
**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 de 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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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this part of ISO 11925 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 11925-2 was prepared by the European Committee for Standardization (CEN) in collaboration with Technical Committee ISO/TC 92, *Fire safety*, Subcommittee SC 1, *Fire initiation and growth*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

Throughout the text of this standard, read "...this European Standard..." to mean "...this International Standard...".

This second edition cancels and replaces the first edition (ISO 11925-2:1997), which has been technically revised.

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 1: Guidance on ignitability*
- *Part 2: Single-flame source test*
- *Part 3: Multi-source test*

Annex A forms a normative part of this part of ISO 11925. Annex B is for information only.

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Foreword

The text of EN ISO 11925-2:2002 has been prepared by 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".

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 August 2002, and conflicting national standards shall be withdrawn at the latest by December 2003.

Annex A is normative. Annex B is informative.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: 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

Safety 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 smoke and gases may be evolved during the test. Operational hazards may also arise during the testing of specimens and the disposal of test residues.

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 relevant personnel. Laboratory personnel should ensure that they follow written safety instructions at all times.

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

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

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1 Scope

This European Standard specifies a method of test for determining the ignitability of building products by direct small flame impingement under zero impressed irradiance using specimens tested in a vertical orientation.

The products that melt and shrink away from the flame without being ignited may be addressed by the additional procedure given in annex A.

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 the 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, *Fire safety — Vocabulary (ISO 13943:1999)*.

3 Terms and definitions

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

3.1

product

material, element or component about which information is required

3.2

essentially flat product

a product having one of the following characteristics:

- a) a planar exposed surface;
- b) a planar exposed surface, with 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 × 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 × 250 mm of the exposed surface.

3.3

flaming debris

material separating from the specimen during the fire test procedure and continuing to flame. For the purposes of this standard, ignition of the filter paper beneath the specimen indicates flaming debris

3.4

sustained flaming

the persistence of flame for a period greater than 3 s

3.5

ignition

the presence of sustained flaming

4 Test apparatus

4.1 Test room

A room capable of providing an environment at (23 ± 5) °C and a relative humidity of (50 ± 20) %.

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

4.2 Combustion chamber

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 through the square box section base in the bottom of the chamber. This shall be made of stainless steel of 1,5 mm thickness, 50 mm in height, with the open square area being 25 mm × 25 mm (see Figure 1). To make free ventilation possible, the chamber shall stand on 40 mm high supports which provide a gap on the lateral sides of the combustion chamber. The gap between the supports at the front of the chamber shall be closed. The air velocity measured in the chimney of the combustion chamber, as shown in Figure 1, shall be $(0,7 \pm 0,1)$ m/s, measured with the pilot burner only ignited and with the ventilation hood 'on'.

The combustion chamber shall be situated under a suitably ventilated hood.

4.3 Ignition source

A burner is 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 onto a horizontal plate so that it moves smoothly forwards and backwards 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.

4.4 Fuel

The fuel shall be 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.

4.5 Specimen holder

The specimen holder consists of a double stainless steel U-shaped frame, 15 mm wide and (5 ± 1) mm thick, with other dimensions as shown in Figure 3. The frame hangs vertically from the support (see 4.6 and Figure 4) in such a way that the underside of the specimen is exposed directly to the flame along its centre line and edges (see Figures 5 to 7).

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

It is important that the technique of clamping used is capable of restraining the specimen for the total duration of the test.

NOTE Small pins of approximately 1 mm in length may be incorporated on the surface of the frame to which the specimen is attached.

4.6 Support

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, see Figure 4.

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

4.7 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.

4.8 Template

Two metal plates, one $(250 \begin{smallmatrix} +0 \\ -1 \end{smallmatrix})$ mm long and $(90 \begin{smallmatrix} +0 \\ -1 \end{smallmatrix})$ mm wide and the other $(250 \begin{smallmatrix} +0 \\ -1 \end{smallmatrix})$ mm long and $(180 \begin{smallmatrix} +0 \\ -1 \end{smallmatrix})$ mm wide, the larger one being used if the procedure in annex A is followed.

4.9 Flame checking devices

4.9.1 Flame height measuring device

A suitable device that, when located against a fixed point of the burner, indicates a flame height of 20 mm (see Figure 8). The tolerance on the flame height-measuring device shall be $\pm 0,1$ mm.

4.9.2 Burner spacer for edge flame impingement

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 9).

4.9.3 Burner spacer for surface flame impingement

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 9).

4.10 Anemometer

A suitable anemometer with an accuracy of $\pm 0,1$ m/s shall be provided for measuring the airflow velocity in the upper outlet of the combustion chamber (see 4.2 and Figure 1).

4.11 Filter paper and tray

The paper shall be new undyed filter paper with a mass/unit area of 60 g/m² with an ash content of less than 0,1 %.

The tray, 100 mm × 50 mm and 10 mm deep, shall be made of aluminium foil. The tray is placed beneath the specimen holder and is replaced between tests.

5 Test specimen

5.1 Preparation

The test specimen is cut from a sample which is representative of the product to be tested using the templates specified in 4.8.

5.2 Dimensions

The dimensions of the test specimens shall be (250⁺⁰₋₁) mm long by (90⁺⁰₋₁) mm wide.

Specimens of normal thickness 60 mm or less shall be tested using their full thickness. Specimens of normal 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, the cut surface shall not be exposed to the flame.

For products which are normally manufactured in sizes less than the test specimen, a test sample of appropriate size shall be specifically produced for the test.

5.3 Products which are not essentially flat

When the product is not essentially flat, the specimens may be tested in the form as in end use (e.g. pipe insulation). The product shall be supplied in its entirety or as specimens of length of 250 mm.

5.4 Number

5.4.1 For each exposure condition a minimum of six representative specimens of the product shall be tested. Three specimens shall be cut lengthwise and three crosswise.

5.4.2 If a product 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.

5.4.3 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 set shall be conducted to evaluate the product.

5.4.4 If a product is installed with covered edges, but can also be used with unprotected edges, tests shall be performed on both covered and uncovered specimens.

5.5 Substrates

Where, in end use conditions, products are fixed to substrates, then the test specimen shall represent the end use conditions. Substrates shall be selected in accordance with EN 13238.

NOTE Care is needed when preparing test 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 such as type of substrate, fixing to substrate, etc.

6 Conditioning

Test specimens and filter paper shall be conditioned as described in EN 13238.

7 Test procedure

7.1 General

Two flame application times are available, 15 s or 30 s, as required by the sponsor. The start time of the test is on application of the flame.

7.2 Preliminary operations

7.2.1 Check the required airflow velocity in the chimney of the combustion chamber (see 4.2).

7.2.2 Remove the set of six test specimens from the conditioning environment and test them within 30 minutes. If necessary, the test specimen can be transferred from the conditioning room to the test apparatus in a sealed container.

7.2.3 Clamp the test 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 test specimen is always placed at this distance.

7.2.4 Check the distances of the burner from the specimen by means of the relevant spacer specified in 4.9.2 or 4.9.3 with the burner tilted at 45° (see Figures 4 to 7, as appropriate).

7.2.5 Position two pieces of filter paper in the aluminium foil tray beneath the specimen, not more than 3 min before the start of the test.

7.3 Testing operations

7.3.1 Light the burner in the vertical position and allow the flame to stabilize. Adjust the burner valve to give a flame height of $(20 \pm 0,1)$ mm using the device specified in 4.9.1. This operation is carried out away from the pre-set operating position to prevent accidental impingement of the flame on the test specimen. The flame height shall be checked prior to each flame application.

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

7.3.2 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 test specimen.

Start the timing device at the moment the flame contacts the test specimen. Apply the flame for 15 s or 30 s as required by the sponsor and then retract the burner in a smooth continuous manner.

7.3.3 Exposure conditions

Tests may need to be conducted to either surface exposure or edge exposure, or both.

NOTE Advice on exposure conditions may be given in the relevant product standards.

7.3.3.1 Surface exposure

For all essentially flat products (see 3.2), the flame shall be applied on the centre line of the specimen, 40 mm above the bottom edge (see Figure 9). Each different surface, which may be exposed in practice, shall be tested (see 5.4.2).

7.3.3.2 Edge exposure

7.3.3.2.1 For essentially flat single layer or multilayer products less than or equal to 3 mm total thickness, the flame shall be applied to the mid point on the bottom of the test specimen (see Figure 5).

7.3.3.2.2 For essentially flat single layer or multilayer products greater than 3 mm total thickness, the flame shall be applied to the centre of the width of the bottom edge of the test specimen 1,5 mm behind the surface (see Figure 6).

7.3.3.2.3 For all multilayer products greater than 10 mm thick, an additional set of tests shall be carried out with the specimen turned at 90° round its vertical axis and the flame impinging at the bottom edge of the centreline of the underside of each different layer (see Figure 7).

7.3.4 For products which are not essentially flat and which are to be tested in their end-use form, the flame shall be applied as described in 7.3.3.1 and 7.3.3.2. A full description of the method of retention shall be given in the test report.

NOTE A modification to the apparatus and/or procedure may be necessary but many non-planar products will normally only require a change in the specimen support frame. In some instances, however, the burner mounting may also be inappropriate and the ignition source may need to be held and applied manually.

The product may be free standing or may be held in its end-use orientation in a retaining frame which may be as simple as a laboratory clamp stand or may require a more substantial, specially constructed framework.

7.3.5 If the product melts or shrinks away from the flame without being ignited during the flame application time on the first test specimen, if required, the product shall be tested in accordance with annex A.

7.4 Duration of test

7.4.1 If the flame application time is 15 s, the total test duration is 20 s from the time at which the flame is first applied.

7.4.2 If the flame application time is 30 s, the total test duration is 60 s from the time at which the flame is first applied.

8 Expression of results

8.1 Record the position of flame application.

8.2 For each of the test specimens, record the following:

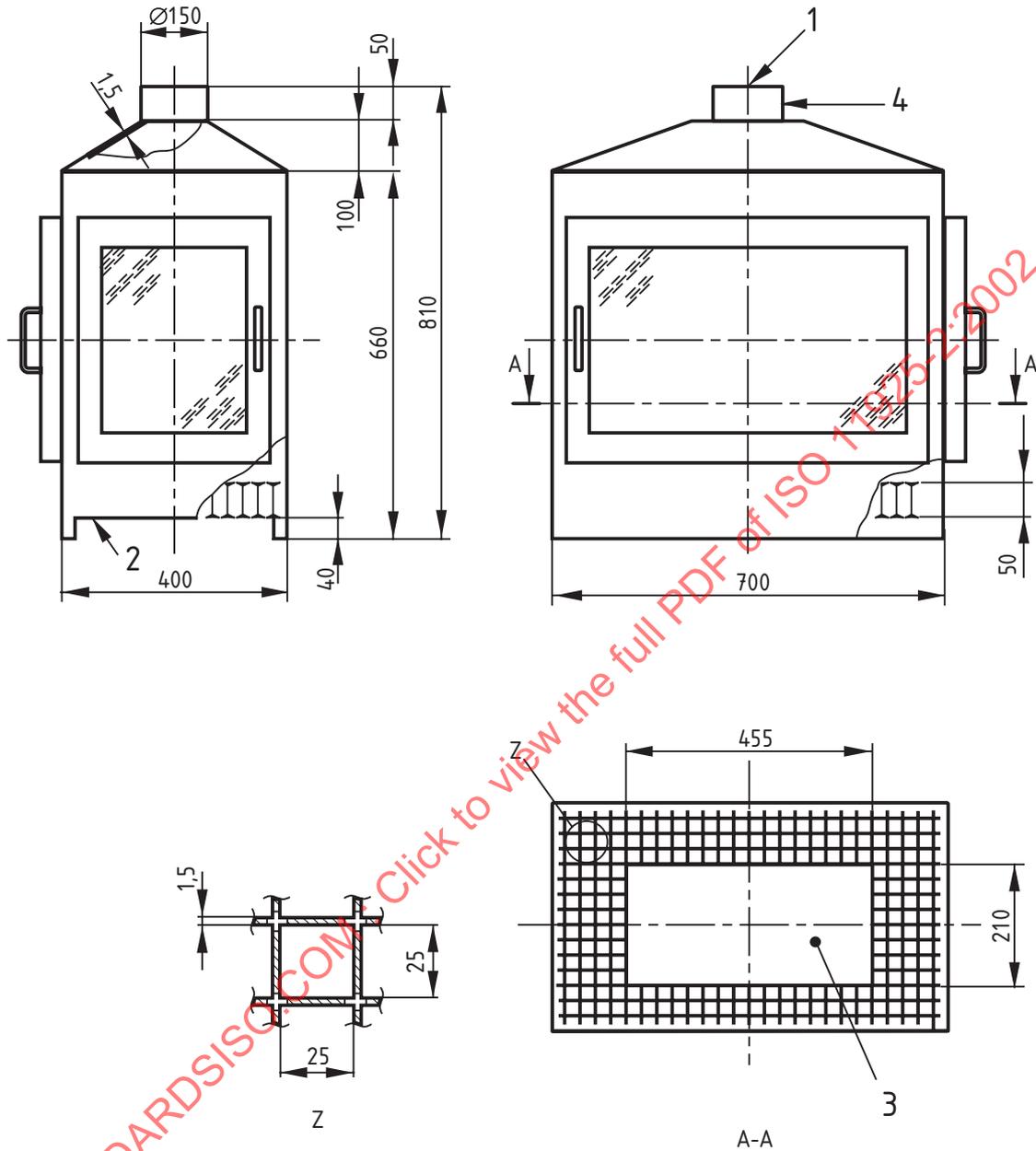
- a) whether ignition occurs;
- b) whether the flame tip reaches 150 mm above the flame application point, and the time at which this occurs;
- c) whether ignition of the filter paper occurs;
- d) observations of physical behaviour of the test specimen.

9 Test report

The test report shall include the following information as a minimum. A clear distinction shall be made between the data provided by the sponsor and data determined by the test.

- a) reference that the test was carried out in accordance with EN ISO 11925-2;
- b) any deviations from the test method;
- c) name and address of the testing laboratory;
- d) date and identification number of the report;
- e) name and address of the sponsor;
- f) name and address of the manufacturer/supplier, if known;
- g) date of sample arrival;
- h) identification of the product;
- i) description of the sampling procedure, where relevant;
- j) a general description of the product tested including density, mass per unit area and thickness, together with the details of construction of the test specimen;
- k) details of conditioning;
- l) details of any substrates used and method of fixing;
- m) date of test;
- n) test results expressed in accordance with clause 8, and annex A if the supplementary procedure is carried out;
- o) the flame application time;
- p) observations made during the test;
- q) Information on the intended application of the building product, if known;
- r) the statement 'The test results relate to the behaviour of the test specimens of a product under the particular conditions of the test; they are not intended to be the sole criterion for assessing the potential fire hazard of the product in use'.

Dimensions in millimetres



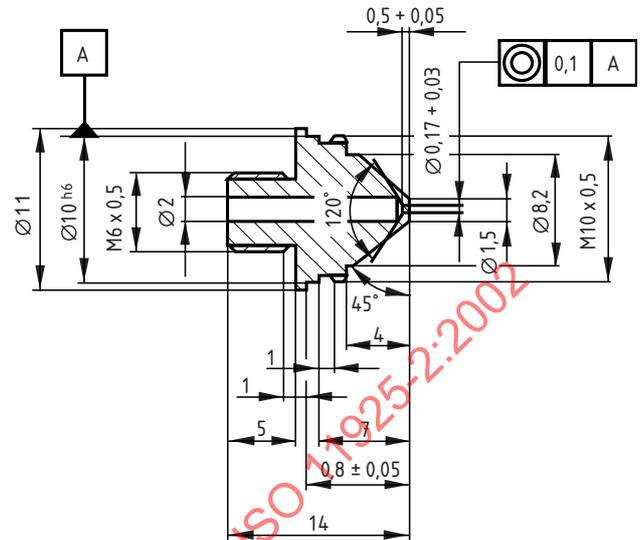
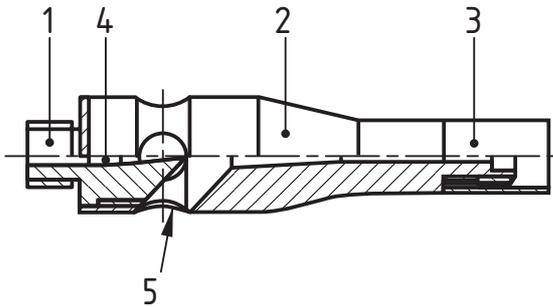
Key

- 1 Measuring point for air velocity
- 2 Metal grid mesh
- 3 Horizontal plate
- 4 Chimney

Figure 1 — Combustion chamber

NOTE All dimensions are nominal values in mm unless tolerances are given.

Dimensions in millimetres

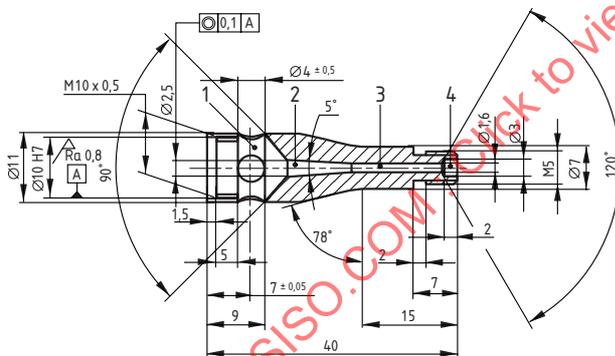


Key

- | | |
|--------------------|-----------------------------------|
| 1 Gas jet | 4 Choke tube |
| 2 Burner tube | 5 Notch fitted in during assembly |
| 3 Flame stabilizer | |

Figure 2 a) Burner assembly

Figure 2 b) Gas jet



Key

- | | |
|------------------------|----------------------|
| 1 Gas mixing zone | 3 Conduction section |
| 2 Acceleration section | 4 Outlet |

Figure 2 c) Burner tube

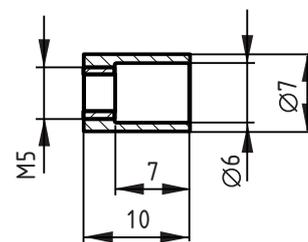


Figure 2 d) Flame stabilizer

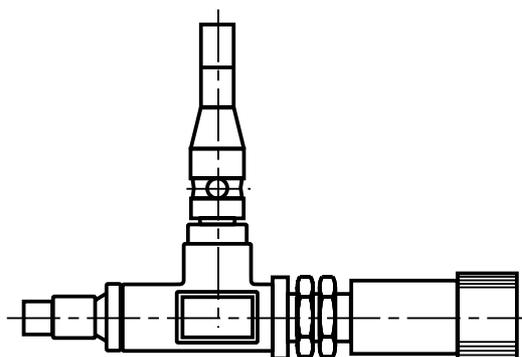
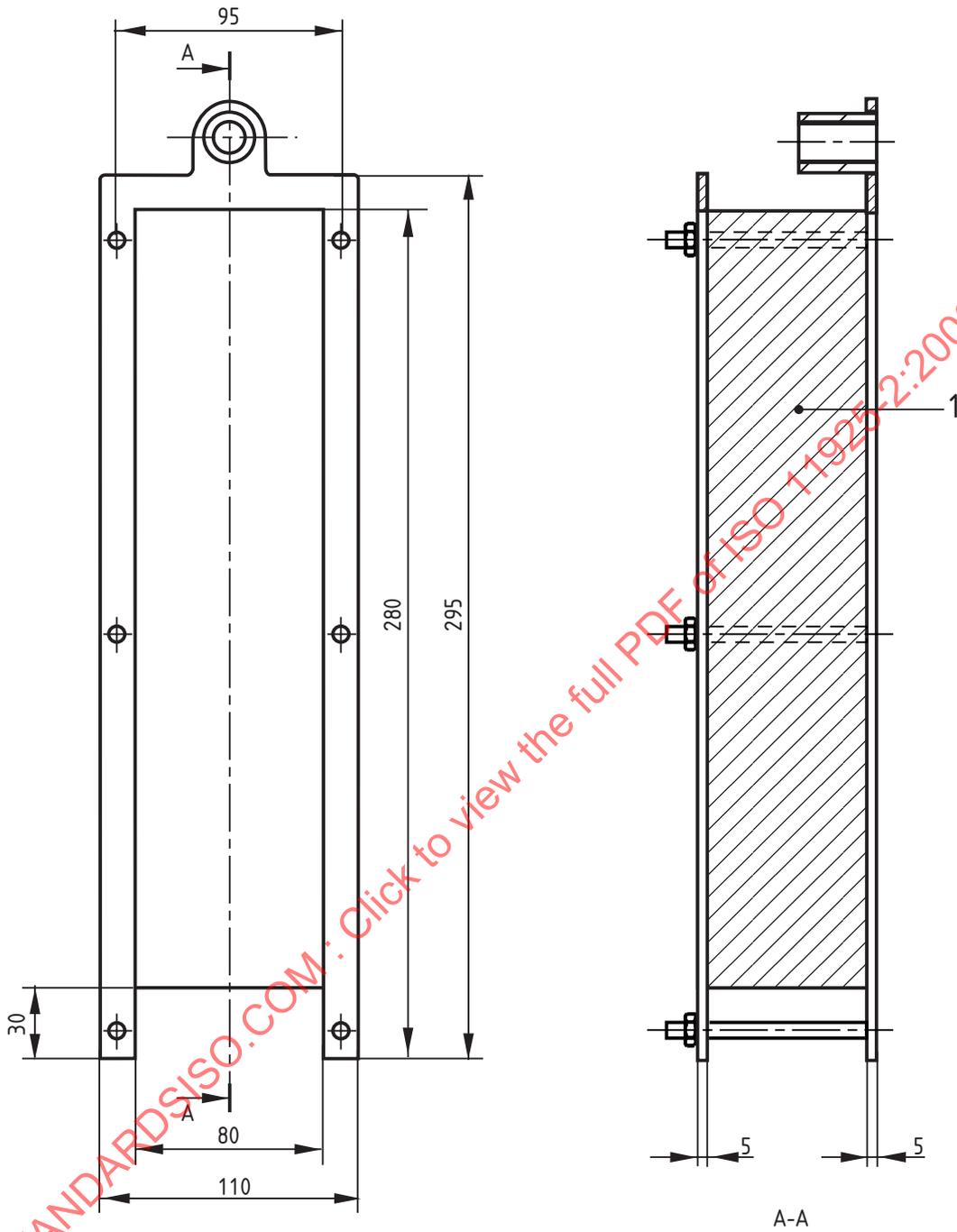


Figure 2 e) Burner and adjustment valve

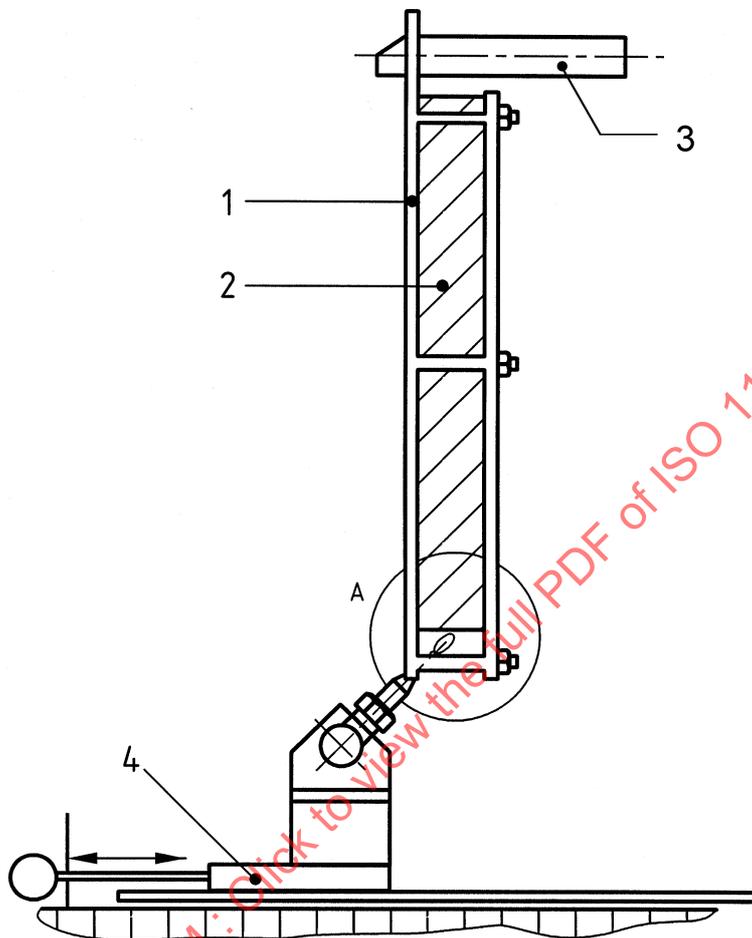
Figure 2 — Gas burner

Dimensions in millimeters



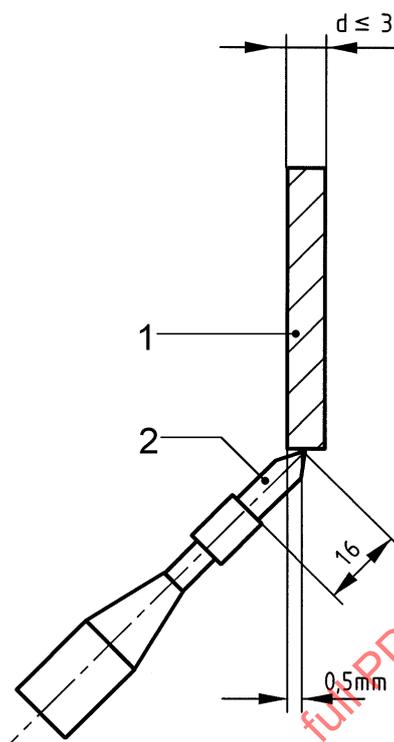
Key
1 Test specimen

Figure 3 — Typical specimen holder



- Key**
- 1 Specimen holder
 - 2 Specimen
 - 3 Support
 - 4 Burner base
 - A See Figure 5

Figure 4 — Typical support and burner positioning (side view)

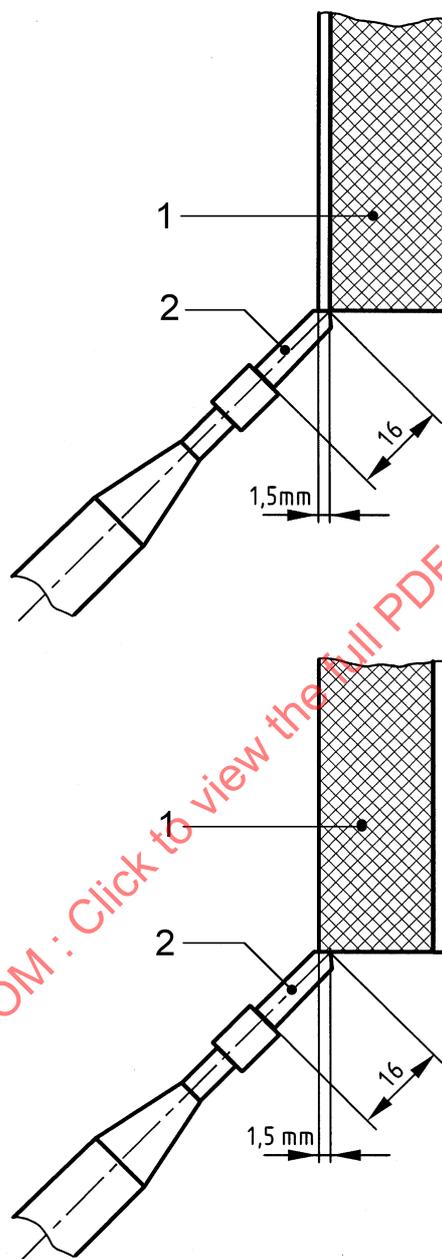


Key

- 1 Test specimen
- 2 Burner spacer
- d – Thickness

Figure 5 — Flame impingement point for products less than or equal to 3 mm thick

Dimensions in millimetres



- Key**
- 1 Test specimen
 - 2 Burner spacer

Figure 6 — Typical flame impingement points for products with thickness greater than 3 mm

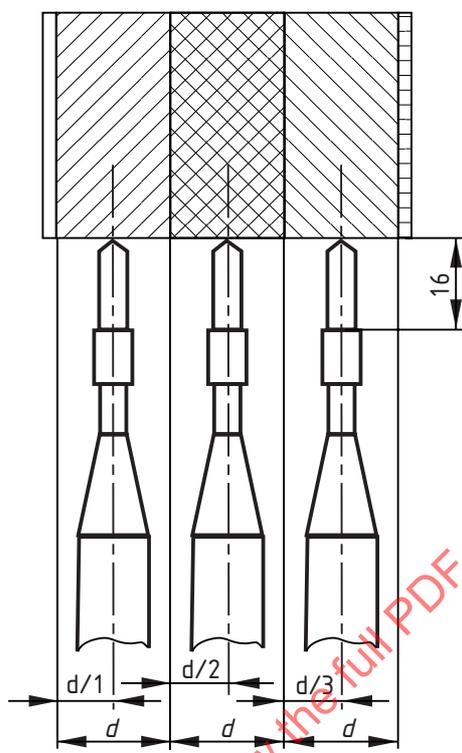
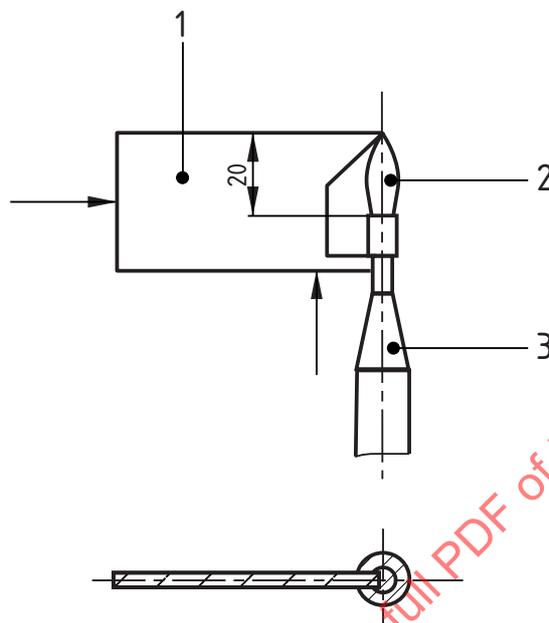


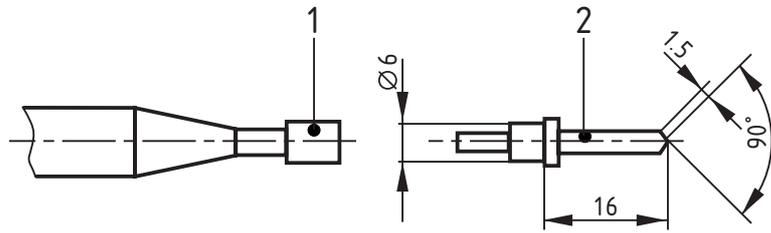
Figure 7 — Flame impingement points for additional set of tests for multilayer specimens greater than 10 mm thick

Dimensions in millimetres

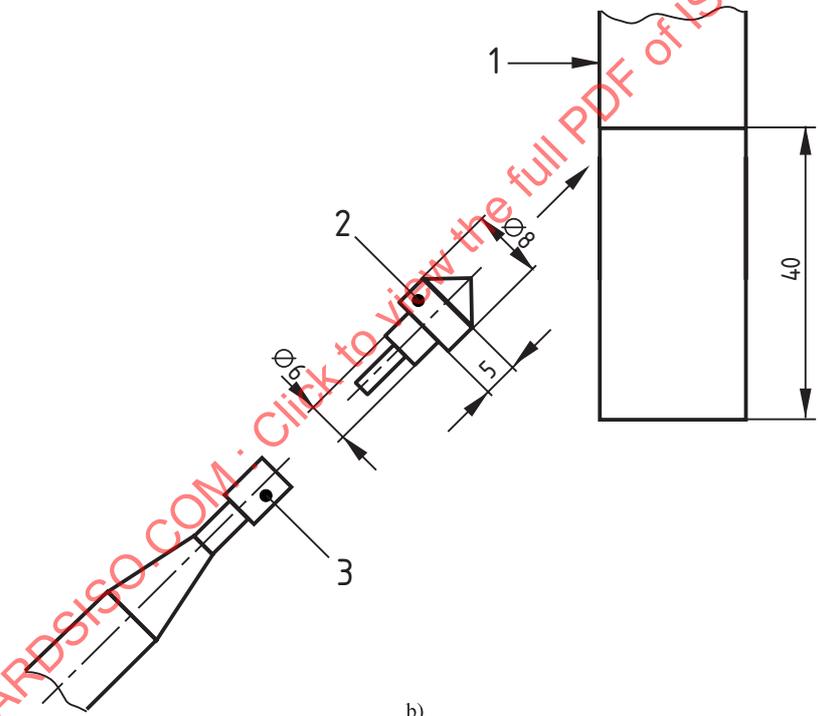


- Key**
- 1 Metal plate
 - 2 Flame
 - 3 Burner

Figure 8 — Typical flame height measuring device



a)



b)

a) Edge flame impingement
Key
 1 Burner
 2 Spacer

b) Surface flame impingement
Key
 1 Specimen surface
 2 Spacer
 3 Burner

Figure 9 — Burner spacer

Annex A (normative)

Procedure for products which melt and shrink

A.1 General

In addition to general requirements given in the body of this standard, when required, the following procedures shall be followed for products that melt and shrink away from the flame without being ignited.

A.2 Test apparatus

A specimen holder (Figure A.1) is required for conducting tests on products that melt or shrink away from the flame without being ignited. The specimen holder shall be capable of clamping specimens 250 mm × 180 mm high and shall consist of a double U-shaped frame (20 ± 1) mm wide and (5 ± 1) mm thick constructed in stainless steel which hangs vertically from a support.

The specimen holder shall be capable of moving laterally in relation to the burner. One method of allowing the movement of the specimen is shown in Figures A.2 and A.3 and consists of attaching the specimen holder to a rail system via a runner so that the specimen can be manually or automatically moved in relation to the burner.

A.3 Test specimen

For products which are observed to melt and shrink away from heat and flame without being ignited, specimens of dimensions (250_{-1}^{+0}) mm long by (180_{-1}^{+0}) mm wide shall be submitted for test. Draw a horizontal line on test specimen 150 mm above the bottom edge of specimen.

A.4 Test procedure

A.4.1 Clamp the test specimen in the holder so that the exposed longer edge is in line with the end of the frame.

A.4.2 Tilt the burner at 45° with respect to its vertical axis and advance it horizontally until the flame reaches the pre-set contact point on the bottom edge of the test specimen, 10 mm from the inside edge of the specimen holder.

Start the timing device at the moment the flame contacts the test specimen. Apply the flame for 5 s and then retract the burner in a smooth continuous manner.

Reposition the test specimen so that the new flame contact point will be at the bottom edge of the test specimen and at the side of any hole created by the previous flame application. Reapply the flame between 3 s and 4 s after extinguishment of the flame on the test specimen or between 3 s and 4 s after the last application if no ignition has occurred.

Repeat this operation until the end of the test specimen is reached.

NOTE In this procedure the test specimen is moved relative to the igniting flame so that the molten drops accumulate at the same point on the filter paper.

A.4.3 The test shall be conducted on all layers of products which melt or shrink away from the flame without being ignited.

A.4.4 Continue the test until the end of the specimen is reached or until flame spread occurs to 150 mm within 20 s from the time at which the flame is applied.

A.5 Expression of results

For each test specimen, record the following:

- a) whether ignition of the filter paper occurs;
- b) whether the flame tip reaches 150 mm above the flame application point and the time at which this occurs.

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Dimensions in millimetres

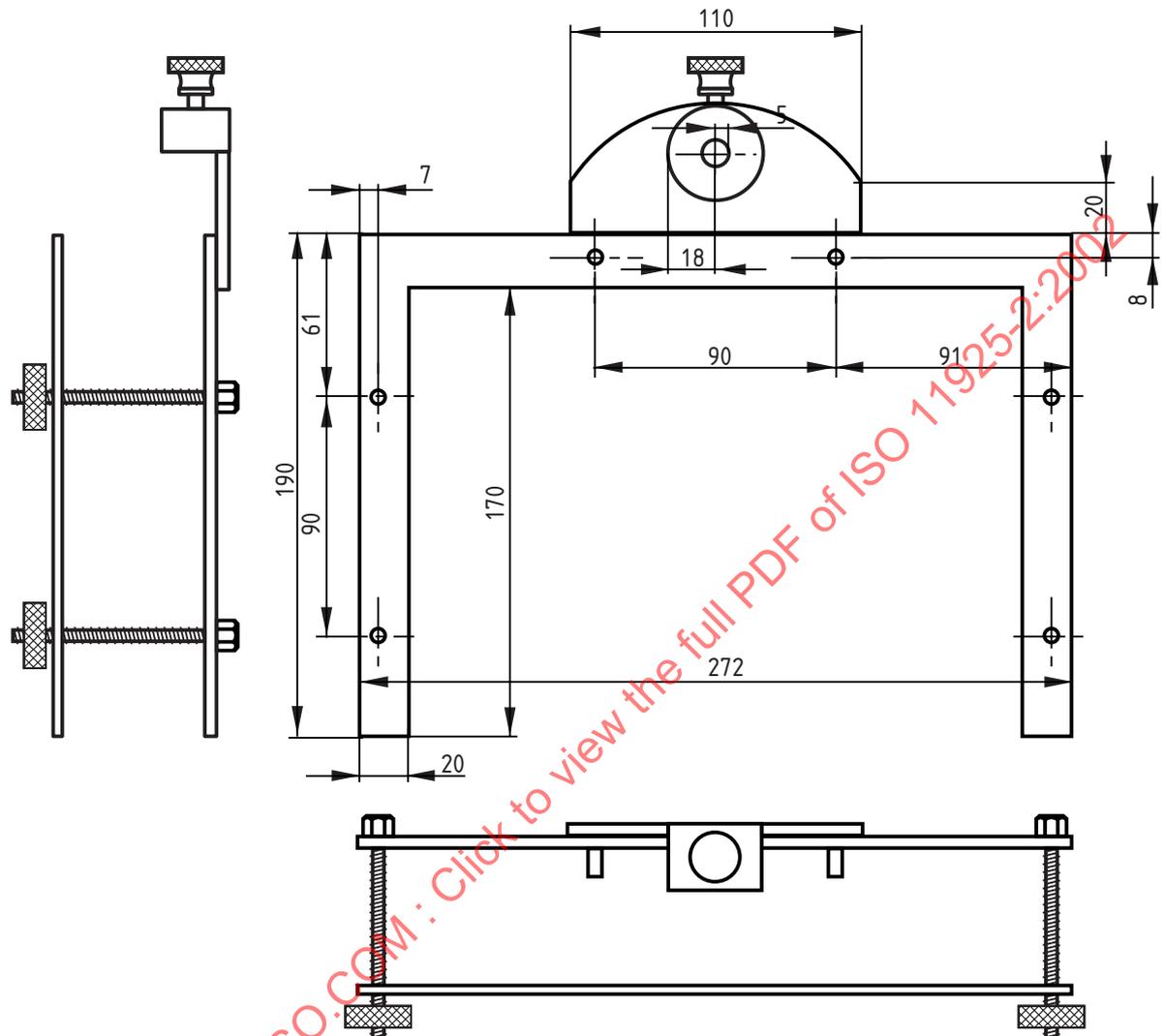


Figure A.1 – Typical details of specimen holder assembly for products which melt and shrink