INTERNATIONAL STANDARD

ISO 12992

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Plastics — Vertical flame spread determination for film and sheet

Plastiques — Détermination de la propagation verticale de la flamme sur films et feuilles

INTERNATIONAL ISO

Reference number
ISO 12992:1995(E)

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 voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 12992 was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 4, *Burning behaviour*.

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Plastics — Vertical flame spread determination for film and sheet

1 Scope

This International Standard specifies a test method for the measurement of flame spread properties of vertically oriented specimens of plastics in the form of film and sheet, 3 mm or less in thickness, subjected to a small igniting flame.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard 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 291:1977, *Plastics — Standard atmospheres for conditioning and testing.*

ISO 11925-2:—[1], *Reaction to fire tests — Ignitability of building products subjected to direct impingement of flame under zero impressed irradiance — Part 2: Single flame source test.*

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

3 Definitions and symbols

For the purposes of this International Standard, the following definitions apply (see ISO/IEC Guide 52):

3.1 afterglow: Persistence of glowing combustion of a material after cessation of flaming or, if no flaming occurs, after the ignition source has been removed.

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

3.3 ignition: Initiation of flaming combustion.

3.4 seat of flame: The flame location at the leading edge of the affected area (see figure 1).

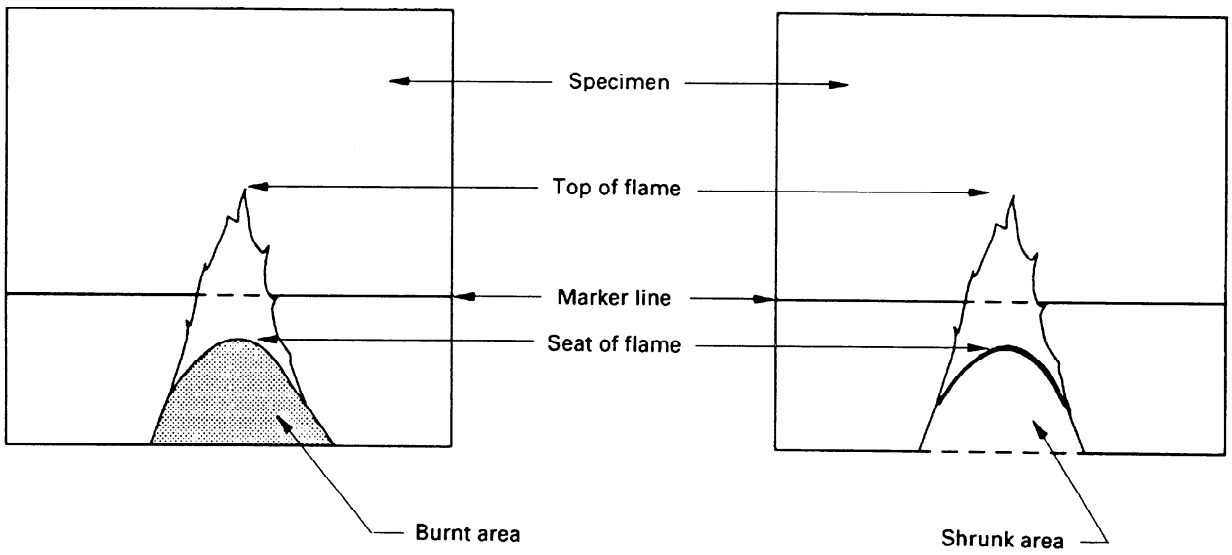
3.5 Symbols specific to this test method

3.5.1 t_1**:** The time, in seconds, when the seat of the flame reaches the 100 mm marking.

3.5.2 t_2**:** The time, in seconds, when the seat of the flame reaches the 300 mm marking.

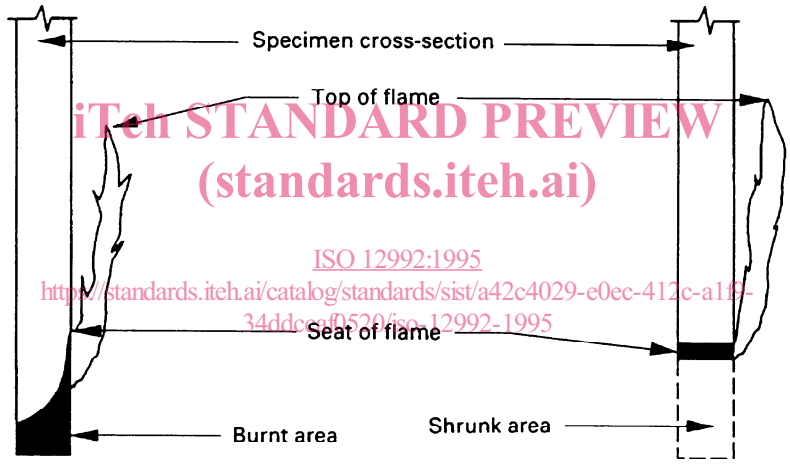
3.5.3 FSR: Flame spread rate, in millimetres per second.

1) To be published.



a) Front view – Thermosets

b) Front view – Thermoplastics



c) Side view – Thermosets

d) Side view – Thermoplastics

Figure 1 — Identification of seat of flame

4 Significance of the test

4.1 Results obtained using the method described in this International Standard can provide a sensitive measure of the burning characteristics of material under certain controlled laboratory conditions, and hence may be useful for preselection or quality control purposes.

4.2 Results obtained from specimens of differing thicknesses, with different ignition sources and/or by different procedures are not comparable. Correlation with flammability behaviour under other fire conditions is not implied.

4.3 This test is not relevant for specimens which distort away from and out of reach of the flame without ignition. Other test methods should be explored for such specimens.

4.4 Results obtained by this standard shall not be used alone to describe or appraise the fire hazard presented by a particular material type or shape under actual fire conditions. The results may be used as one element of a fire risk assessment, which takes into account all the factors which are pertinent to the assessment of the fire hazard of a particular end-use for the material.

5 Principle

5.1 A defined flame from a specified ignition source is applied to film or sheet specimens, that are vertically oriented, for a specified period of time.

5.2 The flame spread time, i.e. the time for the seat of the flame to travel between two markings, is recorded and the flame spread rate between these two markings calculated.

5.3 Other properties relating to flame propagation, such as flaming drops, extinguishing characteristics and afterglow, are observed and recorded.

6 Apparatus

6.1 Draught-free test chamber, where the air movement is less than 0,2 m/s around the specimen at the beginning of the test and is not influenced by devices operating during the test. The enclosure shall have an internal volume of at least 1,0 m^3. The specimen holder shall be at least 300 mm from any wall. An exhaust fan, to remove products of combustion, shall be provided on the enclosure or in the exhaust ducting.

NOTE 1 When burning times are prolonged, chamber sizes greater than 1 m^3 will be required so that sufficient oxygen is available to support combustion.

6.2 Specimen holder, as described in figures 2 to 4. The specimen holder shall be capable of supporting the specimen securely in a vertical position without excessively stressing it, and provide support for marker rods across the front.

6.3 Stainless-steel marker rods, of diameter 2,0 mm ± 0,5 mm, as described in figure 5.

6.4 Gas burner, as described in ISO 11925-2.

6.5 Gas supply: commercial-grade propane, 94,5 % minimum purity.

6.6 Calibrated flow meter, for measuring the propane flow rate, if necessary.

6.7 Timing device, having an accuracy of at least 0,2 s.

6.8 Measuring instrument (ruler), graduated in millimetres, for measuring the height of the burner flame.

6.9 Marker (permanent), which has a fine point and is quick drying.

6.10 Micrometer, having an accuracy of at least 0,02 mm, for measuring the thickness of the test specimens.

7 Test specimens

7.1 The size of each specimen shall be 300 mm ± 5 mm wide by 325 mm ± 5 mm long.

7.2 The thickness of specimens shall not exceed 3 mm.

7.3 Three specimens shall be tested. If the material is anisotropic, test three specimens in both directions.

7.4 Each specimen shall be marked with the marker (6.9) by drawing a line horizontally across the specimen, 100 mm and 300 mm from the bottom edge (see figure 2).

7.5 Two sets of three specimens shall be conditioned at 23 °C ± 2 °C and (50 ± 5) % relative humidity for 48 h (see ISO 291), unless the material specification requires a different conditioning atmosphere.

8 Procedure

8.1 Carry out testing in an atmosphere having a temperature between 10 °C and 30 °C and relative humidity between 20 % and 65 %.

WARNING — Products of combustion may be hazardous and care should be taken when testing highly flammable materials that produce larger flames and high heat release.

8.2 Begin testing each specimen within one hour after conditioning. If testing is not being done immediately, place the specimen in a sealed container until testing begins.

Dimensions in millimetres

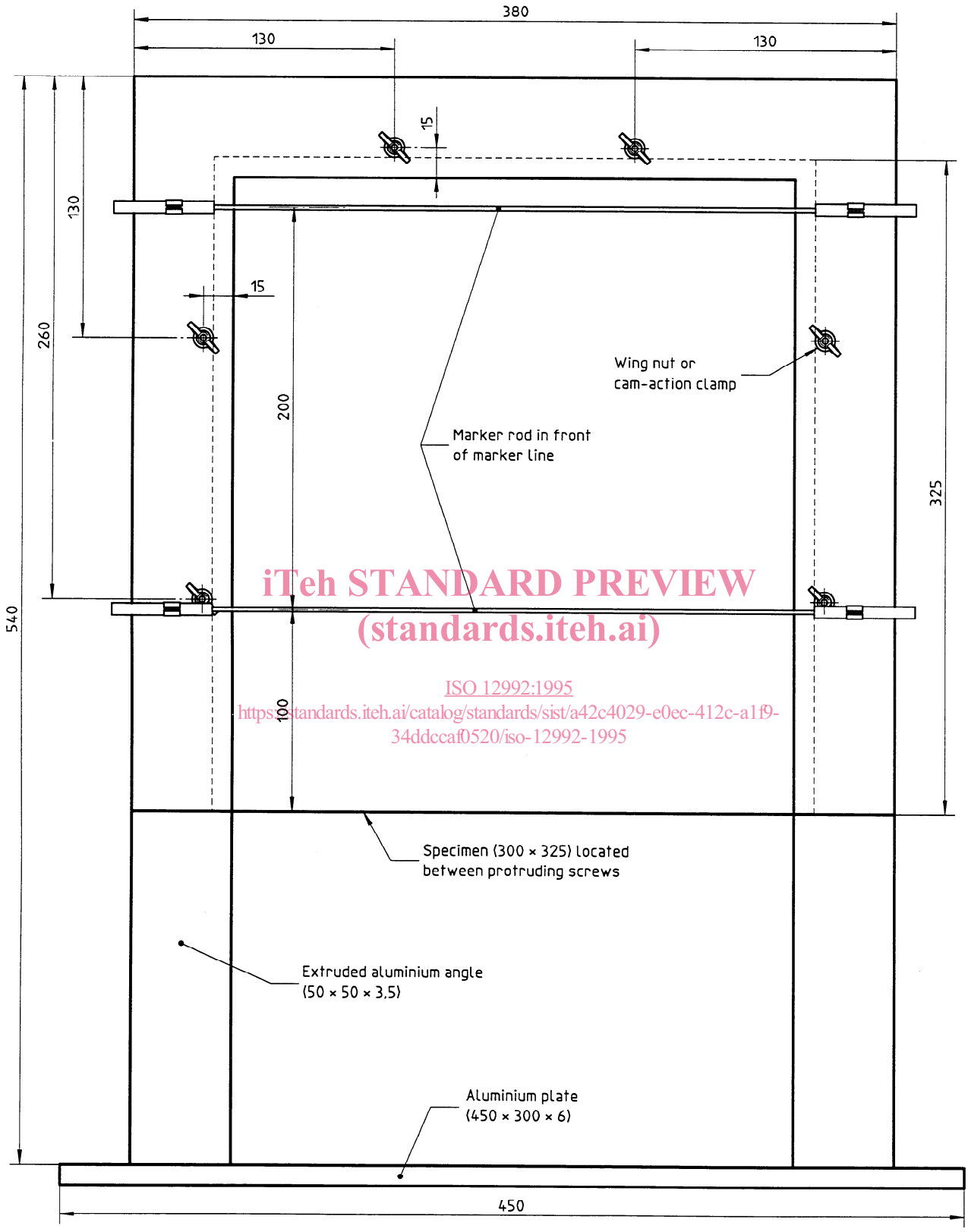


Figure 2 — Specimen support fixture — Front view

Dimensions in millimetres

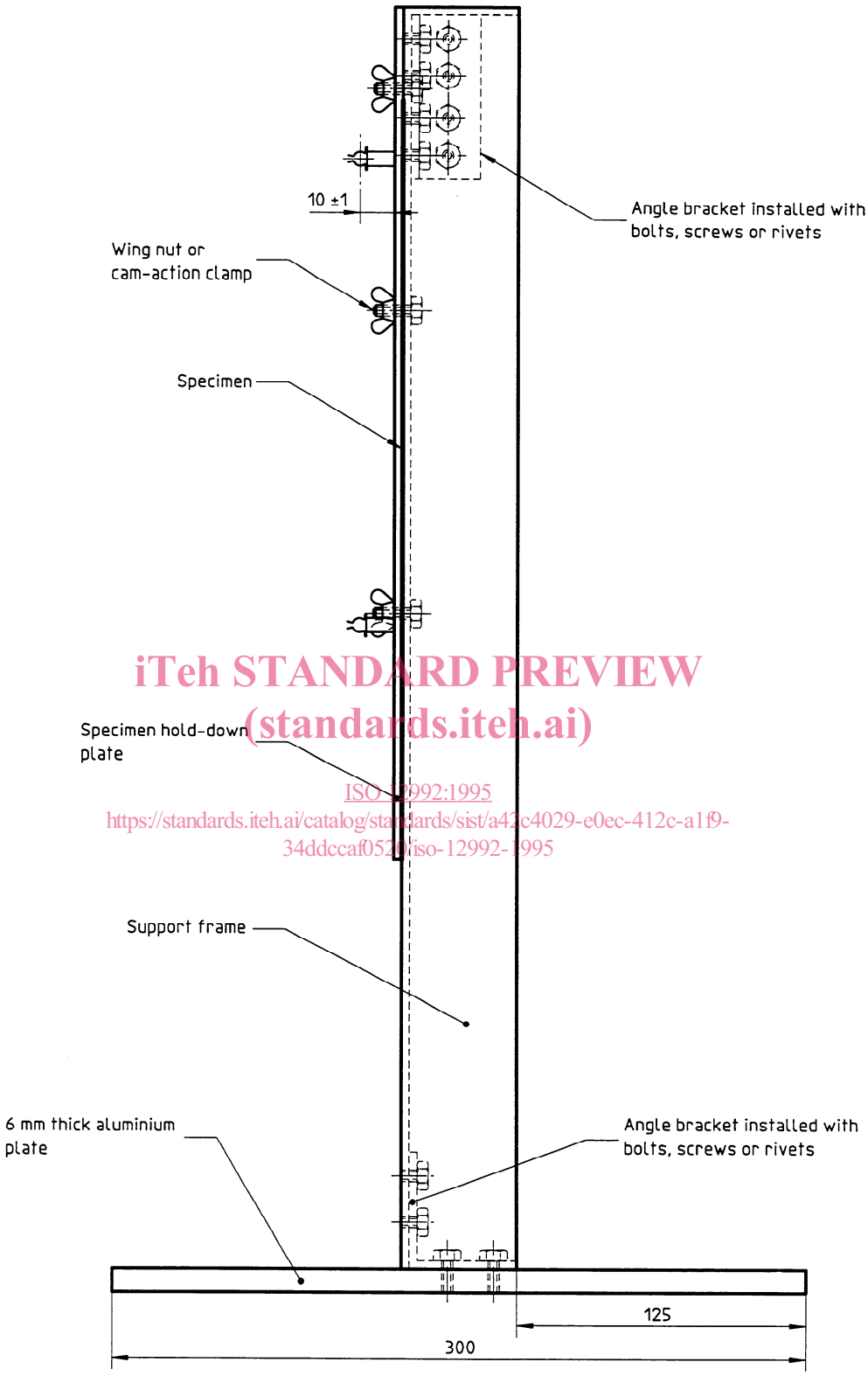


Figure 3 — Specimen support fixture — Side view

Dimensions in millimetres

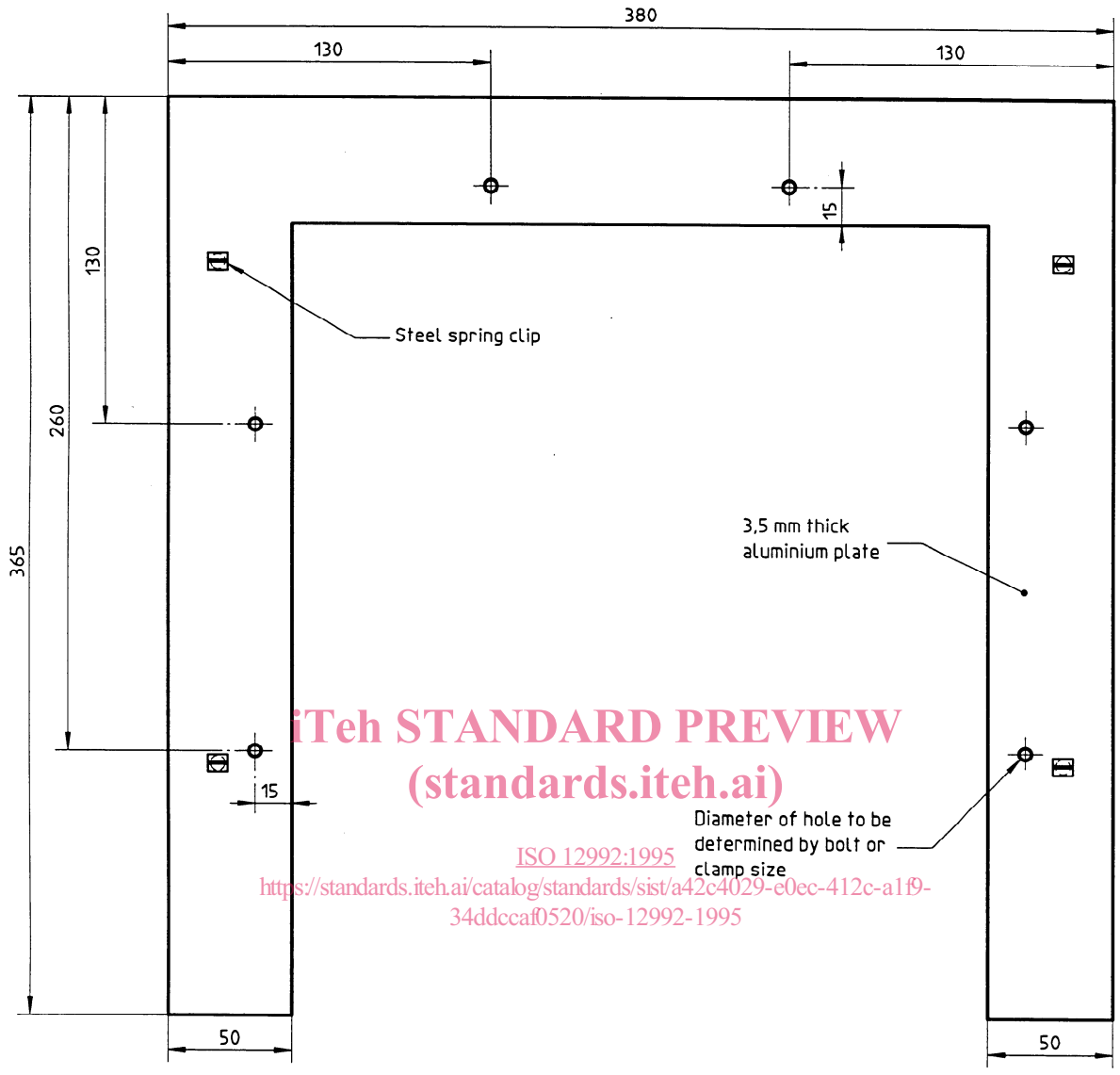


Figure 4 — Specimen hold-down plate

Dimensions in millimetres

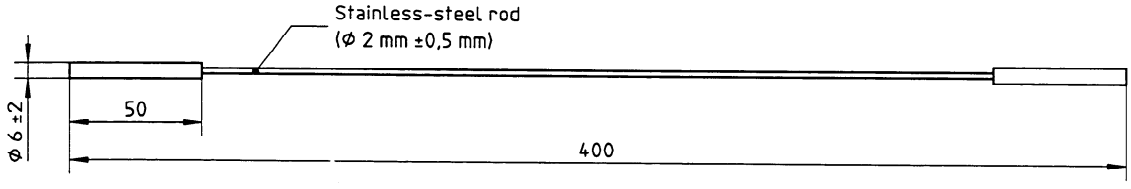


Figure 5 — Marker rod

8.3 Secure the specimen on the test frame with the 100 mm mark at the bottom. The specimen shall be fastened flat with no excessive wrinkles or stressing.

Fasten thin films to the top of the frame first and then tension them downwards to produce a uniform surface.

NOTE 2 The specimen can be spot taped or double-sided taped in place along its edges before the hold-down plate is installed, to maintain it in position.

8.4 Install the marker rods (6.3) on the test frame 10 mm ± 1 mm from the surface of the specimen at the 100 mm and 300 mm markings.

NOTE 3 Marker rods are not needed if the marker lines on the specimen are not distorted or obscured during the test.

8.5 Connect the burner (6.4) to a source of commercial-grade propane (6.5). Ignite the burner and adjust the gas flow so that the flame is 40 mm ± 4 mm high when the burner is oriented vertically. Allow the burner to pre-heat for 2 min. The air supply shall be such that a blue flame is obtained with a small yellow tip (see ISO 11925-2).

NOTE 4 The propane flow rate will be approximately 62 cm^3/min for this flame height.

Dimensions in millimetres

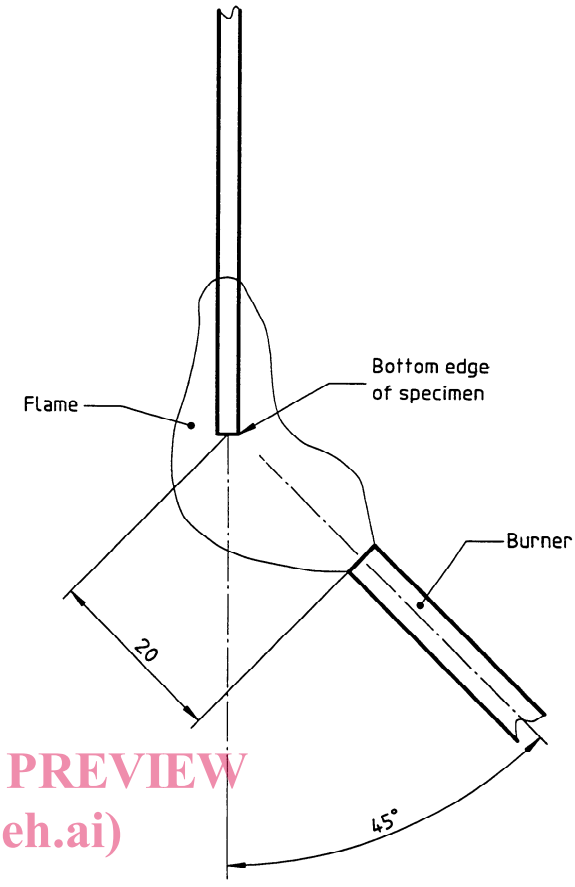


Figure 6 — Position of burner

8.6 Position the burner at 45° to the vertical such that the top of the burner is 20 mm from the bottom edge of the specimen and located on the vertical centreline of the face of the specimen (see figure 6). Ensure that the edge of the specimen bisects the flame.

NOTE 5 An automatic or fixed alignment fixture for positioning the burner has been found to produce consistent results.

8.7 Smoothly apply the burner flame to the specimen and start the timing device (6.7). Maintain the burner flame in position for a period of 60 s.

8.8 Measure and record the time taken for the flame to reach the 100 mm and 300 mm marks (t_1 and t_2).

8.9 Test three specimens. If inconsistent results, such as non-ignition of a single specimen, are obtained, repeat the test on a second set of three specimens. If inconsistent results are obtained on the second set, describe details in the report.

8.10 If, during the 60 s ignition period, the specimen distorts away from and out of reach of the flame without ignition, then the result is not valid.

8.11 Calculate the flame spread rate (FSR), in millimetres per second, for each specimen between the 100 mm marking and 300 mm marking, using the equation

$$FSR = \frac{200}{t_2 - t_1}$$

9 Precision

9.1 Results

Table 1 gives the results of an interlaboratory experiment conducted in 1993 involving seven laboratories testing eight materials. Two of the materials tested (PVC and PC) ceased to burn before the 300 mm marking and their flame spread rate (FSR) could not be determined. Therefore, these materials are not included in table 1. The results were analysed using