



SLOVENSKI STANDARD

SIST EN ISO 1716:2002

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Preskusi odziva gradbenih proizvodov na ogenj - Ugotavljanje specifične toplote zgorevanja (ISO 1716:2002)

Reaction to fire tests for building products - Determination of the heat of combustion (ISO 1716:2002)

Prüfungen zum Brandverhalten von Bauprodukten - Bestimmung der Verbrennungswärme (ISO 1716:2002)

Essais de réaction au feu des produits de construction - Détermination de la chaleur de combustion (ISO 1716:2002)

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Ta slovenski standard je istoveten z: EN ISO 1716:2002

ICS:

13.220.50	Požarna odpornost gradbenih materialov in elementov	Fire-resistance of building materials and elements
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EUROPEAN STANDARD
NORME EUROPÉENNE
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Reaction to fire tests for building products - Determination of the heat of combustion (ISO 1716:2002)

Essais de réaction au feu des produits de construction -
Détermination de la chaleur de combustion (ISO
1716:2002)

Prüfungen zum Brandverhalten von Bauprodukten -
Bestimmung der Verbrennungswärme (ISO 1716:2002)

This European Standard was approved by CEN on 6 January 2002.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Management Centre has the same status as the official versions.

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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EN ISO 1716:2002 (E)**Foreword**

This document has been prepared by Technical Committee CEN /TC 127 "*Fire safety in buildings*", the secretariat of which is held by BSI, in collaboration with Technical Committee ISO/TC 92 "*Fire safety*", SC 1 "*Fire initiation and growth*".

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of the Construction Products Directive.

This document shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by August 2002, and conflicting national standards shall be withdrawn by December 2003.

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

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Introduction

In this test a test specimen of specified mass is burned under standardized conditions, at constant volume, in an atmosphere of oxygen, in a bomb calorimeter calibrated by combustion of certified benzoic acid. The heat of combustion determined under these conditions is calculated on the basis of the observed temperature rise, taking account of heat loss and the latent heat of vaporisation of water.

It should be noted that this is a test method for determining an absolute value of the heat of combustion for a product and does not take into account any inherent variability of the product.

Safety warning

So that suitable precautions are taken to safeguard health, the attention of all persons concerned in fire tests is drawn to the possibility that toxic or harmful gases may be evolved in the combustion of test specimens. In this test procedure, suitable measures should be taken to prevent harm in the event of an explosion.

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EN ISO 1716:2002 (E)**1 Scope**

This European Standard specifies a method for the determination of the heat of combustion of building products at constant volume in a bomb calorimeter.

This European Standard describes a test method for the measurement of the gross heat of combustion (*PCS*). Annex A describes the calculation of the net heat of combustion (*PCI*) when required.

Information on the precision of the test method is given in Annex B.

2 Normative references

This European Standard incorporates by dated or undated reference provisions from other publications. These normative references are cited at 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 Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 13238, *Reaction to fire tests for building products — Conditioning procedures and general rules for selection of substrates*

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

3 Terms and definitions (standards.iteh.ai)

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

3.1**product**

material, element or component about which information is required

3.2**material**

single basic substance or uniformly dispersed mixture of substances e.g. metal, stone, timber, concrete, mineral wool with uniformly dispersed binder, polymers

3.3**homogeneous product**

product consisting of a single material having uniform density and composition throughout the product

3.4**non-homogeneous product**

product that does not satisfy the requirements of a homogeneous product and which is composed of more than one component, substantial and/or non-substantial

3.5**substantial component**

material that constitutes a significant part of a non-homogeneous product, a layer of which having a mass/unit area $\geq 1,0 \text{ kg/m}^2$ or a thickness $\geq 1,0 \text{ mm}$

3.6

non-substantial component

material that does not constitute a significant part of a non-homogeneous product. A layer with a mass/unit area $< 1,0 \text{ kg/m}^2$ and a thickness $< 1,0 \text{ mm}$ is considered to be a non-substantial component

Two or more non-substantial layers that are adjacent to each other (i.e. with no substantial component(s) in between the layers) are regarded as one non-substantial component when they collectively comply with the requirements for a layer being a non-substantial component.

3.7

internal non-substantial component

non-substantial component that is covered on both sides by at least one substantial component

3.8

external non-substantial component

non-substantial component that is not covered on one side by a substantial component

3.9

heat of combustion

thermal energy produced by combustion of unit mass of a given substance

NOTE It is expressed in joules per kilogram.

[EN ISO 13943:2000]

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3.10

gross heat of combustion, PCS (MJ/kg)

heat of combustion of a substance when the combustion is complete and any produced water is entirely condensed under specified conditions

[EN ISO 13943:2000]

3.11

net heat of combustion, PCI (MJ/kg)

heat of combustion of a substance when the combustion is complete and any produced water is in the vapour state under specified conditions

NOTE The net heat of combustion may be calculated from the gross heat of combustion.

[EN ISO 13943:2000]

3.12

latent heat of vaporisation of water (MJ/kg)

heat which is required to change water from a liquid to a gas

4 Test apparatus

4.1 General

The test apparatus is illustrated in Figure 1, and is detailed in 4.2 to 4.12. All dimensions given in the following description are nominal values, unless tolerances are specified.

EN ISO 1716:2002 (E)**4.2 Calorimetric bomb**

The calorimetric bomb shall be constructed as follows:

- a) volume: (300 ± 50) ml;
- b) mass not greater than 3,25 kg;
- c) casing thickness at least 1/10 of the inner diameter of the body.

The lid is intended to receive the crucible and the electric firing device. The lid, including any seals, shall be capable of withstanding an internal pressure of 21 MPa.

NOTE These conditions define a bomb in which 1 g of coal under an initial oxygen pressure no greater than 3 MPa (pressure gauge method) is able to withstand, with a sufficient coefficient of safety, the maximum amount of pressure created under combustion, without a need for a calorimetric bomb of overlarge mass.

The inner surface of the bomb shall be resistant to attack by products of combustion and, even when "fuels" rich in sulphur are used, it shall resist pitting and inter-crystalline corrosion by acids produced during combustion.

4.3 Calorimeter**4.3.1 Jacket**

The jacket shall be a double walled container, which is thermally insulated together with an insulated lid. The jacket is filled with water. The dimensions of the jacket shall be such that there is at least 10 mm space around the calorimetric vessel. The calorimetric vessel shall be supported on an area as small as possible of non-conducting material preferably a 3 point support.

For an adiabatic calorimeter system, a heater and thermometer system shall be incorporated into the vessel so that the water temperature in the jacket is maintained at the same temperature as the water in the calorimetric vessel.

For an isothermal calorimeter system, the temperature of the water in the jacket shall be kept constant. For an isothermal calorimeter, the necessary corrections shall be made (see 8.2).

4.3.2 Calorimetric vessel

This shall be a polished metal container designed to accommodate the bomb. The dimensions shall be such that the bomb can be immersed in water (see 7.3 d)).

4.3.3 Stirrer

A stirrer driven by a constant speed motor shall be provided. To prevent the transfer of heat to and from the calorimeter, the driving shaft of the stirrer shall have a thermally insulated section in a gasket between the jacket lid and the jacket. A magnetic stirring device with a similar performance is an acceptable alternative.

4.4 Temperature measuring device

The temperature measuring device shall be capable of giving a resolution of 0,005 K.

When using a mercury thermometer, this shall have at least 0,01 K graduations with a device e.g. a lens, for taking readings to within 0,005 K. A mechanical vibrator shall also be used to tap gently the thermometer to ensure the mercury column does not stick.

4.5 The crucible

The crucible may be made of metal, such as platinum, nickel, stainless steel, or silica, with a flat base, 25 mm in diameter (maximum dimension if it is truncated) and 14 mm to 19 mm high. The following wall thickness is recommended:

Metal: 1,0 mm

Silica: 1,5 mm

NOTE Several shapes of crucible have proved satisfactory.

4.6 Timing device

The timing device shall be capable of recording elapsed time to the nearest second and shall be accurate to within 1 s in 1 h.

4.7 Electric power source

The voltage to the firing circuit shall not exceed 20 V for the firing. An ammeter shall be added to the circuit to indicate the breaking of the firing wire. A circuit breaker is a useful addition to the supply circuit.

4.8 Pressure gauge and needle-valve

These shall be attached to the oxygen supply circuit to show the pressure in the bomb while it is being filled; this pressure shall be indicated with a resolution of 0,1 MPa.

4.9 Balances

Two balances are required:

- an analytical balance with an accuracy of 0,1 mg.
- a balance with an accuracy of 0,1 g.

4.10 Device for making the “cigarette”

The device and the procedure for making the “cigarette” are shown in Figure 2. The device for producing the “cigarette” comprises a mould and a metallic mandrel (not aluminium).

4.11 Device for making the pellet

If prefabricated pellets are not available, a suitable device for making the pellet shall be used.

4.12 Reagents

4.12.1 Distilled or de-mineralised water.

4.12.2 Pressurized oxygen, free from any other combustible product (purity $\geq 99,5$ %).

NOTE Oxygen prepared by electrolysis may contain a small percentage of hydrogen, which makes it unsuitable for this use.

EN ISO 1716:2002 (E)

4.12.3 Powder or pellet of benzoic acid “reference standard for calorimetry” whose gross heat of combustion is guaranteed.

4.12.4 Combustion aid, with a known heat of combustion e.g. paraffin oil.

4.12.5 Cigarette making paper, which is pre-glued and of minimum dimensions 55 mm × 50 mm with a known heat of combustion.

NOTE A commercially available cigarette making paper of 55 mm x 100 mm has been found suitable when cut into two equal pieces.

4.12.6 Firing wire made of pure iron shall be 0,1 mm in diameter e.g. piano wire. Other types of metal wire (e.g. platinum, nickel or chromium) may be used, provided that they break under their own tension when the switch is closed on the firing circuit and the exact heat of combustion for the wire is known. When using a metal crucible (see 4.5), there shall be no contact between the firing wire and the crucible. It is therefore advisable to wrap the metal wire with a cotton thread.

4.12.7 A thread made of white cellulosic cotton (see 4.12.6).

5 Test specimen**5.1 General**

A product shall be evaluated through each of its components, taking into account the rules for non-substantial components. If a non-homogeneous product cannot be delaminated, its components shall be provided separately. A product can be delaminated when it is possible to separate one component from another without any part of the other component adhering to the component to be evaluated.

5.2 Sampling

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5.2.1 General

From a representative amount of a homogeneous product, or a component of a non-homogeneous product, compose a sample from at least five randomly selected parts taken from across the thickness. A minimum mass of 50 g shall be taken from a homogeneous product and a substantial component of a non-homogeneous product. A minimum mass of 10 g shall be taken for a non-substantial component of a non-homogeneous product.

5.2.2 Loose-fill material

A sample shall be taken at random from the product of a minimum mass of 50 g.

5.2.3 Liquid applied products

A sample of a minimum mass of 10 g of dried material shall be prepared.

5.3 Determination of surface density

Where required, the surface density of each component of a product shall be determined to an accuracy of $\pm 0,5\%$ from a minimum area of 250 mm × 250 mm.

For liquid applied products, the dried weight shall be determined.

5.4 Grinding

The samples as defined in 5.2 shall be reduced gradually to provide the final test sample. Grinding shall be carried out in such a way that no thermal decomposition takes place. Grind the sample and reduce it with a method of cross reduction, grinding to a finer powder as reduction proceeds.