SLOVENSKI STANDARD
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Reaction to fire tests -- Ignitability of building products subjected to direct impingement of flame -- Part 2: Single flame source test

Essais de réaction au feu -- Allumabilité des produits du bâtiment soumis à l'incidence directe de la flamme -- Partie 2: Essai à l'aide d'une source à flamme unique

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INTERNATIONAL STANDARD

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Reaction to fire tests — Ignitability of building products subjected to direct impingement of flame —

Part 2:
Single flame source test

Essais de réaction au feu — Allumabilité des produits du bâtiment soumis à l'incendie directe de la flamme —

Partie 2: Essai à l'aide d'une source à flamme unique

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Annexes

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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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 11925-2 was prepared by Technical Committee ISO/TC 92, *Fire safety*, Subcommittee SC 1, *Reaction to fire*.

ISO 11925 consists of the following parts under the general title *Reaction to fire tests — Ignitability of building products subjected to direct impingement of flame*:

Part 2: Single flame source test
Part 3: Multi-source test

Part 1 is under preparation.

Annexes A to C of this part of ISO 11925 are for information only.

Introduction

Fire is a complex phenomenon; its behaviour and effects depend upon a number of interrelated factors. The behaviour of materials and products depends upon the characteristics of the fire, the method of use of the materials and the environment in which they are exposed. The philosophy of "reaction to fire tests" is explained in ISO/TR 3814.

A test such as is specified in this part of ISO 11925 deals only with a simple representation of a particular aspect of the potential fire situation typified by the impingement of a small flame on a vertical product. It cannot alone provide any direct guidance on behaviour in fire.

A test of this type may, however, be used for comparative purposes or to ensure the existence of a certain quality of performance (in this case ignitability) considered to have a bearing on fire performance generally. It would be wrong to attach any other meaning to performance in this test.

Further development of this method is currently being undertaken in other international fora and this work will be closely monitored by ISO/TC 92, in particular, research on the design of specimen holder and the suitability of the cotton wadding.

The term "ignitability" is defined in ISO/IEC Guide 52 as the measure of the ease with which a specimen can be ignited due to the influence of an external heat source under specific test conditions. It is one of the first fire properties to be manifest and should almost always be taken into account in any assessment of fire hazard. It may not, however, be the main characteristic of the material which affects the subsequent development of fire in a building.

This test does not rely on the use of asbestos-based materials.

Reaction to fire tests — Ignitability of building products subjected to direct impingement of flame —

Part 2:
Single flame source test

CAUTION — So that suitable precautions may be taken to safeguard health, the attention of all concerned in fire tests is drawn to the possibility that toxic or harmful gases may be evolved during exposure of test specimens. The advice on safety given in clause 5 should also be followed.

1 Scope

This part of ISO 11925 specifies a test method for determining the ignitability by direct small flame impingement under zero impressed irradiance of building products used in a vertical orientation to assess the lowest level of performance.

This test method assesses the ignitability of products but not in a real fire situation and as such does not assess hazard. The test should be used simply as a method relating to the "primary" ignitability of materials.

NOTE — Secondary ignition of materials in a growing fire situation can be addressed using ISO 5657 which assesses the ignitability of building products by thermal irradiance.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 11925. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 11925 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO/IEC Guide 52:1990, *Glossary of fire terms and definitions.*

ISO/TR 14697:—[1], *Reaction to fire tests — Guidance on the use of substrates.*

3 Definitions

For the purpose of this part of ISO 11925, the definitions given in ISO/IEC Guide 52 and the following definitions apply.

3.1 constant mass: The state of a test specimen when two successive weighing operations carried out at an interval of 24 hours, do not differ by more than 0,1% of the mass of the specimen or 0,1 g whichever is the greater.

1) To be published.

3.2 essentially flat product: A product having one of the following characteristics:

a) an essentially flat exposed surface;

b) a surface irregularity that is evenly distributed over the exposed surface provided that

(i) at least 50 % of the surface of a representative square area of 250 mm x 250 mm lies within a depth of 6 mm from a plane taken across the highest points on the exposed surface, or

(ii) for a surface containing cracks, fissures or holes which do not exceed 6,5 mm in width nor 10 mm in depth. The total area of such cracks, fissures or holes at the surface does not exceed 30 % of a representative square area of 250 mm x 250 mm of the exposed surface.

3.3 flame height: The distance from the upper edge of the burner to the yellow tip of the flame.

3.4 flaming debris: Matter flowing or separating from the specimen during the test procedure and falling below the initial lower edge of the specimen, continuing to flame as it falls, and igniting the cotton wadding.

3.5 product: Material, composite or assembly about which information is required.

3.6 ignition: After withdrawal of the ignition source, the presence of a flame on the surface of the specimen.

NOTE — For the purposes of this part of ISO 11925, the definition of ignition given in ISO/IEC Guide 52 is insufficient.

4 Principle

Specimens are exposed to a small flame and their ignition behaviour is observed.

5 Safety requirements

There are hazards encountered when assessing the ignitability of any product using flame sources and it is essential that adequate precautions are taken. Particular attention should be paid to the handling of flammable gases, the evolution of potentially toxic gases, and the fact that extensive flaming of specimens may occur.

Adequate means of extinguishing the specimen should be provided, bearing in mind that some specimens may produce severe flaming during the test. A hand and/or fixed water spray which can be directed over the burning area should be available with other means, such as fire extinguishers and fire blankets.

In some cases, smouldering may be difficult to extinguish completely and immersion in water may be necessary.

6 Test specimens

6.1 Preparation

The test specimen can be cut from the product to be tested. The template specified in 7.8 may be used to facilitate this.

6.2 Dimensions

The dimensions of the specimens submitted for test shall be (340 ± 0,1) mm long by (90 ± 1,0) mm wide.

Specimens of nominal thickness 60 mm or less shall be tested using their full thickness. Specimens of nominal thickness greater than 60 mm shall be reduced to a thickness of 60 mm by cutting away the unexposed surface. If it is necessary to reduce the specimen size in this manner, do not expose the cut surface to the flame.

When the product is not essentially flat, the specimens may be tested in the form as in end use (e.g. pipe insulation). In such a case a modified specimen holder is required and this shall be described in the test report (see annex A).

6.3 Number of specimens

6.3.1 Six specimens of the building product to be tested shall be submitted to test. Three specimens shall be cut lengthwise and three others crosswise. A further set of six specimens may be required to repeat the test (8.5.3).

6.3.2 For products more than 3 mm thick, a full preliminary set of additional specimens is required for carrying out tests to identify the least favourable point for flame impingement, if that point is exposed under end-use conditions, as specified in 8.2.2.2 and 8.2.2.3.

6.3.3 If a material under test is asymmetric through its thickness, and in practice either face may be exposed to a source of ignition, test a separate series of specimens on each face. Similarly, for materials which are chemically or physically not uniform in any other plane, test as many series of specimens as needed to represent the actual behaviour of the material when exposed to the ignition source.

6.3.4 Where a product has areas of its surface which are distinctly different, but each of these separate areas can satisfy the surface characteristics described in 3.2, then more than one test shall be conducted to fully evaluate the product.

6.3.5 If a material is installed with covered edges but may also be used with unprotected edges, tests should be performed on both covered and uncovered specimens.

6.4 Conditioning

Specimens of hygroscopic material shall be conditioned before test to constant mass at a temperature of (23 ± 2) °C and a relative humidity of (50 ± 5) % (see 3.1). These requirements correspond to the recommended atmosphere given in ISO 554.

Specimens of non-hygroscopic material shall be stored in this environment for at least 48 h prior to test.

6.5 Substrates

Where materials will be fixed to substrates in practice, analogous procedures shall be used to prepare test specimens as in end-use. (Guidance on substrates for fire tests and on their application to exposed surfaces is given in ISO/TR 14697.)

NOTE — Care is needed when preparing specimens for bottom edge exposure of materials applied to substrates since in practice the substrate may extend beyond the bottom of the material to be tested and not itself be subject to edge exposure. The configuration of the test specimen should reflect the practical aspects of such factors as type of substrate, fixing to substrate, etc.

6.6 Cotton wadding

This shall consist of new, undyed and soft cotton fibres, without any end mixtures of man-made fibres and shall be 100 mm by 50 mm by 20 mm thick and shall have a mass of (1,75 ± 0,2) g. It shall be dried in an oven at (105 ± 5) °C for at least 30 min and then stored in a desiccator to cool and until ready for use.

It shall be placed, not more than 3 min before the start of the test, into a small metal tray, 100 mm by 50 mm and 25 mm deep positioned centrally beneath the specimen holder.

7 Test apparatus

7.1 Test room, capable of providing a substantially draught-free environment at (25 ± 10) °C and a relative humidity of (50 ± 30) %.

NOTE — It has been found that a partially darkened room assists with the perception of small surface flames.

7.2 Combustion chamber, consisting of an enclosure (see figure 1) constructed from stainless steel sheets, with heat resistant, glazed doors provided for access and observation in at least the front and one lateral side. Ventilation of the enclosure shall be free; the air velocity measured in the chimney of the combustion chamber as shown in figure 1 shall be (0,7 ± 0,1) m/s.

For operators' safety the combustion chamber should be situated under a suitably ventilated hood.

For operators' safety the gap between the feet on the front side of the combustion chamber shall be closed.

7.3 Ignition source, comprising a burner constructed as shown in figure 2 and designed so that it can be used vertically or be tilted at 45° with respect to the vertical axis. The burner shall be mounted so that it moves smoothly to and fro in a horizontal plane along the centreline of the combustion chamber.

The burner shall be fitted with a fine adjustment valve to ensure accurate control of the flame height.

7.4 Fuel, comprising a supply of commercial propane, 95% minimum purity. In order to obtain flame stability with the burner tilted at 45°, the gas pressure shall be between 10 kPa and 50 kPa.

7.5 Specimen holder, consisting of a double U-shaped frame, 15 mm wide and (5 ± 1) mm thick, with other dimensions as shown in figure 3 constructed in stainless steel. The frame hangs vertically from the support (see 7.6 and figure 4) in such a way that the underside of the specimen is exposed directly to flame along its centreline and edges (see figures 7 to 10).

The two halves of the specimen holder are held together by screws or clamps to prevent the specimen warping.

The technique of clamping used shall be capable of restraining the specimen for the duration of the test.

7.6 Support, comprising a vertical stand to which the specimen holder is attached in such a way that it hangs vertically and exposes its open edge containing the specimen to the burner flame.

The distance between the underside of the specimen and the horizontal plate above the metal grid shall be (125 ± 10) mm for edge flame impingement and (85 ± 10) mm for surface flame impingement respectively.

The support is mounted on a horizontal plate (210 mm wide and 455 mm long) in such a way that it can be turned at 90° round its vertical axis. The burner slides onto the same plate, along the main axis of the combustion chamber (see figures 1 and 4).

7.7 Timing device, such as a stopwatch with 0,2 s, or shorter divisions, or an equivalent timing device.

7.8 Template, comprising a metal plate (340 ± 0,1) mm long and (90 ± 1,0) mm wide.

7.9 Flame checking devices

7.9.1 Flame height measuring device, which when located against a fixed point of the burner indicates a flame height of 20 mm (see figure 5).

7.9.2 Burner spacer for edge flame impingement, comprising a removable spacer 16 mm long which can be mounted at the burner orifice to check the distance from the pre-set flame contact point on the specimen (see figure 6a).

7.9.3 Burner spacer for surface flame impingement, comprising a removable cone-shaped spacer which can be mounted at the burner orifice to check the fixed distance of 5 mm between the burner edge and specimen's surface (see figure 6b).

7.10 Anemometer, for measuring the air flow velocity in the upper outlet of the combustion chamber (see 7.2 and figure 1).

8 Test procedure

8.1 Preliminary operations

8.1.1 Check the required air flow velocity in the upper outlet of the combustion chamber.

8.1.2 Remove the specimen from its conditioning environment and test it within 3 min. If necessary the specimen may be transferred in a sealed container.

8.1.3 Clamp the specimen in the specimen holder so that one end and both sides are covered by the holder frames and the exposed end is 30 mm from the end of the frame (see figure 3).

NOTE — The operator may find it useful to mark the specimen holder so that the bottom edge of the specimen is always placed at this distance.

8.1.4 Check the distances of the burner from the specimen by means of the relevant spacer specified in 7.9.2 or 7.9.3 with the burner tilted at 45° (see figures 4 and 7 to 10, as appropriate).

8.1.5 Position the cotton wadding in the metal tray beneath the specimen, on the floor of the combustion chamber.

8.2 Testing operations

8.2.1 Light the burner in the vertical position and allow it to stabilize. Adjust the burner valve to give a flame height of 20 mm using the device specified in 7.9.1. This operation is carried out away from the preset operating position to prevent accidental impingement of the flame on the specimen.

NOTE — It has been found useful to measure the flame height against a black background.

8.2.2 Tilt the burner at 45° with respect to its vertical axis and advance it horizontally until the flame reaches the pre-set contact point with the specimen.

Start the timing device at the moment of the first flame contact with the specimen. Apply the flame for 15 s and then retract the burner in a smooth continuous manner.

8.2.2.1 For essentially flat products less than or equal to 7 mm thick which may have an exposed edge in practice, the flame shall be applied to the mid-point of the underside of the specimen (see figure 7).

8.2.2.2 For essentially flat single layer products greater than 7 mm thick, which may have an exposed edge in practice, the flame shall be applied to the least favourable point "X", previously identified by means of a set of tentative tests with the flame impinging on different points along the centreline of the underside of the specimen beginning 1,5 mm behind the front surface (see figure 8).

8.2.2.3 For essentially flat multi-layer products greater than 7 mm thick, which may have an exposed edge in practice, whether this be covered or not, two sets of tests shall be carried out:

a) a first set of tests as specified in 8.2.2.2 (see figure 9);

b) a second set of tentative tests with the specimen turned at 90° round its vertical axis and the flame impinging on different points along the front edge of its underside in such a way that it will be able to reach all inner layers (see figure 10).

The least favourable point shall be previously identified by means of tentative tests for a) (see figure 9) and b) (see figure 10).

8.2.2.4 For essentially flat products (see 3.2) which only have one exposed surface in practice, the flame shall be applied on the centreline of the specimen, 40 mm above the bottom edge (see figure 6b). For this, the specimen holder with the installed specimen has to be lowered by 40 mm.

8.2.2.5 For products which are not essentially flat and which are to be tested in their end-use form, the flame shall be applied to the least favourable point previously identified (see annex A).