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Preskusne metode za izpostavljenost streh požaru z zunanje strani

Test methods for external fire exposure to roofs

Prüfverfahren zur Beanspruchung von Bedachungen durch Feuer von außen

Méthodes d'essai pour l'exposition des toitures à un feu extérieur

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Test methods for external fire exposure to roofs

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Prüfverfahren zur Beanspruchung von Bedachungen durch Feuer von außen

This Technical Specification (CEN/TS) was approved by CEN on 23 August 2011 for provisional application.

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Foreword

This document (CEN/TS 1187:2012) has been prepared by Technical Committee CEN/TC 127 “Fire safety in buildings”, the secretariat of which is held by BSI.

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This document supersedes ENV 1187:2002.

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Introduction

The first mandate given to CEN/TC 127 on fire resistance testing (Mandate No. 117) in support of the Construction Products Directive required two test methods for external fire exposure to roofs. One test method was to include the effect of a burning brand, the other was to include the effect of a burning brand together with wind and supplementary radiant heat. These two draft methods were circulated for the CEN 6-month enquiry, but many countries did not support the two and several countries requested that only one method should be prepared by CEN.

The topic was referred to the EC Fire Regulators' Group. Discussions took place in both the Fire Regulators' Group and the Standing Committee on Construction, and in April 1997 CEN/TC 127 was requested to produce a standard incorporating the two existing draft methods and the Nordtest method.

The Standing Committee accepted this as a short-term solution and strongly expressed the view that a truly harmonised test procedure should be developed in the long term, i.e. a single test procedure for this characteristic.

Realizing that the three test method document (ENV 1187:2002 dated May 2002) and the Amendment A1 (ENV 1187:2002/A1 dated August 2005) did not have the same time scale, it was decided to consider all four methods under the same procedure.

This Technical Specification will be followed by a single test procedure required by the European Commission.

CAUTION — The attention of all persons concerned with managing and carrying out these tests 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.

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 all relevant personnel. Laboratory personnel should ensure that they follow written safety instructions at all times.

1 Scope

This Technical Specification specifies four methods for determining the performance of roofs to external fire exposure. The four methods assess the performance of roofs under the following conditions:

a) test 1 – with burning brands;

b) test 2 – with burning brands and wind;

c) test 3 – with burning brands, wind and supplementary radiant heat;

d) test 4 – with two stages incorporating burning brands, wind and supplementary radiant heat.

The tests assess the fire spread across the external surface of the roof, the fire spread within the roof (tests 1, 2 and 3), the fire penetration (tests 1, 3 and 4) and the production of flaming droplets or debris falling from the underside of the roof or from the exposed surface (tests 1, 3 and 4).

Tests 2 and 3 are not applicable to geometrically irregular roofs or roof mounted appliances, e.g. ventilators and roof lights.

NOTE The four tests listed above do not imply any ranking order. Each test stands on its own without the possibility to substitute or exchange one for another.

2 Normative references

The following referenced documents are indispensable for the application 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 13238:2010, *Reaction to fire tests for building products — Conditioning procedures and general rules for selection of substrates*

EN 13501-1:2007+A1:2009, *Fire classification of construction products and building elements — Part 1: Classification using data from reaction to fire tests*

EN 13501-5:2005+A1:2009, *Fire classification of construction products and building elements — Part 5: Classification using data from external fire exposure to roofs tests*

EN ISO 13943:2010, *Fire safety — Vocabulary (ISO 13943:2008)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN ISO 13943:2000 and the following apply.

3.1
roof
covering and sealing system including any insulating layers or vapour barriers normally provided together with their supporting elements including attachment (glued, mechanically fastened, etc.), and roof lights or other closures for roof apertures that are intended to provide a weatherproof surface

3.2
material
basic single substance or uniformly dispersed mixture of substances (e.g. metal, stone, wood, bitumen, concrete, mineral wool)

3.3
damaged material

3.3.1
damaged material including melting
material that has been burnt, charred, melted or otherwise visually changed by heat

NOTE Discolouration and soot deposits should not be regarded as damage. Areas of the roof covering surface in which combustion has not occurred should not be regarded as damaged (e.g. areas which have only become shiny or only have tiny occasional holes or bubbles).

3.3.2
damaged material not including melting
material that has been burnt or otherwise visually changed by heat, excluding melting

NOTE Discolouration and soot deposits should not be regarded as damage. Areas of the roof covering which have only become shiny or only have tiny occasional holes or bubbles should not be regarded as damaged.

3.4
burnt material
material that has been destroyed by combustion or pyrolysis

3.5
composite
combination of materials which is generally recognized in building construction as a discrete entity

EXAMPLE Coated or laminated products such as roofing felts.

3.6
assembly
fabrication of materials and/or composites

EXAMPLE Sandwich panels.

3.7
product
material, composite or assembly about which information is required

3.8
specimen
representative section of the roof/roof covering prepared for the purpose of the test

3.9
continuous deck
element with a continuous supporting function in which the gap between adjacent elements is not greater than 0,5 mm ((5,0 ± 0,5) mm in the case of wooden planks with plain edges)

3.10
exposed surface
external surface of the specimen which is subject to the heating conditions of the test

3.11
measuring zone
area of the specimen within which measurements are made

3.12
underside
bottom surface of the specimen

3.13
sustained flaming
flames arising from an observed location, which persist for 5 s or longer

3.14
external fire spread
progression and extent of sustained flaming across the exposed surface of the specimen

3.15
fire penetration
appearance on the underside of the specimen of any sustained flaming or glowing due to combustion including the occurrence of any flaming droplets falling from the underside

NOTE Charring and/or discolouration should not be regarded as fire penetration (for test 1 and test 3).

3.16
opening
appearance during the test of any hole greater than 25 mm^2 in area or any crack greater than 2 mm wide, which penetrates completely through the specimen and which would allow burning material to fall through the roof

3.17
internal damage
extent of damaged material in each layer inside the specimen, measured from the edges of the projection of the ignition source in the upwards and downwards directions with respect to the pitch of the roof

3.18
fire spread within the roof
internal fire spread
maximum burnt length measured from the upper edge of the projection of the ignition source in the upward direction and from the lower edge in the downward direction of each layer for sloped roofs, and in any direction for horizontal roofs

NOTE See 4.8.1.

3.19
flaming droplets or debris
burning material falling from the specimen that continues to burn on the floor for at least 5 s

3.20
joint
kind of connection or link within a layer in the roof, such as overlap or seams

3.21
roof covering
uppermost layer of a roof

NOTE This layer can comprise single layer or multiple layer coverings.

3.22
damaged length
length of damaged material of the roof covering and the substrate respectively, expressed in millimetres as measured from the centre of the wood crib position (for test 2)

3.23
substrate
product which is used immediately beneath the roof covering, about which information is required (for test 2)

3.24
roof pitch
inclination of the roof surface to the horizontal

3.25
non-combustible product
product which satisfies reaction to fire class A1 or A2-s1,d0 according to EN 13501-1:2007+A1:2009

3.26
combustible product
product not satisfying the definition of non-combustible product

3.27
penetration by fire
appearance on the underside of the specimen of any flaming or glowing other than that of the test flame, disregarding any test flame appearing through pre-existing openings in the test specimen (for test 4)

4 Test 1: Method with burning brands

4.1 Test equipment

4.1.1 Basket, as shown in Figure 1.

The basket shall be made from 3 mm diameter mild steel wire forming a mesh of approximately 50 mm × 50 mm. The basket shall be open at the top and bottom and have four projecting feet 10 mm long, one at each corner. The outer dimensions of the basket shall be 300 mm × 300 mm × 200 mm deep. The mass of the basket shall be (650 ± 50) g.

4.1.2 Wood wool.

Wood wool shall consist of fibres approximately 2 mm wide × 0,2 mm to 0,3 mm thick and be manufactured from softwood, e.g. spruce, pine or fir.

4.1.3 Balance.

The balance is used to weigh the wood wool. It shall have a nominal capacity of at least 2 kg and an accuracy of ± 1 g.

4.1.4 Timing device.

A timing device with an accuracy of ± 5 s over 24 h shall be used.

4.2 Calibration

Each new batch of wood wool shall be checked by carrying out a control test as follows: A sample of calcium silicate board as described in 4.4.2.2, c), measuring 1 m × 1 m shall be supported horizontally at a height of about 1 m above the floor. A basket filled with conditioned wood wool as described in 4.5.1 and 4.7.1 shall be placed at the centre of the board and ignited as described in 4.7.3. The burning time shall be measured from the commencement of ignition until the final flame extinguishes.

Three separate tests shall be carried out. The calcium silicate board used shall be cooled down between the tests. If the range of the burning times recorded is greater than 2 min, a further three tests shall be conducted. The mean burning time for all performed tests shall be calculated and shall lie within the range of 4 min to 5 min.

4.3 Test conditions (roof pitch)

Roofs intended to be installed with pitches up to 20° in practice shall be tested at a pitch of 15°. Roofs intended to be installed with pitches greater than 20° shall be tested at a pitch of 45°.

In special cases (e.g. where proof for a specific type of roof is to be provided), by way of departure from the specifications regarding roof pitches, verification of the resistance of a roof to burning brands may also be carried out by testing at the actual intended roof pitch. The test results so obtained shall then be valid only for the roof pitch tested.

4.4 Test specimen

4.4.1 General

Four specimens with minimum dimensions 0,8 m in width × 1,8 m in length shall be prepared under appropriate supervision by the laboratory for each roof pitch to be tested.

Roof lights shall be tested in the original size, with a waterproofing system attached as in practice.

The specimens shall be representative, in all details of practical application (except for the standard supporting deck), with regard to both the support, and the type and number of layers of roofing materials (including any insulation, vapour barriers, etc.), and with regard to the joining of those layers. An example specimen section is shown in Figure 2.

Joints have to be provided in the several layers forming the specimen. The positioning of the joints shall follow 4.4.3.

4.4.2 Selection of standard supporting decks

4.4.2.1 General

When the product being evaluated is a roof covering system intended for general application over a variety of decks (see 4.10), the test deck shall be selected in accordance with either 4.4.2.2, b) or 4.4.2.2, c).

4.4.2.2 Roof coverings intended to be installed over continuous decks

a) In the case of roof coverings intended to be installed over a continuous deck which is not profiled, a roof deck in accordance with either 4.4.2.2, b) or 4.4.2.2, c) shall be used. If the materials are to be laid over a profiled steel deck, then a trapezoidal profiled steel deck, in accordance with 4.4.2.2, d) shall be used.

b) If it is intended to simulate a wooden continuous deck with a gap not exceeding 0,5 mm, the wood particle board deck shall be constructed from planks 250 mm wide × 16 mm thick running parallel to the eaves with plain edges and tightly butt jointed so that the gaps between planks do not exceed 0,5 mm.

   If it is intended to simulate a deck made of narrow solid wood planks, the gaps between the particle board panels shall be (5,0 ± 0,5) mm.

   The wood particle board shall consist of wood particles bonded with polymer adhesive (e.g. ureaformaldehyde); it shall have a density of (680 ± 50) kg/m^3 and shall not be treated with fire retardants.

c) If roofing materials are intended to be laid only on continuous, non combustible deck with a minimum thickness of 10 mm, then the deck shall consists of a (11 ± 2) mm thick reinforced calcium silicate board, density (870 ± 50) kg/m^3 (EN 13238:2010, 5.3, Table 1).

d) The trapezoidal profiled steel deck shall have the width of the crown approximately equal to 50 % of the pitch and a trough depth of approximately 100 mm. The corrugations shall run parallel to the eaves and be open at the ends.

4.4.2.3 Roof coverings intended to be installed without a continuous deck

The spacing of roof supports of any type shall be in accordance with the maximum permissible spans proposed by the manufacturer for the particular application but not exceeding the minimum dimensions prescribed for the specimen in 4.4.1.

4.4.3 Positioning of joints

4.4.3.1 Specimen types

The five types are illustrated in Figure 3.

Type 1: Single central joint in the top layer parallel to the roof pitch. No joints are required in any other layer (including insulation).

Type 2: Single joint in the top layer at 90° to the roof pitch 100 mm above the lower edge of the basket. No joints are required in any other weathering layer. A single central joint in the insulation parallel to the roof pitch shall be provided, where applicable (see Table 1). The joint shall extend from 100 mm below the lower edge of the basket to 800 mm above the upper edge of the basket.

Type 3: No joint is required in any of the weathering layers. A single central joint in the insulation parallel to the roof pitch shall be provided, where applicable.

Type 4: A single central joint in the weathering layer parallel to the roof pitch next to the insulation. No joints are required in any other layer (including insulation).

Type 5: A single central joint in the weathering layer parallel to the roof pitch next to the top layer. No joints are required in any other layer (including insulation).

Where there are overlapping layers, the position of the joints shall be considered to be the edge of the upper layer.

4.4.3.2 Types to be tested

According to the different compositions of roofs, test specimens described in Table 1 shall be tested.

Table 1 — Test specimens

	Specimen type			
Roof covering	**1st spec.**	**2nd spec.**	**3rd spec.**	**4th spec.**
three or more layers	1	2	4	5
two layers	1	2	3	4
one layer	1	2	3	3

Where the dimensions of the elements of any of the layers are such that it requires more than four pieces to cover the specimen, or if any of the layers are jointless, then the specimens shall be fabricated in such a way

that those layers are representative. In the first instance, at least one joint in the layer(s) concerned shall be located underneath the basket.

4.4.4 Edge detailing

No special measures shall be taken by the sponsor to protect the edge of the specimen.

4.5 Conditioning

4.5.1 Wood wool

Before being stored, any compressed wood wool shall be loosened by pulling apart, but not to the extent that the fibres are separated. Large pieces of unshredded wood shall be removed.

The wood wool shall not be selected for tests until the stabilized moisture content of a representative sample lies within the range of 8 % to 12 % of the dry mass. This shall be determined by drying a 10 g to 20 g sample in an oven at (105 ± 5) °C to constant mass. Wood wool used for this moisture content determination shall not be used for the test.

A suitable amount of wood wool selected for the test shall be stored for at least 12 h in a room at a temperature of (23 ± 2) °C and a relative humidity of (50 ± 5) %.

The wood wool shall not be exposed to a different atmosphere for a period of more than 1 h before the test is carried out.

4.5.2 Test specimen

At the time of test, the test specimen shall be in equilibrium with the laboratory environment.

If the materials involved are likely to absorb or contain a significant amount of moisture (liable to influence the test results), then extra care shall be exercised to ensure that the specimen is at this stable equilibrium. The moisture content of these materials shall be measured and recorded at the time of test. Special samples may be used for moisture content determination and may be conditioned with the test specimens. These special samples shall be fabricated so as to represent the loss of water vapour from the specimen by having similar thicknesses and exposed faces.

NOTE Normally the test specimen should be stored in the laboratory environment for at least 12 h before the start of the test.

4.6 Test environment

Testing shall be carried out in a draught-free area, in an enclosure of not less than 150 m^3 in volume. The lower edge of the top surface of the specimen shall be (0,75 ± 0,25) m above the laboratory floor. The temperature in the enclosure shall be (20 ± 10) °C prior to the fire test.

NOTE An exhaust hood can be fitted above the specimen provided it does not create a draught over the specimen.

4.7 Test procedure

4.7.1 Filling the basket

Wood wool specified in 4.1.2 and conditioned in accordance with 4.5.1 shall be uniformly pressed into the wire frame basket, in at least six layers, until the mass of wood wool in the basket is (600 ± 10) g. The packed volume of the wood wool shall correspond to the internal dimensions of the basket, excluding the feet.