



SLOVENSKI STANDARD

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Preskusne metode za strehe, izpostavljene 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 a un feu extérieur

Ta slovenski standard je istoveten z: **CR 1187:2001**

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English version

Test methods for external fire exposure to roofs

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

Prüfverfahren zur Beanspruchung von Bedachungen durch
Feuer von außen

This CEN Report was approved by CEN on 19 April 2001. It has been drawn up by the Technical Committee CEN/TC 127.

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Foreword

This CEN Report 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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Introduction

The first mandate given to CEN/TC127 on fire resistance testing 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 these characteristics.

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 may 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.

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1 Scope

This CEN Report specifies three methods for determining the performance of roofs to external fire exposure. The three methods assess the performance of roofs under the following conditions:

test 1 - with burning brands

test 2 - with burning brands and wind

test 3 - with 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, the fire penetration (tests 1 and 3) and the production of flaming droplets or debris falling from the underside of the roof or from the exposed surface (tests 1 and 3).

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

NOTE The three 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

This CEN Report 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 below. For dated references, subsequent amendments to or revisions of any of these publications apply to this CEN Report only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN ISO 13943:2000 Fire safety – Vocabulary (ISO 13943:2000).

3 Terms and definitions

For the purposes of this CEN Report, the terms and definitions given in EN ISO 13943:2000, together with the following apply:

3.1

roof

covering and sealing systems 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 a uniformly dispersed mixture of substances (e.g. metal, stone, wood, bitumen, concrete, mineral wool)

3.3

damaged material

material that has been burnt, melted or otherwise visually changed by heat. Discolouration and soot deposits are not to be regarded as damaged material

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 (e.g. coated or laminated products such as roofing felts)

3.6**assembly**

fabrication of materials and / or composites (e.g. sandwich panels)

3.7**product**

material, composite or assembled about which information is required

3.8**specimen**

representative section of the roof prepared for the purpose of the test

3.9**continuous deck**

element with a continuous supporting function in which the nominal gap between adjacent elements is not greater than 0,5 mm (5,0 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 any sustained flaming or glowing due to combustion including the occurrence of any flaming droplets falling from the underside. Charring and/or discolouration are not to be regarded as fire penetration

3.16**opening**

appearance during the test of any hole greater than 25 mm² in area or any crack greater than 2 mm wide, which penetrates completely through the specimen and which would allow burning materials 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**

maximum burnt length measured from the upper edge of the projection of the ignition source in the upward direction of each layer for sloped roofs, and in any direction for horizontal roofs (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**

any kind of connection or link within a layer in the roof such as overlap, seams etc.

3.21**roof covering**

uppermost layer of a roof. This layer can comprise single layer or multiple layer coverings

3.22**damaged length**

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

3.23**substrate**

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

3.24**pitch**

inclination of the roof to the horizontal

4 Test 1: Method with burning brands**4.1 Test equipment****4.1.1 Basket**

A basket as shown in figure 1 shall be used. The basket shall be made from 3 mm diameter mild steel wire forming a mesh of approximately 50 mm x 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 x 300 mm x 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 x 0,2 mm to 0,3 mm thick and be manufactured from softwood e.g. spruce, pine or fir.

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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 1 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 board as described in 4.4.2.2 c), measuring 1 m x 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 4.7.2 shall be placed at the centre of the board and ignited as described in 4.7.5. 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 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 (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 pitches, verification of the resistance of a roof to burning brands may also be carried out by testing at the actual intended pitch. The test results so obtained shall then be valid only for the pitch tested.

4.4 Test specimen

4.4.1 General

Four specimens with minimum dimensions 0,8 m in width x 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 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.

Where appropriate (see table 1), at least one specimen shall incorporate a vertical joint in the top layer and another specimen shall incorporate a horizontal joint in the top layer. The other two specimens may be without any joint in the top layer.

In the case of a roof with jointed thermal insulation, a vertical joint in the insulation shall be included in each of the specimens. This joint shall be located on the longitudinal axis of the test specimen. Additional guidance on joints is given in 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 gaps not exceeding 0,5 mm, the wood particle board deck shall be constructed from planks 250 mm wide x 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 $(5,0 \pm 0,5)$ 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/m³ and shall not be treated with fire retardants.

c) If roofing materials are intended to be laid only on continuous, non-combustible decks with a minimum thickness of 10 mm, then the deck shall consist of 10 mm thick reinforced calcium silicate board, dry density (680 ± 50) kg/m³.

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. 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 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

Composition of the roof	Specimen Type			
	1 st spec	2 nd spec	3 rd spec	4 th spec
3 or more weathering layers	1	2	4	5
2 weathering layers	1	2	3	4
1 weathering 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

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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 weight. This shall be determined by drying a 10 g to 20 g sample in an oven at $(105 \pm 5) ^\circ\text{C}$. 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 $(23 \pm 2) ^\circ\text{C}$ and a relative humidity of $(50 \pm 5) \%$.

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.

4.6 Test environment

Testing shall be carried out in a draught-free area, in an enclosure of not less than 150 m³ 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 may be fitted above the specimen provided it does not create a draught over the specimen.

4.7 Test procedure

4.7.1 Protection of the edges

It may be necessary for the laboratory to take measures to prevent failure due to flames passing around the edges of the specimen. These measures shall not affect the fire behaviour within the measuring zone (see also figure 4) and shall be fully described in the test report. If it is necessary to protect the lower edge, this shall be done in such a way so as not to interfere with or obstruct material flowing or falling from the roof surface.

4.7.2 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.

4.7.3 Positioning of the brand

4.7.3.1 The basket filled with wood wool (the brand), shall be suspended with its base (excluding the feet) parallel to the nominal slope of the specimen 10 mm from the surface of the specimen so that this position is maintained throughout the test. On a curved surface the centre of the base of the basket shall be 10 mm above the surface.

In cases where the weight of the basket will not affect the deformation of the roof or roof covering during the test, the basket may be placed directly on the roof surface. Any device used to retain the basket shall not interfere with the burning behaviour of the wood wool.

The brand shall be placed in accordance with figure 4.

4.7.3.2 Roof lights shall be tested with the basket placed in turn at:

- a) the upper edge of the roof light, where the slope is smallest (see position **a**, figure 5);
- b) the centre of the roof light (see position **b**, figure 5);
- c) the lower edge of the roof light, where the slope is greatest (see position **c**, figure 5);
- d) on the waterproofing attached to the lower side of the roof light and as close as possible to the upstand of the roof light (see position **d**, figure 5).

If the roof light consists of several segments joined together, the basket shall be positioned over the joint closest to the centre in test b.

A new specimen shall be used for each test if interference could exist between successive tests.