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Basic environmental testing procedures - Part 2: Tests - Test T: Soldering

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BASIC ENVIRONMENTAL TESTING PROCEDURES
PART 2: TESTS
TEST T: SOLDERING

Essais fondamentaux climatiques et de robustesse mécanique
Deuxième partie: Essais
Essai T: Soudure

Umweltprüfungen
Teil 2: Prüfungen
Prüfgruppe T: Löten

BODY OF THE HD

The Harmonization Document consists of:

RD: IEC 68-2-20:1979 + A2:1987

This Harmonization Document was approved by CENELEC on 1988-02-29.

The English and French versions of this Harmonization Document are provided by the text of the IEC publication and the German version is the official translation of the IEC text.

According to the CENELEC Internal Regulations the CENELEC member National Committees are bound:

to announce the existence of this Harmonization Document at national level
by or before -

to publish their new harmonized national standard
by or before 1988-02-28

to withdraw all conflicting national standards
by or before - .

Harmonized national standards are listed on the HD information sheet, which is available from the CENELEC National Committees or from the CENELEC Central Secretariat.

The CENELEC National Committees are the national electrotechnical committees of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxemburg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

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Essai T: Soudure

Basic environmental testing procedures

Part 2: Tests

Test T: Soldering

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

BASIC ENVIRONMENTAL TESTING PROCEDURES

Part 2: Tests — Test T: Soldering

FOREWORD

1) The formal decisions or agreements of the IEC on technical matters, prepared by Technical Committees on which all the National Committees having a special interest therein are represented, express, as nearly as possible, an international consensus of opinion on the subjects dealt with.

2) They have the form of recommendations for international use and they are accepted by the National Committees in that sense.

3) In order to promote international unification, the IEC expresses the wish that all National Committees should adopt the text of the IEC recommendation for their national rules in so far as national conditions will permit. Any divergence between the IEC recommendation and the corresponding national rules should, as far as possible, be clearly indicated in the latter.

PREFACE

This standard has been prepared by Sub-Committee 50C, Miscellaneous Environmental Tests, of IEC Technical Committee No. 50, Environmental Testing.

This edition supersedes all previous editions.

A first draft was discussed at the meeting held in The Hague in 1975. As a result of this meeting, a draft, Document 50C(Central Office)7, was submitted to the National Committees for approval under the Six Months' Rule in September 1976.

Amendments, Document 50C(Central Office)16, were submitted to the National Committees for approval under the Two Months' Procedure in March 1978.

The following countries voted explicitly in favour of publication:

Australia	Germany	South Africa (Republic of)
Austria	Hungary	Spain
Belgium	Israel	Sweden
Brazil	Italy	Switzerland
Denmark	Netherlands	Turkey
Egypt	Norway	United Kingdom
Finland	Poland	United States of America
France	Portugal	

Other IEC publications quoted in this standard:

Publications Nos. 68-1: Basic Environmental Testing Procedures. Part 1: General.
68-2-2: Part 2: Tests. Tests B: Dry Heat.
68-2-3: Test Ca: Damp Heat, Steady State.
249: Metal-clad Base Materials for Printed Circuits.
326-2: Printed Boards. Part 2: Test Methods.

Note concerning Clause C.1 of Appendix C

"WW" is a common designation of very white (pure) colophany that is well known by experts all over the world and used by all suppliers of colophany.

The "ball and ring" method is known and used in laboratories where colophany is tested.

The flow point (or dropping point) method, known as "Ubbelohde method" is known and commonly used in laboratories where colophany is tested. It is a variant of the method of test for the "dropping point of lubricating grease" given in ISO 2176. The "Ubbelohde method" is used mainly for the testing of bitumen.

BASIC ENVIRONMENTAL TESTING PROCEDURES

Part 2: Tests — Test T: Soldering

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1. Scope

This standard is applicable to all electrical and electronic components liable to be submitted to the tests described below.

2. Object

To determine the ability of component terminations and printed circuits to wet easily, and to check that the component itself will not be damaged by assembly soldering processes.

3. Terminology

Note. — (Refers to French text only).

3.1 *Colophony*

A natural resin obtained as the residue after removal of turpentine from the oleo-resin of the pine tree, consisting mainly of abietic acid and related resin acids, the remainder being resin acid esters.

Note. — "Rosin" is a synonym for colophony, and is deprecated because of the common confusion with the generic term "resin".

3.2 *Contact angle*

In general the angle enclosed between two planes, tangent to a liquid surface and a solid/liquid interface at their intersection (see Figure 1). In particular the contact angle of liquid solder in contact with a solid metal surface.

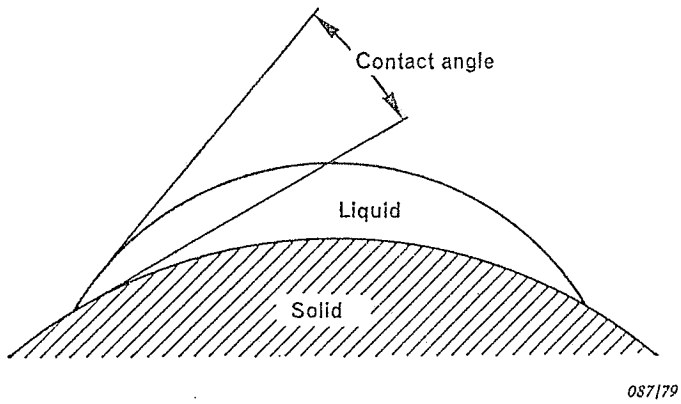

FIGURE 1

3.3 *Wetting*

The formation of an adherent coating of solder on a surface. A small contact angle is indicative of wetting.

3.4 *Non-wetting*

The inability to form an adherent coating of solder on a surface. In this case the contact angle is much greater than 90°.

3.5 *De-wetting*

The retraction of molten solder on a solid area that it has initially wetted. In some cases an extremely thin film of solder may remain. As the solder retracts the contact angle increases.

3.6 *Solderability*

The property of a surface which allows it to be readily wetted by molten solder.

3.7 *Soldering time*

The time required for a defined surface area to be wetted under specific conditions.

3.8 *Resistance to soldering heat*

The ability of a specimen to withstand the heating stresses produced by soldering.

4. Test Ta: Solderability of wire and tag terminations

4.1 *Object*

To determine the solderability of the areas on wire and tag terminations that are required to be wetted by solder, and, if required, to determine any de-wetting.

4.2 *General description of the test*

Test Ta provides three different test methods, viz.:

Method 1: Solder bath at 235 °C

Method 2: Soldering iron at 350 °C

Method 3: Solder globule at 235 °C

Method 1 with suitable changes in times and temperatures is used to determine de-wetting behaviour.

The test method to be used shall be indicated in the relevant specification. The solder bath method is the one which simulates most closely the soldering procedures that are generally used in practice; however, it is not practicable to express the results as a number.

With the solder globule method a specimen of round wire termination bisects a globule of molten solder of a given weight. It is easy to apply and the soldering time is a precise inspection criterion.

The soldering iron method may be used in cases where the other two methods are impracticable.

If required by the relevant specification, the test conditioning may be preceded by accelerated ageing. The relevant specification shall indicate one of the following ageing procedures:

Ageing 1a: 1 h steam ageing

Ageing 1b: 4 h steam ageing

Ageing 2: 10 days damp heat, steady state condition (Test Ca)

Ageing 3: 16 h at 155 °C dry heat (Test Ba).

4.3 *Specimen preparation*

4.3.1 The surface to be tested shall be in the "as received" condition and shall not be subsequently touched by the fingers or otherwise contaminated.

4.3.2 The specimen shall not be cleaned prior to the application of a solderability test. If required by the relevant specification, the specimen may be degreased by immersion in a neutral organic solvent at room temperature.

4.4 *Initial measurements*

The specimens shall be visually examined and, if required by the relevant specification, electrically and mechanically checked.

4.5 *Accelerated ageing*

If accelerated ageing is required by the relevant specification, one of the following procedures shall be adopted.

Note. — Terminations may be detached if the ageing temperature is higher than the component's maximum operating or storage temperature, or if the component is likely to degrade considerably at 100 °C in steam and thus affect the solderability in a manner which would not normally occur in natural ageing.

4.5.1 *Ageing 1*

The relevant specification shall indicate whether ageing 1a (1 h in steam) or ageing 1b (4 h in steam) is to be used. For these procedures the specimen is suspended, preferably with the termination vertical, with the area to be tested positioned 25 mm to 30 mm above the surface of boiling distilled water which is contained in a borosilicate glass or stainless steel vessel of suitable size (e.g., a 2 l beaker). The termination shall be not less than 10 mm from the walls of the vessel.

The vessel shall be provided with a cover of like material consisting of one or more plates which are capable of covering approximately seven-eighths of the opening. A suitable method of suspending the specimens shall be devised; perforations or slots in the cover are permitted for this purpose. The specimen holder shall be non-metallic.

The level of water shall be maintained by the addition of hot distilled water, added gradually in small quantities, so that the water will continue to boil vigorously; alternatively a reflux condenser may be provided if desired. (See Figure 3, Appendix A.)

4.5.2 *Ageing 2*

Specimens are subjected to 10 days damp heat, steady state, according to Test Ca of IEC Publication 68-2-3, Part 2: Tests. Test Ca: Damp Heat, Steady State.

4.5.3 *Ageing 3*

Specimens are subjected to 16 h dry heat at 155 °C according to Test Ba of IEC Publication 68-2-2, Part 2: Tests. Tests B: Dry Heat.

4.5.4 At the end of the conditioning, the specimen shall be subjected to standard atmospheric conditions for testing for not less than 2 h and not more than 24 h.

4.6 *Method 1: Solder bath at 235 °C*

This method provides a procedure for assessing the solderability of wires, tags, and terminations of irregular form.

4.6.1 *Description of solder bath*

The solder bath shall be not less than 40 mm in depth and not less than 300 ml in volume. The bath shall contain solder as specified in Appendix B, and the temperature of the solder in the bath prior to the test shall be 235 ± 5 °C.

4.6.2 *Flux*

The flux to be used shall consist of 25% by weight of colophony in 75% by weight of 2-propanol (isopropanol) or of ethyl alcohol, as specified in Appendix C.

When non-activated flux is inappropriate, the above flux with the addition of diethylammonium chloride (analytical reagent grade), up to an amount of 0.5% chloride (expressed as free chlorine based on the colophony content), may be used as required by the relevant specification.

4.6.3 *Procedure*

The surface of the molten solder shall be wiped clean and bright with a piece of suitable material immediately before each test.

The termination to be tested shall be immersed first in the flux described in Sub-clause 4.6.2 at laboratory temperature, and excess flux shall be eliminated either by draining off for a suitable time, or by using any other procedure likely to produce a similar result. In case of dispute, drainage shall be carried out for 1 min ± 5 s.

The termination is then immersed immediately in the solder bath in the direction of its longitudinal axis. The point of immersion of the termination shall be at a distance not less than 10 mm from the walls of the bath.

The speed of immersion shall be 25 ± 2.5 mm/s and the termination shall remain immersed for 2.0 ± 0.5 s with the body of the component at the distance above the solder prescribed in the relevant specification. The specimen shall then be withdrawn at 25 ± 2.5 mm/s.

For components having a high thermal capacity the relevant specification may prescribe an immersion time of 5.0 ± 0.5 s.

If required by the relevant specification, a screen of thermally insulating material of 1.5 ± 0.5 mm thickness with clearance holes appropriate to the size of the termination may be placed between the body of the component and the molten solder.

Any flux residue shall be removed with 2-propanol (isopropanol) or ethyl alcohol.

4.6.4 *Requirements*

Inspection shall be carried out under adequate light with normal eyesight or with the assistance of a magnifier capable of giving a magnification of 4× to 10×.

The dipped surface shall be covered with a smooth and bright solder coating with no more than small amounts of scattered imperfections such as pin-holes or un-wetted or de-wetted areas. These imperfections shall not be concentrated in one area.

4.7 *Method 2: Soldering iron at 350 °C*

This method provides a procedure for assessing the solderability of terminations in cases where the solder bath or globule methods are impracticable.