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Reaction to fire tests for products — Determination of the gross heat of combustion (calorific value)

Essais de réaction au feu de produits — Détermination du pouvoir calorifique supérieur (valeur calorifique)

Reference number
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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 92, *Fire safety*, Subcommittee SC 1, *Fire initiation and growth*.

This fourth edition cancels and replaces the third edition (ISO 1716:2010), which has been technically revised.

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Reaction to fire tests for products — Determination of the gross heat of combustion (calorific value)

WARNING — The attention of all persons concerned with managing and carrying out this test is drawn to the fact that fire testing may be hazardous and that there is a possibility that toxic and/or harmful gases may be evolved during the test. Operational hazards may also arise during the testing of specimens, such as the possibility of an explosion, and during the disposal of test residues.

WARNING — An assessment of all the 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 instructions at all times.

1 Scope

This document specifies a method for the determination of the gross heat of combustion (Q_{PCS}) of products at constant volume in a bomb calorimeter.

This method is intended to be applied to solid products.

NOTE Liquids can be tested with similar equipment and using conditions described in ASTM D240[1], as described in IEC 61039[2] using ISO 1928[3] test equipment.

Annex A specifies the calculation of the net heat of combustion, Q_{PCI}, when required.

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

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

ISO 554, *Standard atmospheres for conditioning and/or testing — Specifications*

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

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
product
material, element or component about which information is required

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3.2
material
single basic substance or uniformly dispersed mixture of substances

EXAMPLE Stone, timber, concrete, mineral wool with a uniformly dispersed binder and polymers.

3.3
homogeneous product
product (3.1) consisting of a single *material* (3.2) having uniform density and composition throughout the *product* (3.1)

3.4
non-homogeneous product
product (3.1) that does not satisfy the requirements of a *homogeneous product* (3.3) and which is composed of more than one component, substantial or non-substantial

Note 1 to entry: If a non-homogeneous product cannot be easily separated into its component parts, the individual components shall be provided separately by the sponsor.

3.5
non-substantial component
material (3.2) that does not constitute a significant part of *a non-homogeneous product* (3.4) and that has a layer with a mass/unit area below 1,0 kg/m^2 and a thickness below 1,0 mm

Note 1 to entry: If the non-substantial layers do not comply with the above requirements, together they shall be considered to be substantial.

Note 2 to entry: 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.

3.6
substantial component
material (3.2) that constitutes a significant part of a *non-homogeneous product* (3.4) and that has a layer with a mass/unit area more than or equal to 1,0 kg/m^2 or a thickness more than or equal to 1,0 mm

Note 1 to entry: 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 substantial component when they collectively comply with the requirements for a layer being a substantial component.

3.7
internal non-substantial component
non-substantial component (3.5) that is covered on both sides by at least one *substantial component* (3.6)

3.8
external non-substantial component
non-substantial component (3.5) that is not covered on one side by a *substantial component* (3.6)

3.9
heat of combustion
DEPRECATED: calorific value
Q
thermal energy produced by combustion of unit mass of a given substance

Note 1 to entry: The heat of combustion is expressed in megajoules per kilogram.

[SOURCE: ISO 13943:2008, 4.174, modified — The Note 1 to entry was changed.]

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3.10
gross heat of combustion
Q_{PCS}
heat of combustion (3.9) of a substance when the combustion is complete and any produced water is entirely condensed under specified conditions

Note 1 to entry: The gross heat of combustion is expressed in megajoules per kilogram.

Note 2 to entry: The acronym PCS is derived from the French term “pouvoir calorifique supérieur”.

3.11
net heat of combustion
Q_{PCI}
heat of combustion (3.9) of a substance when the combustion is complete and any produced water is in the vapour state under specified conditions

Note 1 to entry: The net heat of combustion may be calculated from the gross heat of combustion.

Note 2 to entry: The net heat of combustion is expressed in megajoules per kilogram.

Note 3 to entry: The acronym PCI is derived from the French term “pouvoir calorifique inférieur”.

3.12
latent heat of vaporization of water
q
heat which is required to change water from a liquid to a gas

Note 1 to entry: The latent heat of vaporization is expressed in megajoules per kilogram.

3.13
surface density
mass per unit area

Note 1 to entry: The surface density is expressed in kilograms per square metre.

4 Principle

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 vaporization of water.

This is a test method for determining an absolute value of the heat of combustion for a product and it does not take into account any inherent variability of the product.

5 Test apparatus

The test apparatus (bomb calorimeter) shall be as illustrated in Figure 1, and as detailed in 5.1 to 5.4. Additional equipment shall be in accordance with 5.5 to 5.10.

Equipment described in 5.1 to 5.4 could also be available as automatic or semi-automatic apparatuses. Any deviation from these subclauses has to be evaluated by the user according to requirements of subsequent subclauses.

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