shall be individually fixed and lateral joints staggered according to ENV 1995-1-2.

The fire protection systems shall be applied to floor, beam and small scale test specimens as in practice.