

INTERNATIONAL STANDARD

IEC 61189-3

1997

AMENDMENT 1
1999-07

Amendment 1

**Test methods for electrical materials,
interconnection structures and assemblies –**

**Part 3:
Test methods for interconnection structures
(printed boards)**

Amendement 1

*Méthodes d'essai pour les matériaux électriques,
les structures d'interconnexion et les ensembles –*

*Partie 3:
Méthodes d'essai des structures d'interconnexion
(cartes imprimées)*

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For price, see current catalogue

FOREWORD

This amendment has been prepared by IEC technical committee 52: Printed circuits.

The text of this amendment is based on the following documents:

FDIS	Report on voting
52/805/FDIS	52/825/RVD

Full information on the voting for the approval of this amendment can be found in the report on voting indicated in the above table.

A bilingual version of this amendment may be issued at a later date.

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CONTENTS

Add the following figures to the list of figures:

Figure 10 – Needle burner test

Figure 11 – Pencil holder

Figure 12 – Composite test pattern

Figure 13 – Test specimen

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2 Normative references

Insert, in the existing list, the titles of the following standards:

IEC 60454-1:1992, *Specifications for pressure-sensitive adhesive tapes for electrical purposes – Part 1: General requirements*

IEC 60695-2-2:1991, *Fire hazard testing – Part 2: Test methods – Section 2: Needle-flame test*

IEC 62326-4:1996, *Printed boards – Part 4: Rigid multilayer printed boards with interlayer connections – Sectional specification*

IEC 62326-4-1:1996, *Printed boards – Part 4: Rigid multilayer printed boards with interlayer connections – Sectional specification – Section 1: Capability Detail Specification – Performance levels A, B and C*

ISO 4046:1978, *Paper, board, pulp and related terms – Vocabulary*

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7.2 Test 3D02: Conductor width and spacing (under consideration)

Replace this subclause by the following subclause:

7.2 Test 3D02: Conductor width and spacing

7.2.1 Object

The purpose of this test method is to provide a procedure for determining the conductor width and spacing of a printed board.

7.2.2 Test specimens

The specimen shall be a suitable printed board having conductor patterns for test.

Where the use of test coupons, as specified in IEC 62326-4-1, is agreed between the user and the supplier, the measurement shall be carried out on specimen F.

7.2.3 Test apparatus and materials

An illuminated eyepiece or microscope or projector having an ocular micrometer with a resolution of 0,01 mm or better shall be used.

7.2.4 Procedure

The conductor width and spacing between conductors shall be measured at random points, including central and corner areas, according to the relevant specification, and viewed vertically from above. The measured value shall be recorded to the nearest 0,01 mm. Edge defects such as indentations, projections, and slivers shall be excluded from measurement.

7.2.5 Report

The report shall include

- a) the test method number and revision;
- b) the date of the test;
- c) the identification and description of the specimen;
- d) the conductor width and spacing measured;
- e) the layer number;
- f) the number of measurements;
- g) the maximum and minimum observed conductor widths and spaces;
- h) the average conductor width and spaces;
- i) any deviation from this test method;
- j) the name of the person conducting the test.

7.2.6 Additional information

None.

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8.3 Test 3C03: Flammability; rigid printed board needle plane test (under consideration)

Replace this subclause by the following subclause:

8.3 Test 3C03: Flammability; needle flame test, rigid printed boards

8.3.1 Object

The object of the test is to determine the effect upon a printed board of exposure to a glowing wire under specific conditions.

The intensity of the ignition source is similar to that of an accidentally overheating or glowing of a single electronic component.

Reference should be made to 8.3 of IEC 60326-3, with regard to the fire integrity of printed boards and the suitability of test methods.

Timings measured by this test are an indication of the ability of the printed board to self-extinguish. There is no correlation with other properties of the material(s), such as the oxygen index.

8.3.2 Test specimen

The test specimen shall be a production board or a test board that is representative of the production board in terms of:

- base material(s);
- surface coating(s);
- type (for example multilayer, single-sided, etc.);
- size;
- design;
- surface area;
- thickness;
- metal distribution.

Test boards of 150 mm × 150 mm may be considered large enough to represent larger production boards. Smaller production boards should be tested in their actual size.

A minimum of five specimens shall be tested.

8.3.3 Test apparatus and materials

The following test apparatus and materials shall be used:

- a) A room or compartment, in which the test is conducted, having dimensions adequate to ensure that the test is carried out in a substantially draught-free atmosphere, but which allows a sufficient supply of air for normal combustion. Subdued light is advantageous.
- b) A burner to produce the test flame, which is a tube with a length of at least 35 mm with an internal diameter of $(0,5 \pm 0,1)$ mm and an external diameter not exceeding 0,9 mm. The burner shall be held in a movable fixture.

- c) A burner shall be supplied with butane gas having a minimum purity of 95 %. No air may be admitted to the burner tube. Propane gas may be used, but butane gas shall be the reference.

The burner shall be adjusted whilst in a vertical axis, in order to produce a flame having a height of (12 ± 1) mm. See figure 10a.

- d) A wooden board to be placed underneath the specimen. The board shall be covered with tissue paper which complies with 6.86 of ISO 4046. The distance between the lower edge of the specimen and the tissue paper shall be (200 ± 5) mm.
- e) A hand-operated timing device with a resolution of $\pm 0,5$ s or better.
- f) An air circulating oven capable of maintaining (125 ± 5) °C.
- g) A desiccator capable of maintaining 20 % R.H. or less.

8.3.4 Test procedure

The test specimens shall be pre-conditioned for 24 h at (125 ± 5) °C in an air-circulating oven. The test specimens shall then be allowed to stabilize for 4 h at room temperature in a desiccator over anhydrous calcium chloride.

The relevant specification shall detail the position of the test specimen and the point of application of the flame (for example surface, edge). The attitude of the specimen (for example horizontal or vertical) should mimic the intended mode of operation in the assembled equipment.

Where surface application is used, the point of application of the flame shall, specimen size permitting, not be less than 10 mm from the nearest edge, in order to minimize edge effects.

Where edge application is used, the flame shall not, specimen size permitting, be less than 10 mm from the nearest corner.

The burner shall be mounted at an angle of about 45°, so that any drops from the test specimen can fall freely onto the underlying tissue paper.

If the intended operational attitude of the printed board is not known or is variable, the test specimens shall be positioned as follows.

Edge application: The lower edge shall be horizontal and the specimen shall be inclined at approximately 80°. The flame shall be applied to the lower side of the test specimen.

The burner shall be ignited away from the test specimen, and the height of the flame shall be adjusted to (12 ± 2) mm. The burner shall then be positioned as described, so that the test specimen penetrates the flame by approximately 2 mm. A vertical distance of between 8 mm and 10 mm from the tip of the burner and the surface or edge to be tested is adequate for this purpose. In the case of application to a vertical surface, a horizontal distance of approximately 5 mm is necessary.

The detail specification shall state the severity to be used.

Test flame application times as detailed in clause 5 of IEC 60695-2-2 are preferred. These severities are: 5 s - 10 s - 20 s - 30 s - 60 s - 120 s.

8.3.5 Report

The report shall include

- a) the test number and revision;
- b) the date of the test;
- c) the identification and description of the specimen;
- d) the number of specimens, if other than five;
- e) the position of the test specimens;
- f) the point of application of the test flame;
- g) the duration of application of the test flame;
- h) for each specimen whether flames and/or burning or glowing particles fall from the test specimen spreading fire to surrounding parts of the test specimen or to the tissue paper beneath the test specimen;
- i) for each specimen whether there is flame or glowing at the end of the application of the test flame;
- j) for each specimen whether the duration of burning is less than 30 s;
- k) any deviation from this test method;
- l) the name of the person conducting the test.

8.3.6 Additional information

There are obvious hazards associated with flammability testing. Training of test operators and familiarity with laboratory safety procedures is of paramount importance.

The smoothness of the specimen edges can be critical to the performance of the sample. A polished finish is recommended. A rough finish (for example blanked) will significantly degrade performance due to the increase in surface area available to the flame.

Small-scale flammability tests, such as the one described herein, are an indicator of the behaviour of the material(s) tested. Fire integrity of equipment in which printed boards are used can only be assessed by equipment level testing.

Detail requirements to be stated in specifications which reference this test method should be based on clause 11 of IEC 60695-2-2.

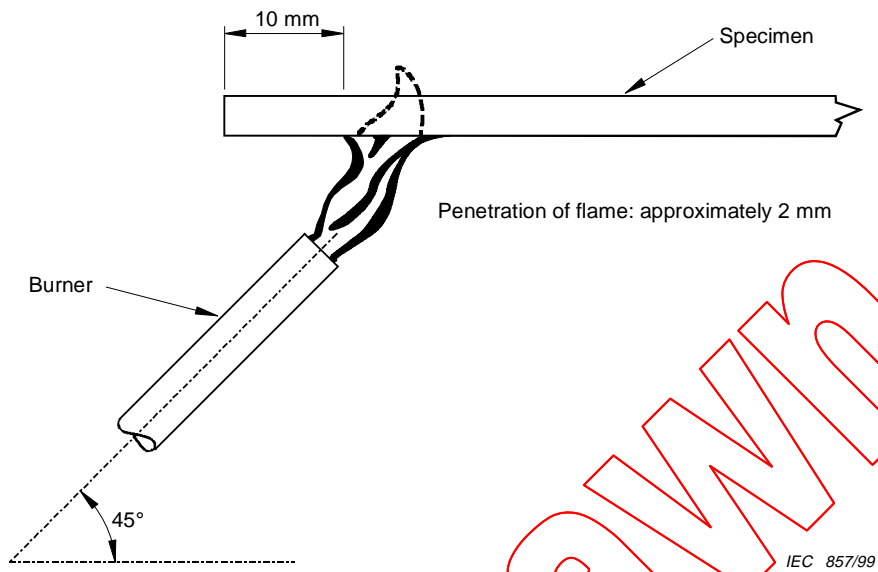


Figure 10a – Horizontal specimen – Flame applied to surface

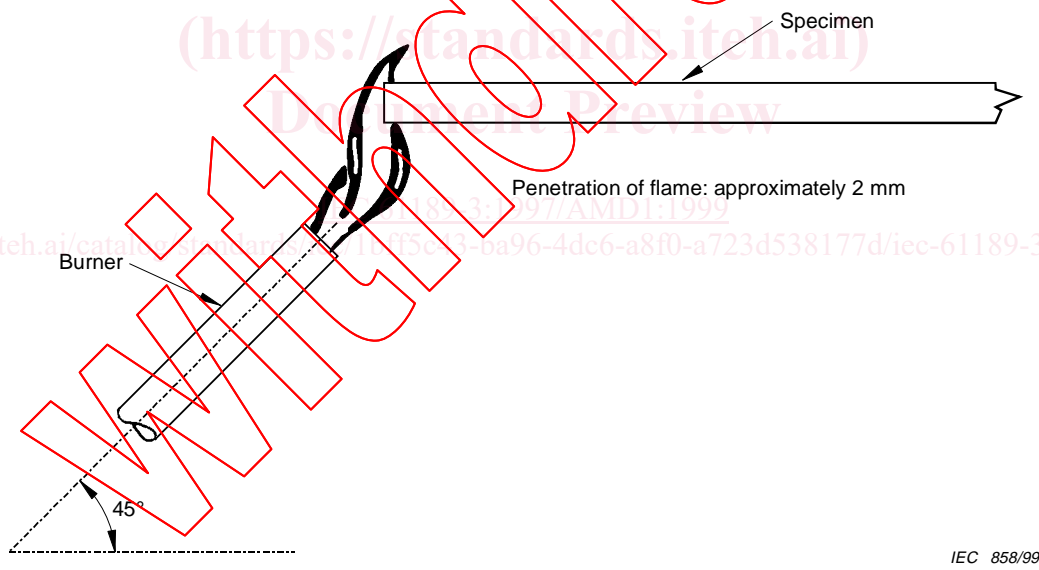


Figure 10b – Horizontal specimen – Flame applied to edge

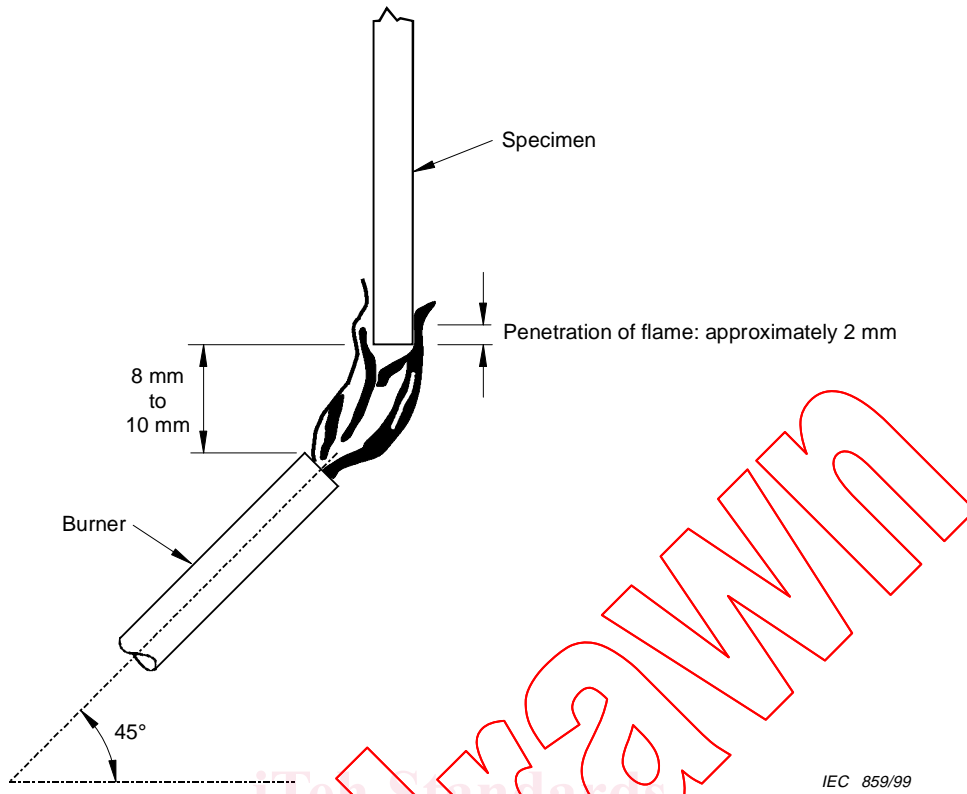


Figure 10c – Vertical specimen – Lower edge horizontal – Flame applied to edge

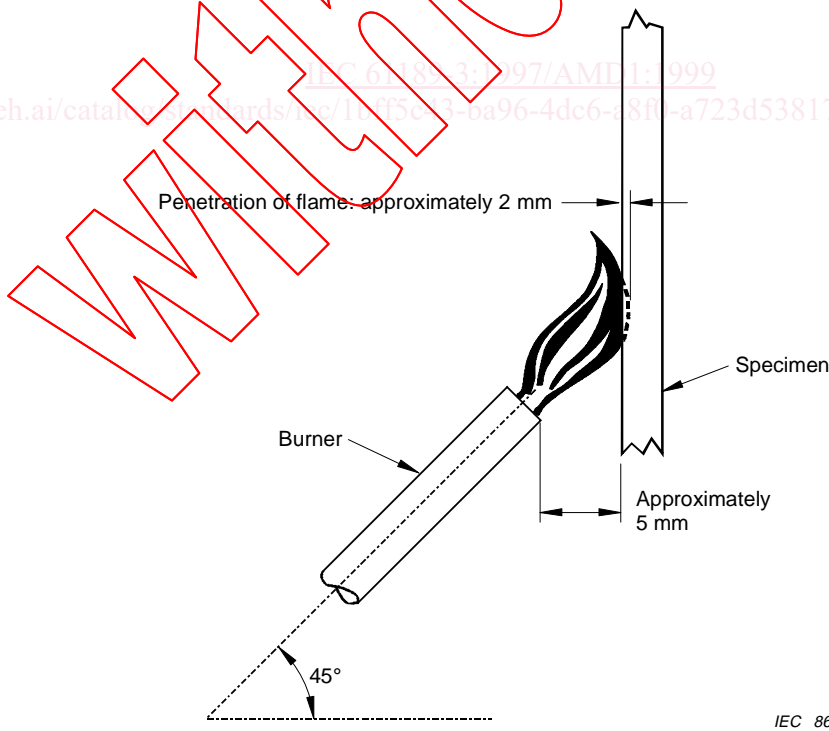


Figure 10d – Vertical specimen – Lower edge horizontal – Flame applied to surface

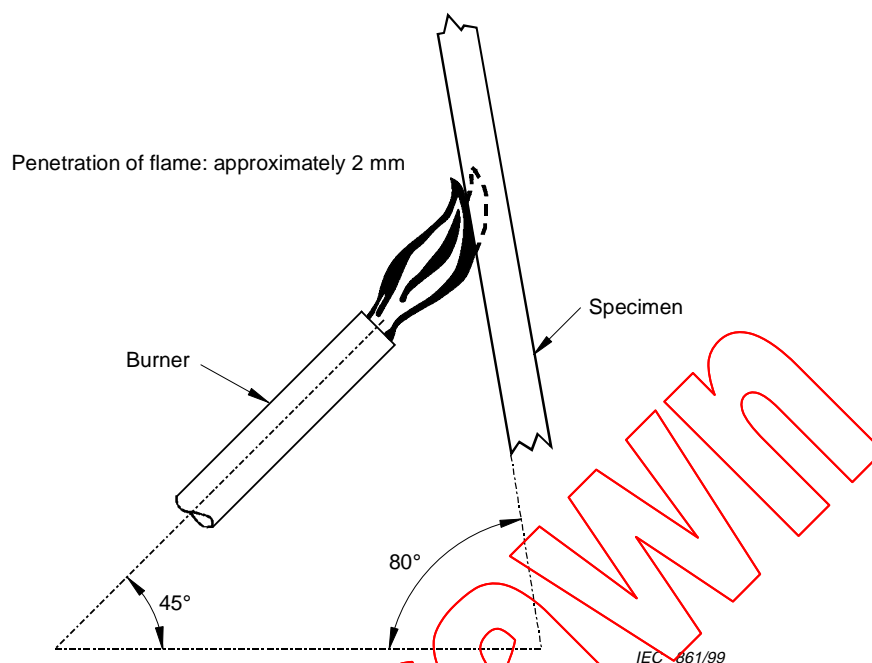


Figure 10e – Needle burner test – Side views of test board and burner

Figure 10 – Needle burner test

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9.8 Test 3M08: Resistance of abrasion of printed board organic surface coatings
(under consideration)

Replace this subclause by the following subclause:

9.8 Test 3M08: Hardness (resistance to abrasion) of organic surface coatings of printed circuit boards

9.8.1 Object

This test method details the procedure for the determination of the hardness of permanent organic surface coatings used on printed boards.

Organic materials suitable for testing in accordance with this procedure include:

- permanent polymeric coatings;
- conductive inks;
- marking legend inks.

Hardness is determined by comparison with a standard set of pencils with increasing hardness.

9.8.2 Test specimens

The test specimen shall consist of a piece of metal-clad base material (100 ± 10) mm \times (100 ± 10) mm, with the organic surface coating applied and cured as recommended by the supplier.

Alternatively, a coated portion of a production board may be used as agreed between the customer and the supplier.

A minimum of three specimens (separate boards) shall be tested.

9.8.3 Test apparatus and materials

The following test apparatus and materials shall be used:

- a) Test device (pencil holder, see figure 11).
- b) Standard set of pencils of hardness from 4B to 8H.

4B, 3B, 2B, B, HB, F, H, 2H, 3H, 4H, 5H, 6H, 7H, 8H
 Soft ————— Hard

9.8.4 Procedure

Place the specimen on a firm horizontal surface.

The tips of all pencils shall be sharpened as shown in figure 11.

Starting with the hardest pencil in the carriage, push the carriage in the direction as illustrated in figure 11 with a uniform forward force in a 20 mm to 30 mm stroke, whereby, because of the weight of the specimen holder of (750 ± 25) g, a downward directed force of $(7,65 \pm 0,25)$ N will result at the pencil tip. Proceed with the next softest pencil in succession until a pencil is used which will not cut into or gouge the coating material. Used pencils shall be resharpened after every test.

The hardness is an attribute, rather than a variable. No statement of uncertainty is required.

9.8.5 Report

The report shall include

- a) the test method and revision;
- b) the date of the test;
- c) the identification and description of the specimen(s);

- d) the achieved hardness; i.e. the hardness of the pencil which failed to cut into or gouge the organic surface coating;
- e) the supplier and description of the pencil set;
- f) any deviation from this test method;
- g) the name of the person conducting the test.

9.8.6 Additional information

It is accepted that the results achieved using this test method are subjective in nature. To limit this subjectivity, it is recommended that only professional grade draftsman's pencils are used. Where disputes between testing agencies result, an agreed single source of pencil should be used for the test.

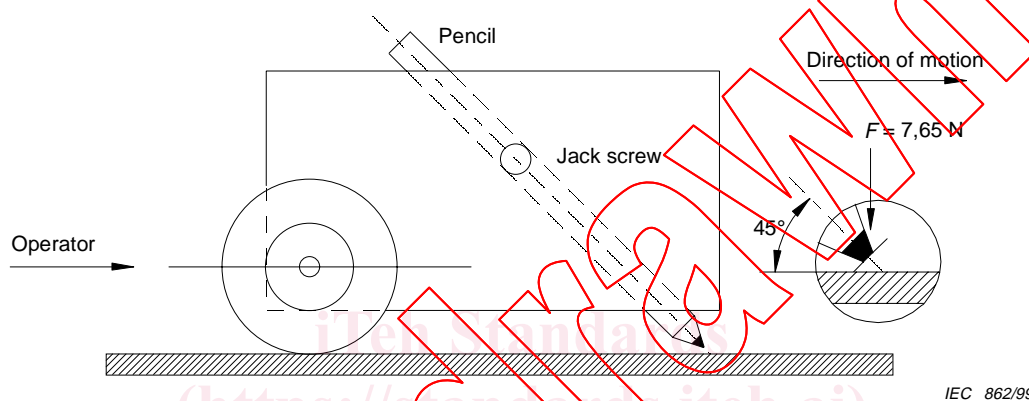


Figure 11 – Pencil holder

10.8 Test 3E08: Plated-through hole resistance change, thermo-cycle (under consideration)

Replace this subclause by the following subclause:

10.8 Test 3E08: Plated-through hole (pth) resistance change, thermal cycling

10.8.1 General

The purpose of this test method is to provide a procedure for determining the change in resistance of plated-through holes that may occur when the holes are subjected to thermal cycling. An alternative test method is 3E16: Plated-through hole (pth) and interconnection resistance change, thermal shock.