SLOVENSKI STANDARD
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Preskusi odziva gradbenih proizvodov na ogenj - Gradbeni proizvodi razen talnih oblog, izpostavljeni toplotnemu delovanju enega samega gorečega predmeta

Reaction to fire tests for building products - Building products excluding floorings exposed to the thermal attack by a single burning item

Prüfungen zum Brandverhalten von Bauprodukten - Thermische Beanspruchung durch einen einzelnen brennenden Gegenstand für Bauprodukte mit Ausnahme von Bodenbelägen

Essais de réaction au feu des produits de construction - Produits de construction à l'exclusion des revêtements de sol exposés à une sollicitation thermique provoquée par un objet isolé en feu

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ICS:

13.220.50	Požarna odpornost gradbenih materialov in elementov	Fire-resistance of building materials and elements

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Reaction to fire tests for building products - Building products excluding floorings exposed to the thermal attack by a single burning item

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Contents

Page

Foreword

This document (EN 13823:2010) has been prepared by Technical Committee CEN/TC 127 “Fire safety in buidlings”, 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of an identical text or by endorsement, at the latest by January 2011, and conflicting national standards shall be withdrawn at the latest by January 2011.

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Introduction

The classification of the reaction to fire performance of construction products established by EC Decision 2000/147/EC (OJEU L50 of 23.2.2000) defines in Table 1 the reaction to fire classes for building products excluding floorings. The relevant test methods for determining the reaction to fire are being prepared by CEN/TC 127.

Safety warning

The attention of all persons concerned with managing and carrying out the tests described in this standard is drawn to the fact that fire testing can be hazardous and that toxic and/or harmful smoke and gases can be produced during the test.

An assessment of all potential hazards and risks to health should be made and safety precautions should be identified and provided. Smoke and gases should be removed from the workplace. 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.

Special precautions are required for the propane gas supply system.

— The equipment, for example tubes, couplings, flow meters, should be approved for propane.

— The burner should be equipped with a remote-controlled ignition device, for example a pilot flame or a glow wire. There should be a warning system for leaking gas and a valve for immediate and automatic cut-off of the gas supply in case of extinction of the ignition flame. The pilot flames can be ignited directly by an operator in the test room, however, no one should be present in the test room during ignition of a burner.

— It should be possible to operate the switch between auxiliary and main (primary) burner and the preceding main valve (to open or stop the propane supply) from outside the test room.

Special precautions are required for the extinction of burning specimens.

When the extinction is carried out because of intensive combustion of the specimens, it is recommended that a second operator is ready to intervene. Means for extinguishing should be available (e.g. since the heat output during intensive combustion can damage the apparatus).

1 Scope

This European Standard specifies a method of test for determining the reaction to fire performance of construction products excluding floorings, and excluding products which are indicated in Table 1 of EC Decision 2000/147/EC, when exposed to thermal attack by a single burning item (SBI). The calculation procedures are given in Annex A. Information on the precision of the test method is given in Annex B. The calibration procedures are given in Annexes C and D, of which C is a normative annex.

NOTE This European Standard has been developed to determine the reaction to fire performance of essentially flat products. The treatment of some families of products, e.g. linear products (pipes, ducts, cables etc.), can need special rules.

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, *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 60584-1:1995, *Thermocouples — Part 1: Reference tables (IEC 60584-1:1995)*

EN ISO 13943:2000, *Fire safety — Vocabulary (ISO 13943:2000)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN ISO 13943:2000 and EN 13501-1:2007+A1:2009 and the following apply.

3.1
backing board
calcium silicate panel used to back the specimen that can be placed directly against a free-standing test specimen or at a distance from it

3.2
specimen
piece of a product, which is to be tested

NOTE This can include the mounting technique used in its end-use application. This also can include an air gap and/or a substrate where appropriate.

3.3
substrate
product which is used immediately beneath the product about which information is required

3.4
***THR*$_{600s}$**
total heat release from the specimen in the first 600 s of exposure to the main (primary) burner flames

3.5
LFS
lateral flame spread on the long specimen wing

NOTE The *LFS* is defined in more detail in 8.3.3.

3.6
TSP_{600s}
total smoke production from the specimen in the first 600 s of exposure to the main (primary) burner flames

3.7
$FIGRA_{0,2\ MJ}$
maximum of the quotient of heat release rate from the specimen and the time of its occurrence using a *THR*-threshold of 0,2 MJ

NOTE The *$FIGRA_{0,2\ MJ}$* is described in more detail in A.5.3.

3.8
$FIGRA_{0,4\ MJ}$
maximum of the quotient of heat release rate from the specimen and the time of its occurrence using a *THR* threshold of 0,4 MJ

NOTE The *$FIGRA_{0,4\ MJ}$* is described in more detail in A.5.3.

3.9
SMOGRA
smoke growth rate
maximum of the quotient of smoke production rate from the specimen and the time of its occurrence

NOTE The *SMOGRA* is described in more detail in A.6.3.

3.10
sustained flaming
persistence of flame on or over a surface for a minimum period of time

[EN ISO 13943:2000]

4 Test facility

4.1 General

The SBI test facility shall consist of a test room, the test apparatus (trolley, frame, burners, hood, collector and ducting), the smoke exhaust system and general measuring equipment. These components are specified in 4.2 to 4.7. Design drawings are given in Annex E. Dimensions given in the drawings are nominal unless tolerances are given in the text.

NOTE The air supply to the test room entering below the trolley should be fresh, uncontaminated air.

4.2 Test room

4.2.1 The test room shall have an inner height of (2,4 ± 0,05) m and an inner floor area of (3,0 ± 0,05) m in both directions. The walls shall be made of stone type building blocks (e.g. cellular concrete), gypsum boards, calcium silicate boards or other boards classified as class A1 or A2.

4.2.2 One wall of the test room shall have an opening to insert the trolley from the surrounding laboratory into the test room. The opening shall be at least 1 470 mm wide and 2 450 mm high (dimensions of the frame). Windows shall be placed in the two walls facing the front side of the two

perpendicular specimen planes. To be able to handle the SBI apparatus and the specimen when the trolley is in place, an additional door is needed.

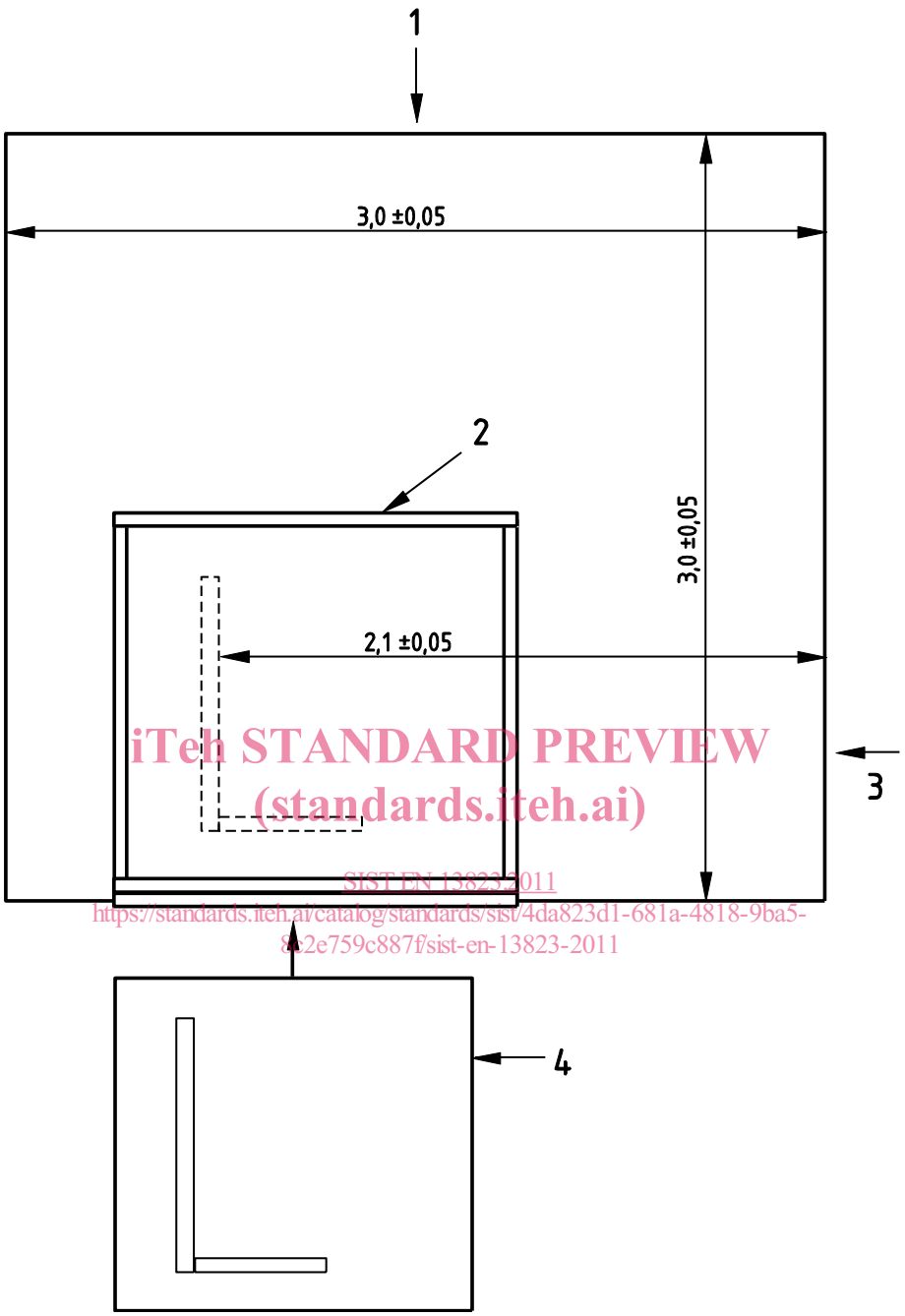
4.2.3 With the trolley in place in the test room, the distance between the long wing specimen surface touching the U-profile and the wall of the test room shall be (2,1 ± 0,05) m. This distance shall be measured perpendicularly to the wall facing the long wing. The areas of the openings in the test room, excluding the air inlet at the bottom of the trolley and the smoke exhaust opening in the hood, shall not exceed a total of 0,05 m^2.

4.2.4 Both left-orientated arrangements, as shown in Figure 1, and right-orientated arrangements (the trolley shown in Figure 1 mirrored around a vertical line) are allowed.

NOTE 1 To be able to remove side plates of the hood without removing the collector, attention should be paid to the connection between the frame of the SBI apparatus and the ceiling of the room. It should be possible to move the side plate outwards at the bottom.

NOTE 2 The relative position of the frame in the test room depends on the details of the connection between room and frame.

Dimensions in metres



Key

1 visual observation
2 fixed frame
3 visual observation (left orientated specimen)
4 trolley (with left orientated specimen)

NOTE Both left orientated and right oriented specimens are acceptable. For right orientated specimens the figure is mirrored around a vertical line.

Figure 1 — Top view of the SBI test room design (schematic drawing)

4.3 Materials

4.3.1 Commercial propane, of minimum purity 95 %.

4.4 Test apparatus

NOTE See Figures E.1 to E.35.

4.4.1 Trolley, on which two perpendicular specimen parts are placed, with a sandbox burner at the bottom of the vertical corner.

The trolley is put in place with its back side closing the opening in the wall of the test room; the air inlet under the floor of the trolley is provided with perforated plates (open area to total area 40 % to 60 %; perforation diameter 8 mm to 12 mm) to produce an evenly distributed flow along the floor of the test room.

The base of the trolley shall be positioned horizontally, within ± 5 mm, during the test. This shall be measured directly behind the U-profile and in-between the C-shaped profiles, prior to a new test series or when a new trolley is used. If the base of the trolley is not horizontal the trolley shall be adjusted.

4.4.2 Fixed frame, in which the trolley is pushed and which supports the hood; a second burner is fixed to the frame.

4.4.3 Hood, on top of the frame, which collects the combustion gases.

4.4.4 Collector, on top of the hood with baffles and a horizontal outlet for the exhaust duct.

4.4.5 Exhaust duct (J-shaped), circular tube of inner diameter (315 ± 5) mm, and insulated with 50 mm high temperature resistant mineral wool, with the following parts (in flow direction):

— connection to the collector;

— ducting, of length 500 mm with four thermocouple mountings (for optional temperature measurements) at a distance of at least 400 mm from the collector;

— ducting, of length 1 000 mm;

— two 90° bends, (radius of curvature of axis 400 mm);

— ducting, of length 1 625 mm with guide vanes and an orifice; guide vane length 630 mm starting 50 mm after the bends; directly behind the guide vanes a (2,0 ± 0,5) mm thick circular orifice with inner opening diameter 265 mm and an outer diameter of 314 mm;

— ducting, of length 2 155 mm with mountings for pressure-probe, four thermocouples, gas-sampling probe and white light extinction system; this section is called the "general measurement section";

— ducting, of length 500 mm;

— connection to exhaust.

NOTE Attention should be paid to the fixing of the measuring duct. The total mass excluding probes, etc. is about 250 kg.

4.4.6 Two identical sandbox burners (see Figure E.9), one in the bottom plate of the trolley (the "main (primary) burner"), one fixed to a post of the frame (the "auxiliary (secondary) burner"), with the following specifications:

a) Shape: right angled triangle (top view) with two equal sides of 250 mm, height 80 mm, bottom closed except for a 12,5 mm pipe socket at the gravitational centre, top open. A right-angled triangular perforated plate shall be positioned in the burner at a height of 10 mm above the bottom. Metal gauze with a maximum mesh size of 2 mm shall be positioned at heights of 12 mm and 60 mm above the bottom. All dimensions shall be within ± 2 mm.

b) Material: box made of 1,5 mm stainless steel, filled from bottom to top with, successively, a 10 mm void, a layer of pebbles within a size distribution of 4 mm to 8 mm up to a height of 60 mm, and a top layer of sand within a size distribution of 2 mm to 4 mm up to a height of 80 mm. The metal gauze is used to stabilize the two layers and prevent the pebbles from entering the gas pipe socket. The pebbles and sand used shall be rounded (river) stones, not broken ones.

c) Position of main (primary) burner: mounted in the tray (see Figures E.9 and E.19) and connected to the U-profile at the bottom of the specimen position. The top edge of the main (primary) burner shall be (25 ± 2) mm above the top edge of the U-profile.

d) Position of auxiliary (secondary) burner: fixed to the post of the frame opposite to the specimen corner, with the top of the burner at a height of (1 450 ± 5) mm from the floor of the test room (1 000 mm vertical distance to the hood), its diagonal parallel and nearest to the hypotenuse of the main (primary) burner.

e) The main (primary) burner is connected to U-profiles at the long and the short wing specimen position (see Figure E.18, part 10). In both U-profiles a blanking plate (see Figure E.19) is placed with its top at the same height as the top of the U-profile and at 0,3 m from the corner line between the mounted specimen wings (at the border of the burner zone, see 8.3.4).

f) The main (primary) burner shall be protected with a tilted triangular grid when previous tests on the same type of product have led to an early termination to the test due to fallen material on the sand-bed in accordance with 8.5. The grid shall have a ratio of open area to total area of at least 90 %. One side of the grid shall be placed on the hypotenuse of the burner. The tilt angle is (45 ± 5)° with the horizontal, measured along the line from the hypotenuse midpoint to the specimen corner.

4.4.7 Shield of rectangular shape, width (370 ± 5) mm, height (550 ± 5) mm, made of calcium silicate board (specification the same as the backing boards), to protect the specimens from the heat flux of the flames of the auxiliary (secondary) burner.

It shall be fixed to the hypotenuse side of the auxiliary (secondary) burner, centred in the horizontal plane (shielding the total width of the diagonal plus (8 ± 3) mm at both sides) with the top edge (470 ± 5) mm above the top level of the auxiliary (secondary) burner.

4.4.8 Mass flow controller with a range of at least 0 g/s to 2,3 g/s and an accuracy of 1 % of the reading for the range 0,6 g/s to 2,3 g/s. (See also C.1.5.)

NOTE The propane flow of 2,3 g/s corresponds to a heat release of 107 kW using the effective lower heat of combustion of propane (46 360 kJ/kg).

4.4.9 Switch, used to supply propane to either of the burners.

The switch shall prevent propane being supplied to both burners at the same time, except during burner switching time (the short period of time in which the auxiliary (secondary) burner is decreasing and the main (primary) burner is increasing in output). This burner switch response time, calculated in accordance with C.2.1, shall be not more than 12 s.

It shall be possible to operate the switch and the preceding main valve from outside the testing room.

4.4.10 Backing boards, used to back the specimen wings in the trolley.

The backing boards shall be calcium silicate boards with a density of (800 ± 150) kg/m^3 and a thickness of (12 ± 3) mm. The dimensions of the backing boards shall be:

a) for the short wing: (at least 570 + thickness of the specimen) mm × (1 500 ± 5) mm;

b) for the long wing: (1 000 + air gap ± 5) mm × (1 500 ± 5) mm.

On the short wing, the backing board is wider than the specimen. The additional width shall extend at one side only. For specimens mounted with an air gap, the width of the backing board for the long wing should be increased by an amount equal to the size of the air gap.

4.4.11 Removable panel parts, to allow for additional airflow behind both specimen wings panels 22 and 25 in Figure E.20 shall be replaced by half panels, covering only the upper half of the space covered by panels 22 and 25.

The panel shall only be removed under the conditions given in 5.2.2, a).

4.5 Smoke exhaust system

4.5.1 Under test conditions, the smoke exhaust shall be capable of continuously extracting a volume flow, normalized to 298 K, of 0,50 m^3/s to 0,65 m^3/s.

4.5.2 The exhaust duct shall have two side ducts (circular tubes of inner diameter 45 mm) horizontally perpendicular to and at the height of the longitudinal axis of the exhaust duct (see Figures E.32 and E.33).

4.5.3 The two possible configurations of the extraction duct are given in Figure E.1. The trolley opening in the test room is at the topside in the configuration drawings. The orientation of the duct may deviate from Figure E.1 if proof is provided that this does not change the airflow over the specimen. Removal of the 180° bend in the extraction duct and replacement of the bi-directional pressure probe are acceptable, provided that it is proved that the uncertainty in flow measurement is equal or better.

NOTE 1 Due to changes in heat output, some exhaust systems (especially those provided with local fans) can need manual or automatic readjustment during tests, to meet the requirement given in 4.5.1.

NOTE 2 The duct should be cleaned at intervals to avoid excessive accumulation of soot.

4.6 General measurement section equipment

NOTE See Figures E.28 to E.35.

4.6.1 Three thermocouples, all of the K-type in accordance with EN 60584-1:1995, diameter 0,5 mm, sheathed and insulated.

The position of the tips shall be at a radius of (87 ± 5) mm from the axis and with 120° mutual angular distance.

4.6.2 Bi-directional probe, connected to a pressure transducer with a range of at least 0 Pa to 100 Pa, and an accuracy of ± 2 Pa.

The pressure transducer output shall have a 90 % response time of 1 s or better.

4.6.3 Gas sampling probe, connected to a gas conditioning unit and gas analysers for O_2 and CO_2.

a) The O_2 analyser shall be of the paramagnetic type and capable of measuring at least a range of 16 % to 21 % oxygen (V_{O2}/V_{air}). The response time of the analyser shall be not more than 12 s (as measured in accordance with C.2.2). The noise and drift of the analyser shall be not more than 100 ppm over a period of 30 min (both as measured in accordance with C.1.3). The output from the analyser to the data acquisition system shall have a resolution of maximum 100 ppm.

b) The CO_2 analyser shall be of the IR type and capable of measuring at least a range of 0 % to 10 % carbon dioxide. The linearity of the analyser shall be 1 % of full scale or better. The response time of the analyser shall be not more than 12 s (as measured in accordance with C.2.2). The output from the analyser to the data acquisition system shall have a resolution of maximum 100 ppm.

4.6.4 Light attenuation system, of the white light type, mounted with a flexible connection to the side ducts of the exhaust duct, and consisting of the following:

a) *Lamp,* of the incandescent filament type and operating at a colour temperature of (2 900 ± 100) K. The lamp shall be supplied with stabilized direct current, stable within ± 0,5 % (including temperature, short-term and long-term stability).

b) *Lens system*, to align the light to a parallel beam with a diameter of at least 20 mm. The photocell aperture shall be placed at the focus of the lens in front of it and it shall have a diameter, *d*, chosen with regard to the focal length of the lens, *f*, so that *d*/*f* is less than 0,04.

c) *Detector,* with a spectrally distributed responsivity agreeing with the CIE, V(γ)-function (the CIE photopic curves) to an accuracy of at least ± 5 %. The detector output shall, over an output range of at least two decades, be linear within 3 % of the measured transmission value or 1 % of the absolute transmission.

For the calibration of the light attenuation system, see C.1.6. The 90 % response time of the system shall be not more than 3 s.

To prevent smoke being trapped in the side ducts and the deposition of soot on the optics, air shall be introduced into the side ducts either by self-suction or pressurized airflow. If pressurised airflow is used, the flow rate shall be no more than 5 l/min.

4.7 Other general equipment

4.7.1 Thermocouple, of the K-type in accordance with EN 60584-1:1995, diameter (2 ± 1) mm, installed on the outer wall of the testing room within 0,20 m of the trolley opening and less than 0,20 m above the floor, for measuring the ambient temperature of the air flow into the test room.

4.7.2 Equipment for measuring the ambient pressure, having an accuracy of ± 200 Pa (2 mbar).

4.7.3 Equipment for measuring the relative ambient air humidity, having an accuracy of ± 5 % within the range 20 % to 80 %.

4.7.4 Data acquisition system (used to record the data automatically) having an accuracy equal to or better than 100 ppm (0,01 %) for O_2 and CO_2, 0,5 °C for the temperature measurements, 0,01 % of full scale instrument output for all other instruments and 0,1 s for time.

The data acquisition system shall record and store the following quantities every 3 s (information on a data file format is given in Annex F):

a) time, in seconds;

b) mass flow of propane gas through the burner, in milligrams per second;

c) pressure difference from the bi-directional probe, in pascals;