
International Standard



6941

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Textile fabrics — Burning behaviour — Measurement of flame spread properties of vertically oriented specimens

Textiles — Comportement au feu — Détermination des propriétés de propagation de flamme d'éprouvettes orientées verticalement

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Descriptors: textiles, fabrics, tests, fire tests, determination, flame propagation, test equipment, burners.

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been authorized 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.

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.

International Standard ISO 6941 was developed by Technical Committee ISO/TC 38, *Textiles*, and was circulated to the member bodies in July 1983.

It has been approved by the member bodies of the following countries :

Australia	Ghana	ISO 6941:1984
Belgium	Hungary	Poland
Brazil	India	Portugal
Bulgaria	Iraq	Romania
Canada	Ireland	South Africa, Rep. of
China	Israel	Spain
Czechoslovakia	Italy	Sri Lanka
Denmark	Jamaica	Sweden
Egypt, Arab Rep. of	Japan	Switzerland
Finland	Kenya	Tanzania
France	Korea, Rep. of	Turkey
Germany, F.R.	New Zealand	USSR
		Yugoslavia

The member bodies of the following countries expressed disapproval of the document on technical grounds :

Netherlands
United Kingdom

Textile fabrics — Burning behaviour — Measurement of flame spread properties of vertically oriented specimens

1 Scope and field of application

This International Standard specifies a method for the measurement of flame spread properties of vertically oriented textile fabrics intended for apparel, curtains and draperies in the form of single- or multi-component (coated, quilted, multilayered, sandwich construction and similar combinations) fabrics.

The method should be used solely to assess the properties of materials or systems in response to heat flame under controlled laboratory conditions. The results may not apply to situations where there is restricted air supply or prolonged exposure to heat as in a conflagration.

2 References

ISO 139, *Textiles — Standard atmospheres for conditioning and testing*.

ISO 4880/1, *Burning behaviour of textiles and textile products — Vocabulary — Part 1*.

3 Definitions

For the purpose of this International Standard, the following definitions apply (see ISO 4880/1):

3.1 afterflame: Persistence of flaming of a material, under specified test conditions, after the ignition source has been removed.

3.2 afterflame time: The length of time for which a material continues to flame, under specified test conditions, after the ignition source has been removed. (*Also called* Duration of flame.)

3.3 afterglow: Persistence of glowing of a material, under specified test conditions, after cessation of flaming or, if no flaming occurs, after removal of the ignition source.

3.4 afterglow time: The time for which a material continues to glow, under specified test conditions, after cessation of flaming, or after removal of the ignition source. (*Also called* Duration of afterglow.)

3.5 flame spread time: The time taken by a flame on a burning material to travel a specified distance under specified test conditions.

4 Principle

A defined ignition flame from a specified burner is applied for a defined period of time to textile specimens which are vertically oriented. The flame spread time is the time in seconds for a flame to travel between marker threads located at defined distances. Other properties relating to flame spread may also be observed, measured and recorded.

NOTE — Attention is drawn to annex B regarding quality of experimental techniques.

5 Health and safety of test operators

Burning of textiles may produce smoke and toxic gases which can affect the health of operators. The testing area should be cleared of smoke and fumes by suitable means.

6 Apparatus and materials

6.1 Construction of testing equipment

Some products of combustion are corrosive. The equipment should be constructed of material which will not be adversely affected by the fumes.

6.2 Location of test

A location in which the air movement is less than 0,2 m/s at the commencement of the test and is not further influenced by mechanical devices operating during the test is required. The volume of air surrounding the test location shall be such that the test is not affected by any reduction of oxygen concentration. Where an open-fronted cabinet is used for the test, provision shall be made to permit the specimen to be mounted at least 300 mm from any wall.

6.3 Template

A flat rigid template made of suitable material and of a size corresponding to the size of the specimen shall be used. Holes approximately 2 mm diameter are drilled in the template and positioned so that the distances between the centres of the holes correspond to the distances between the pins on the frames (see figure 1). The holes shall be located equidistant about the vertical centrelines of the template (see the note in 7.2).

6.4 Specimen holder

A specimen holder consisting of a rectangular frame 560 mm high having two rigidly connected parallel rods spaced 150 mm apart on which are fitted pins for mounting the test specimen which is located in a plane at least 20 mm from the frame. The mounting pins shall be not greater than 2 mm diameter and at least 27 mm long. The pins are located on the parallel rods at locations shown in figure 1. The frame is fitted onto a suitable support to maintain the rods in a vertical orientation during testing.

NOTE — For the purpose of locating the specimen on the pins in a plane away from the frame, spacer stubs 2 mm diameter may be provided adjacent to the pins.

6.5 Gas burner

A gas burner as described in annex A.

NOTE — Small differences in the design and dimensions of the burner can influence the configuration of the burner flame and so affect the results of the tests.

6.6 Gas

Commercial grade propane or butane gas.

6.7 Marker threads

White mercerized cotton threads having a maximum linear density of 50 tex.

6.8 Timing devices

An appropriate number of suitable timing devices having an accuracy of at least 0,2 s.

6.9 Measuring instruments

Rulers graduated in millimetres.

7 Test specimens

7.1 Size

The size of each specimen shall be 560 mm × 170 mm.

7.2 Pin location marks

Place the template (see 6.3) centrally on top of the specimen and, by using the holes in the template, mark the positions through which the pins must pass.

NOTE — Where the fabric is of open construction (e.g. scrim, gauze), small pieces of adhesive tape may be affixed to the fabric at the pin sites and the pin positions marked on the tape.

7.3 Number

Cut three specimens from each of the length direction and the width direction. Where the two surfaces of the fabric are different, cut another set of specimens and test both surfaces. Where the two surfaces are similar test the face side of the fabric. Extra specimens may be needed if retesting is necessary (see 8.8).

NOTE — The flame spread time for a fabric may depend on whether the machine direction is upwards or downwards, or whether the face or the back of the fabric is ignited.

7.4 Conditioning of test specimens

Condition test specimens in one of the following ways:

- in the standard temperate atmosphere of 20 ± 2 °C and (65 ± 2) % rh in accordance with ISO 139;
- drying in an oven at 105 ± 2 °C for not less than 1 h, then cooling in a desiccator for at least 30 min; or
- any other conditioning atmosphere as agreed by the interested parties.

8 Procedure

8.1 Carry out the test in an atmosphere having a temperature between 10 and 30 °C and a relative humidity between 15 % and 80 %.

8.2 Light the burner and preheat it for 2 min. Adjust the flame height to 40 ± 2 mm measured as the distance between the top of the burner tube and the tip of the yellow part of the flame when the burner is vertically oriented and the flame is viewed in dim light.

8.3 If testing is not being performed immediately, place the specimens in sealed containers until testing begins. Begin testing each specimen within 2 min of removing it from the conditioning atmosphere or sealed container.

8.4 Place the specimen on the pins of the test frame, making certain that the pins pass through the points marked off from the template and that the specimen is at least 20 mm removed from the frame. Fit the frame on the support so that the specimen is vertical. (See 7.2.)

8.5 Attach the marker threads horizontally in front of the specimen at the locations shown in figure 1. At each location, mount a loop of thread so that the two segments are spaced 1 mm and 5 mm from the plane of the front of the specimen. Attach each loop to a suitable timing device. Impose sufficient tension to the thread to maintain its position relative to the specimen.

8.6 For all fabrics, position the burner as described in 8.6.1. Where fabrics intended for curtains and drapes fail to ignite in the position of the burner described in 8.6.1, the burner position described in 8.6.2 is used if required by the relevant fabric specification.

8.6.1 Surface ignition: Position the burner perpendicular to the surface of the specimen such that the axis of the burner is 20 mm above the line of the lower pins in line with the vertical centreline of the face of the specimen [see figure 2a)]. The end of the burner is 17 mm from the face of the specimen.

8.6.2 Edge ignition: Position the burner in front of, but below, the specimen such that it lies in a plane passing through the vertical centreline of the specimen and perpendicular to its face [see figure 2b)], such that the longitudinal axis is inclined upwards at 30° to the vertical towards the lower edge of the specimen. The distance between the tip of the burner and the lower edge of the specimen is 20 mm.

NOTE — The edge of the specimen should bisect the flame.

8.7 Test three specimens in the length direction and three specimens in the width direction at the selected ignition time. Apply the flame to the specimen for 5 s. Ignition shall be deemed to have occurred if flaming of the specimen continues for 5 s after removal of the igniting flame. If ignition does not occur, apply the flame for 15 s to another conditioned specimen.

8.8 If any result in any set of three specimens exceeds the minimum result by 50 %, test another set of three specimens for that direction or face. If one or two specimens in any set of three specimens fail to burn to the top marker thread, test another set of three specimens for that direction or face.

8.9 Measure the following times, in seconds:

- a) from the start of the application of the igniting flame to the severance of the first marker thread;
- b) from the start of the application of the igniting flame to the severance of the second marker thread; and
- c) from the start of the application of the igniting flame to the severance of the third marker thread.

8.10 If required, the following characteristics may be noted:

- a) the afterflame time and afterglow time in seconds;
- b) the maximum burnt or damaged width and the maximum burnt or damaged length;
- c) whether the flame reaches a vertical edge of the specimen;
- d) whether or not a hole is burnt or melted in the specimen;
- e) whether any flaming fabric debris falls below the bottom edge of the frame and continues to flame.

9 Precision

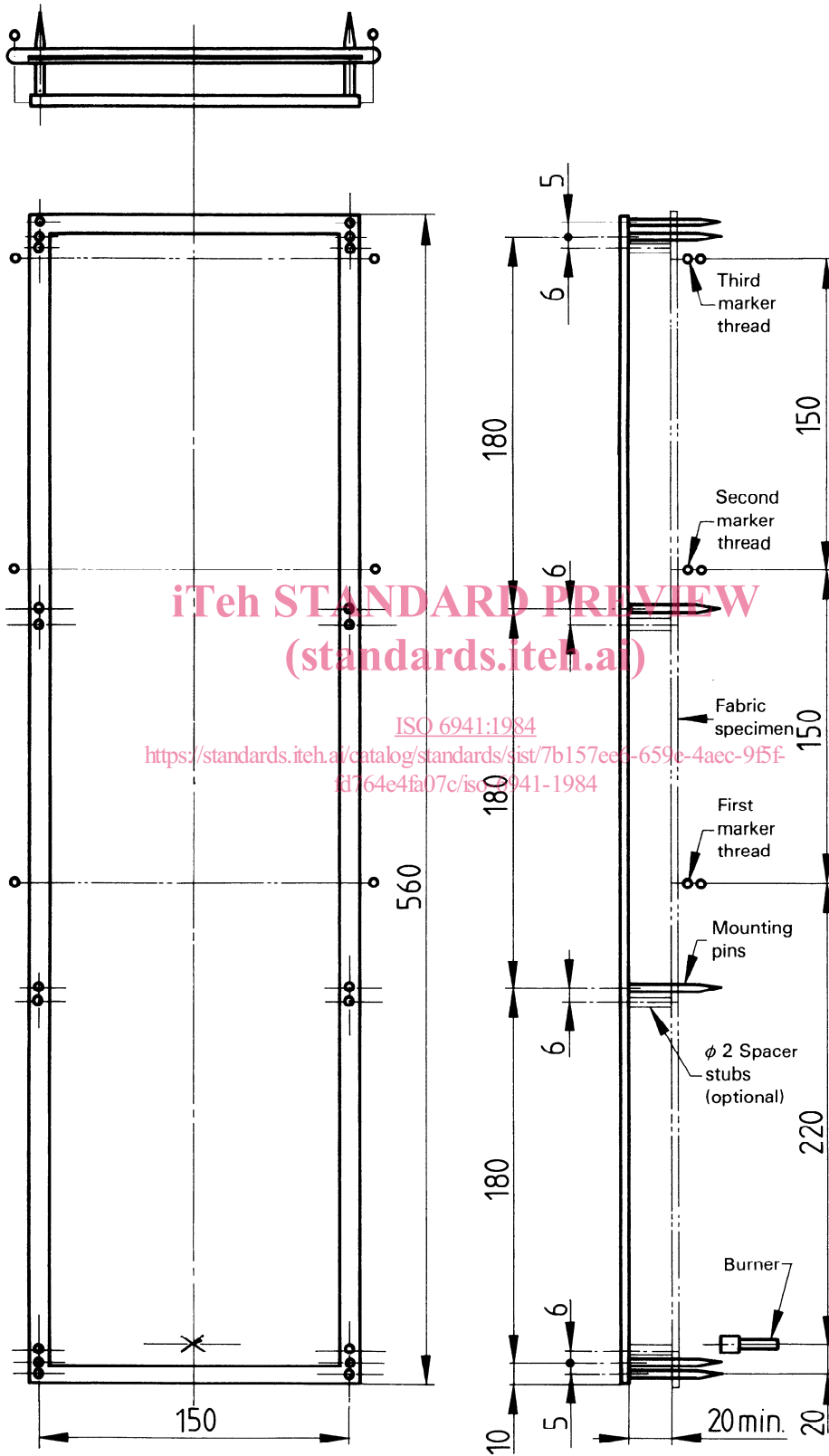
The precision of this method is being established.

10 Test report

The test report shall include the following particulars:

- a) a statement that the test was carried out in accordance with this International Standard and details of alterations to it, if any;
- b) date of test;
- c) conditioning atmosphere used for the test specimens (see 7.4);
- d) ambient conditions of temperature, relative humidity and barometric pressure in the area in which the test is carried out;
- e) techniques used to attach fabrics which cannot be supported on the pins;
- f) gas used to ignite the test specimens;
- g) identification of the fabric tested;
- h) orientation of the burner for igniting the test specimen (see 8.6);
- i) time used to ignite the specimen;
- k) the following times, in seconds, for the length and width directions and for each face tested:
 - 1) the flame spread times measured according to 8.9 a), b) and c),
 - 2) the mean of the times from the first marker thread to the second marker thread,
 - 3) the mean of the times from the second marker thread to the third marker thread,
 - 4) if six specimens are tested (see 8.8), determine the mean from the results for all the specimens that burn to the respective marker threads and report the number of values averaged. Do not compute a mean of less than three values;
- m) the number of specimens that failed to ignite;
- n) if required, any additional characteristics noted (see 8.10).

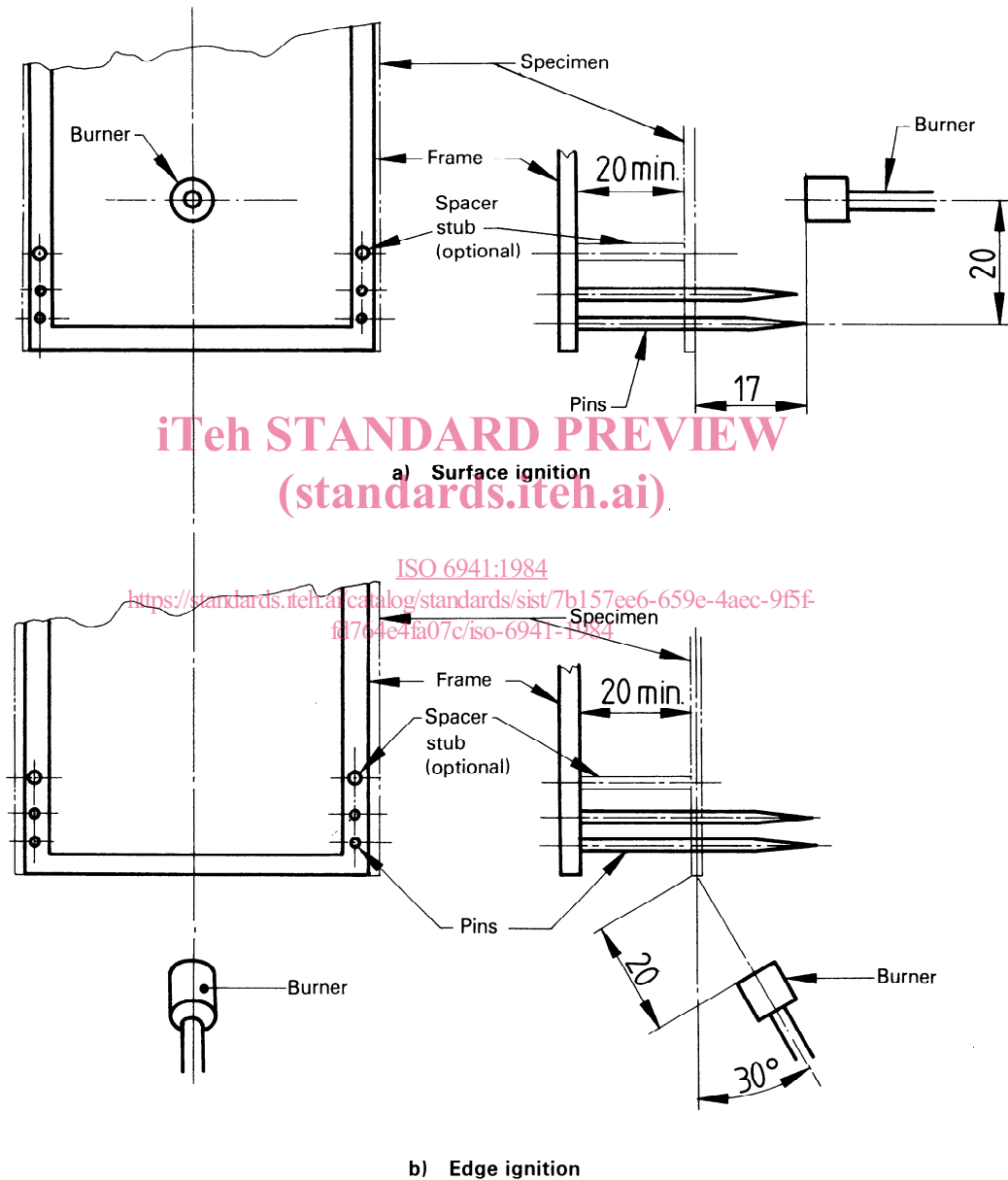
Dimensions in millimetres



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Figure 1 – Specimen holder

Dimensions in millimetres



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Figure 2 — Burner ignition location

Annex A

Description and construction of the burner¹⁾

A.1 Description

The burner provides a flame of suitable dimensions, the length of which can be regulated from 10 to 60 mm.

A.2 Construction

The construction of the burner is shown in figure 3a). The burner consists of three parts:

A.2.1 Gas jet

The orifice diameter of the gas jet [see figure 3b)] shall be $0,18^{+0,03}_0$ mm.

The orifice shall be drilled and after drilling, all burrs shall be removed from both ends of the drilled hole without rounding the corners.

A.2.2 Burner tube

The burner tube [see figure 3d)] consists of four zones:

- 1) air chamber;
- 2) gas mixing zone;
- 3) diffusion zone;
- 4) gas outlet.

Within the air chamber, the burner tube has four air holes 4 mm diameter for air inlet. The forward edge of the air holes is approximately level with the tip of the jet.

The diffusion zone is of conical shape and has the dimensions indicated in figure 3c). The burner has a bore of 1,7 mm inside diameter and outlet of 3,0 mm inside diameter.

A.2.3 Flame stabilizer

The flame stabilizer is as detailed in figure 3c).

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1) The burner may be obtained from Dr.-Ing. Georg Wazau, Mess- und Prüftechnik, Keplerstr. 12, D-1000 Berlin 10, Germany, F.R.

