BS EN 3844-2:2011

BSI Standards Publication

Aerospace series — Flammability of non metallic materials

Part 2: Small burner test, horizontal — Determination of the horizontal flame propagation

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National foreword

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The UK participation in its preparation was entrusted to Technical Committee ACE/65, Non-metallic materials for aerospace purposes (excluding textiles).

A list of organizations represented on this committee can be obtained on request to its secretary.

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ISBN 978 0 580 73880 7

ICS 13.220.40; 49.025.99

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This British Standard was published under the authority of the Standards Policy and Strategy Committee on 30 November 2011.

Amendments issued since publication

Date	Text affected

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 3844-2

November 2011

ICS 49.025.15

English Version

Aerospace series - Flammability of non metallic materials - Part 2: Small burner test, horizontal - Determination of the horizontal flame propagation

Série aérospatiale - Inflammabilité des matériaux non métalliques - Partie 2: Essai au brûleur, horizontal - Détermination de la propagation horizontale de la flamme

Luft- und Raumfahrt - Entflammbarkeit nichtmetallischer Werkstoffe - Teil 2: Kleinbrenner-Prüfung, waagerecht - Bestimmung der waagerechten Flammenausbreitung

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Foreword

This document (EN 3844-2:2011) has been prepared by the Aerospace and Defence Industries Association of Europe - Standardization (ASD-STAN).

After enquiries and votes carried out in accordance with the rules of this Association, this Standard has received the approval of the National Associations and the Official Services of the member countries of ASD, prior to its presentation to CEN.

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of an identical text or by endorsement, at the latest by May 2012, and conflicting national standards shall be withdrawn at the latest by May 2012.

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1 Scope

This European Standard specifies the test method for the determination of the horizontal flame propagation of non metallic materials when subjected to a small flame.

This test method is also used for testing non metallic materials which have to meet the test criteria for the horizontal Bunsen burner test.

It is used for evaluation of non metallic materials or constructions used in the interiors of aerospace vehicles but may be used in other applications as specified in applicable procurement and regulatory documents.

This standard should be used to measure and describe the properties of non metallic materials, products or assemblies in response to heat and flame under controlled laboratory conditions and should not be used to describe or appraise the fire hazard or fire risk of materials, products, or assemblies under actual fire conditions. However results of this test may be used as elements of a fire risk assessment which takes into account all of the factors which are pertinent to an assessment of the fire hazard of a particular end use.

2 Normative references

The following referenced documents are indispensable for the application 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.

ASTM-D 5025, *A laboratory burner used for small-scale burning test on plastic materials* 1)

3 Terms and definitions

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

3.1
flame spread rate
distance travelled by a flame front during its propagation, per unit time, under specified test conditions

NOTE In this test, it is the speed with which a flame front moves across a test specimen mounted horizontally.

3.2
time of flame application
length of time the burner flame is applied to the specimen

3.2
burn length
distance in millimetres from the original specimen edge to the farthest evidence of damage of the test specimen due to that area's combustion, including areas of partial consumption, charring, or embrittlement, but not including areas sooted, stained, warped or discoloured, nor areas where material has shrunk or melted away from the heat

4 Principle of method

Testing is performed on a specimen that is held horizontal. A burner flame, having defined parameters, is applied to the specimen for a defined period of time. The after flame time and the burn length is measured. The occurrence of drips and their after flame time is measured.

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1) Published by: ASTM National (US) American Society for Testing and Materials http://www.astm.org/.

5 Designation

EXAMPLE

Description block	Identity block
HORIZONTAL BUNSEN BURNER TEST	**EN3844-2**

Number of this standard

6 Test apparatus

6.1 Test cabinet

Tests shall be conducted in a draught-free cabinet, as shown in Figure 1. Details and dimensions of the test cabinet are given in Figure 2.

The cabinet shall have a removable cover which either contains a pyrex observation window with a 8,5 mm wide ventilating clearance all around, 50 mm away from the edges, or 28 equally spaced, 12,5 mm ventilating holes distributed over the cover evenly.

1 mm thick metal sheet shall be used for the bottom surface and the cabinet shall have six equally spaced 12,5 mm ventilating holes along each side, placed 45 mm above the lower end of the side wall.

It is recommended to paint the entire inside back walls of the cabinet mat black to facilitate the viewing of the test specimen.

Cabinets of larger dimensions may be used if it has been proven that similar results are obtained.

It is suggested that the cabinet be located inside an exhaust hood for clearing the cabinet of smoke and fumes after each test.

6.2 Specimen holder

The specimen holder shall be fabricated of corrosion-resistant metal.

A specimen holder shall be provided, such that the exposed area of the specimen is 50 mm × 305 mm. An example for a construction is given in Figure 3.

Each of the rectangular frames must be 6,5 mm in thickness. An example for a construction is given in Figure 3.

6.3 Burner

6.3.1 Burner type

The burner shall be a Bunsen or Tirril type, have a 9,5 mm inside diameter barrel, and shall be equipped with a needle valve to adjust the gas flow rate and thereby adjust the flame height.

The burner shall have no air supplied either directly or by aspiration. The Bunsen burner defined in ASTM-D 5025 has been found acceptable.

6.3.2 Burner fuel

Bottled methane gas shall be used as burner fuel. Natural gas is also acceptable if it contains more than 90 % methane.

6.3.3 Plumbing for gas supply

The necessary gas connections and the applicable plumbing shall be essentially as specified in Figure 4. A control valve system with a delivery rate designed to furnish gas to the burner under a pressure of at least 5 kPa at the burner inlet shall be installed between the gas supply and the burner.

6.3.4 Flame height indicator

There shall be a flame height indicator spaced 25 mm from the burner barrel and extending above the burner, as shown in Figure 5. The indicator shall have two prongs, 8 mm in length, marking the distances, 22 mm and 38 mm above the top of the burner. When the flame is properly adjusted, then the tip of the flame shall be at the 38 mm prong and for pure methane the tip of the inner cone of the flame will be at the 22 mm prong. The flame height indicator shall be removable.

6.4 Timer

One or more stop-watches or other timers, calibrated and graduated to the nearest 0,1 s, shall be used to measure the time of flame application and the time of the specimen burning.

6.5 Ruler

A ruler or a scale, calibrated and graduated to the nearest 1 mm, shall be used to measure the burn length and for specimen preparation.

7 Test specimens

7.1 Number of specimens

At least three specimens shall be prepared and tested.

7.2 Specimens orientation

For materials which may have anisotropic flammability properties (i.e. different properties in different directions, such as machine and cross-machine direction for extrusions, warp and weft for woven fabrics, etc.), the specimens shall be tested in both directions.

The values for every direction have to be averaged and reported separately.

7.3 Specimens preparation

The specimens shall be a rectangle of at least 75 mm × 305 mm.

7.4 Specimens size

Mark gauge lines on the back surface (opposite the exposed surface) of the specimen as shown in Figure 6.

8 Conditioning

Condition specimens at (23 ± 2) °C and at (50 ± 5) % relative humidity for min. 24 h. Remove only one specimen at a time from the conditioning environment immediately before being tested.

9 Burner adjustment

— Assure that the air supply to the burner is shut off.

— Open the stopcock in the gas line fully.

— Light the burner.

— Adjust the gas flowrate to produce a flame height of 38 mm.

10 Test procedure

Make sure that the test cabinet is essentially draught free.

Place the burner at least 76 mm away from the test position.

Mount the specimen into the specimen holder so that the clamped edges are held securely. One short edge of the specimen has to be flush with the open end of the specimen holder.

The exposed surface of the specimen, defined in the test specification shall be face down.

Insert the holder with the specimen into the cabinet.

Close the cabinet door, and keep it closed during the test.

Assure that the lower edge of the specimen is 19 mm above the level of the top of the burner.

Start the timer as soon as the burner is in test position.

Apply the flame for 15 s, then withdraw the burner by moving the burner into start position.

Note the times and/or locations on the specimen at which the following events occur:

— if the flame front crosses the 38 mm gauge line, note the elapsed time in seconds, t_{38}, at which the crossing occurs;

— if the flame front crosses the 292 mm gauge line, note the elapsed time in seconds, t_{292}, at which the crossing occurs;

— if the specimen burns very slowly so that the flame front does not reach the 292 mm gauge line within 5 min or if the flame extinguishes before reaching the 292 mm gauge line, the total burn length in millimetres and the elapsed time in seconds may be noted and the test terminated.

After all flaming ceases, open the cabinet door slowly to clear the test cabinet of fumes and smoke.

Remove any material from the bottom of the cabinet that fell from the specimen. If necessary, clean the test cabinet window prior to testing the next specimen.

11 Calculation

Depending on the burning behaviour of the material calculate the flame spread rate as follows:

a) if the flame front self-extinguished before crossing the 292 mm gauge line: no calculation, record the flame spread rate as 0;

b) if the most advanced part of the flame front reached the 292 mm gauge line calculate as follows: flame spread rate [mm/min] $= \frac{(292 - 38)\,[\text{mm}] \times 60\ [\text{s/min}]}{(t_{292} - t_{38})\,[\text{s}]}$;

c) if the specimen burnt very slowly so that the flame front does not reach the 292 mm gauge line within 5 min: no calculation, record the burn length in millimetres.

12 Report

The test report shall include the following data:

— complete description of the specimen material and specimen construction (material designation, manufacturer's identification, manufacturing number, construction, specimen thickness, density, etc.);

— manufacturer/supplier and order number;

— statement of conformity given by the quality assurance of specimen manufacturer;

— designation of the test method;

— flame spread rate for each specimen tested and the average value;

— burn length for each specimen tested;

— specimen orientation (if applicable);

— observations about melting, sagging, delamination, or other behaviour that affected the exposed surface area or mode of burning occurred, and the time in seconds at which such behaviour occurred;

— changes in test procedure required by the test specification;

— name and address of the test laboratory/organisation;

— date of testing;

— operator's name and signature of the responsible engineer.

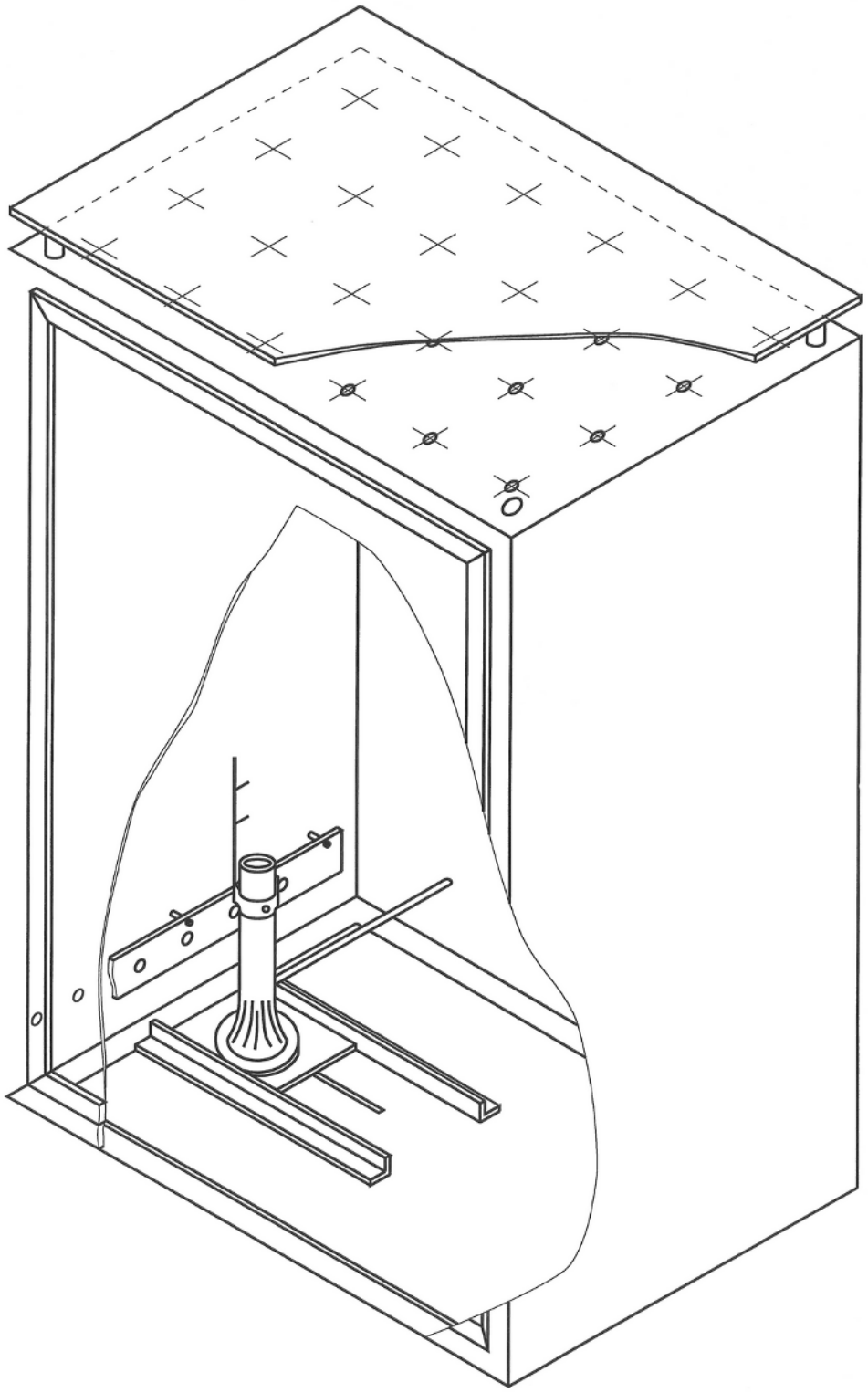


Figure 1 — Draught-free cabinet

Dimensions in millimetres

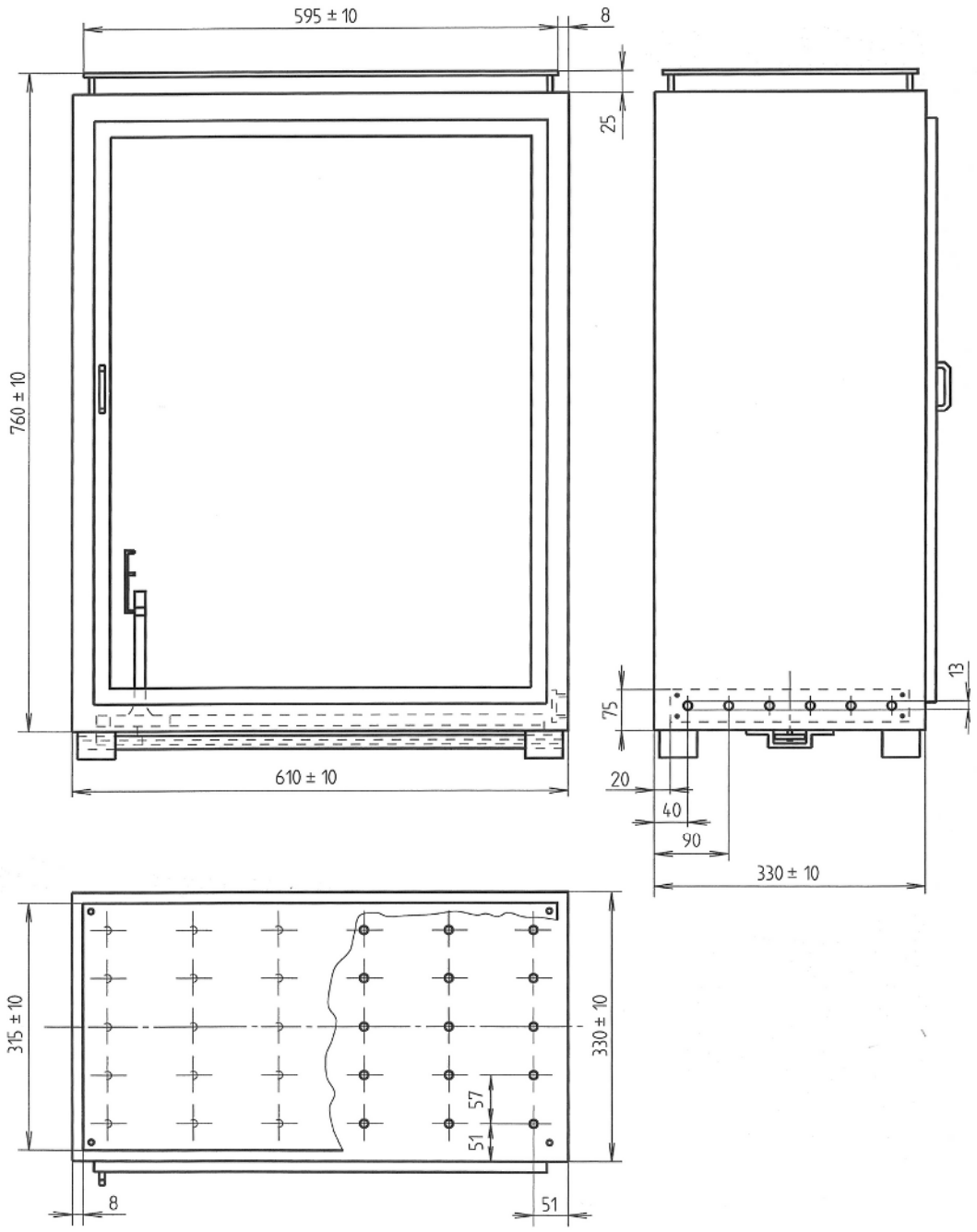


Figure 2 — Details and dimensions

Dimensions in millimetres

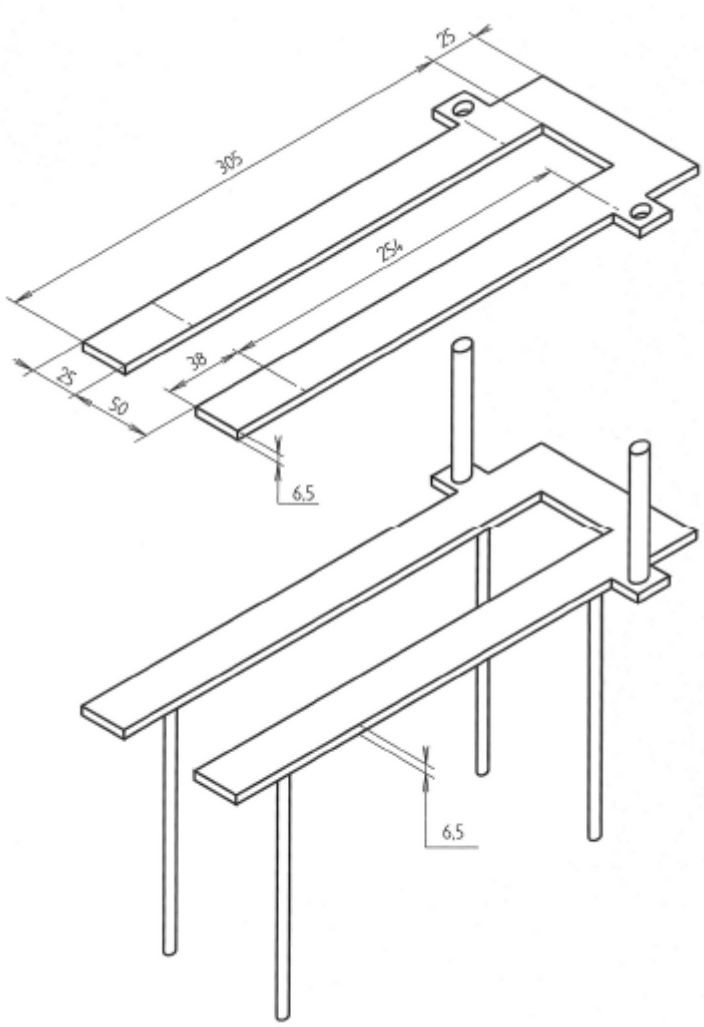
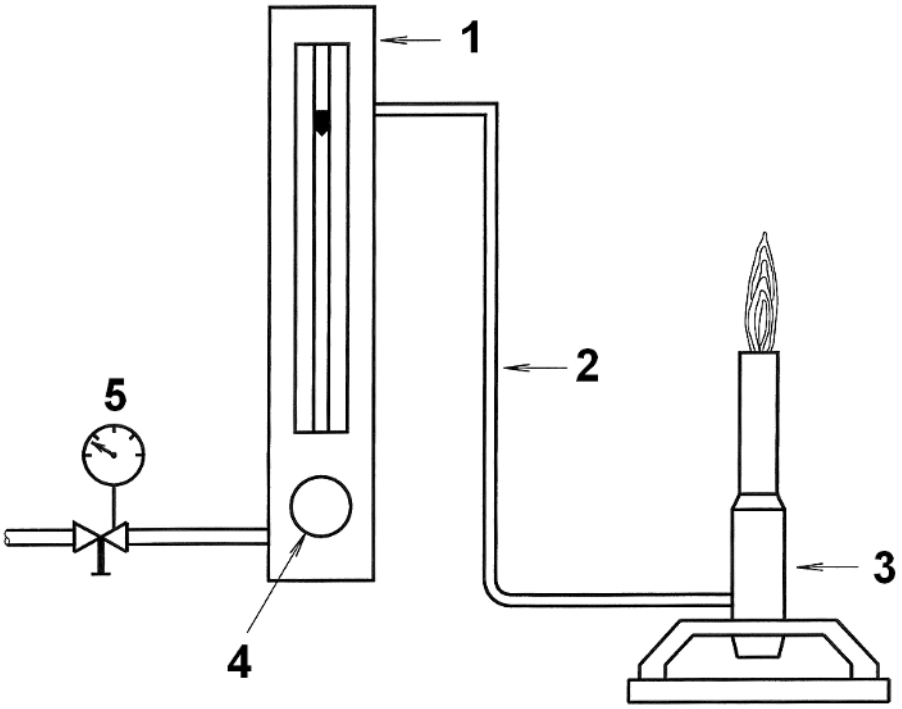


Figure 3 — Specimen holder

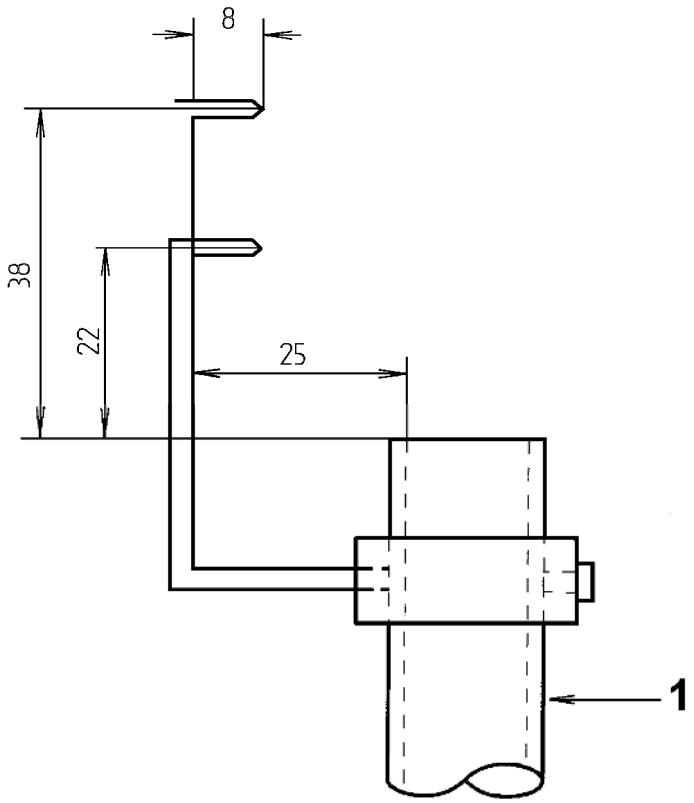


Key

1 flowmeter (optional)
2 hose
3 burner
4 needle valve
5 pressure-gauge valve

Figure 4 — Plumbing of gas supply

Dimensions in millimetres

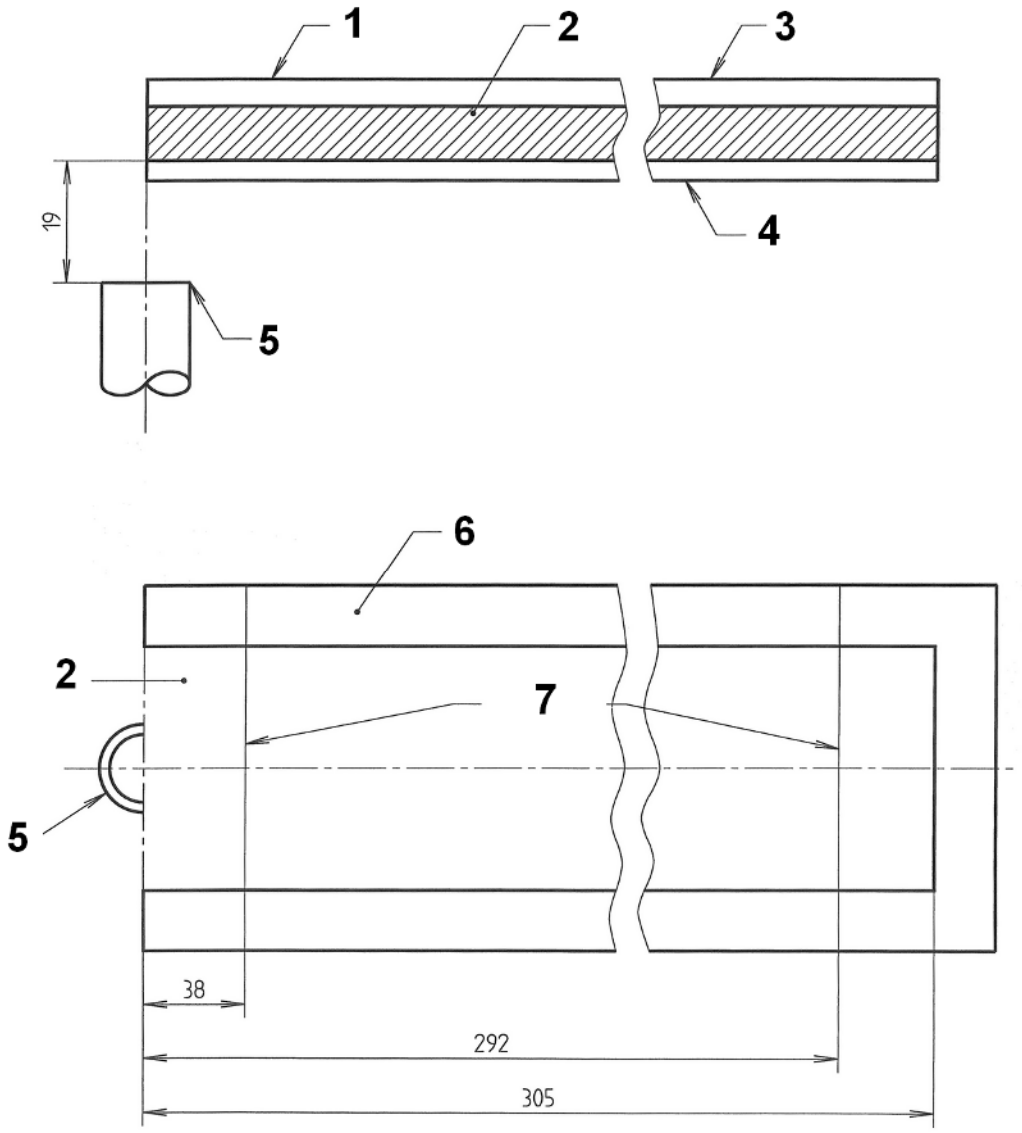


Key

1 burner

Figure 5 — Flame height indicator

Dimensions in millimetres



Key

1 frame
2 specimen
3 specimen holder (top)
4 specimen holder (bottom)
5 burner orifice
6 specimen holder
7 gauge lines

Figure 6 — Specimen and specimen holder in test position

Bibliography

For the preparation of this standard, the following documents were used:

[1] FAR Part 25 Section 25.853, Federal Aviation Administration Part 25 - Airworthiness Standards: Transport Category Airplanes - Fire Protection Sec 25.853 Compartment interiors

[2] FAR Part 25 Appendix F Part 1 Paragraph (a) (3) and (5), Federal Aviation Administration - Appendix F to Part 25. Part 1: Test criteria and procedures for showing compliance with § 25.853 or 25.855 (a) Material test criteria.

3) Vertical test.

5) Horizontal test.

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