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Basic environmental testing procedures - Part 2: Tests - Test TA: Soldering -  
Solderability testing by the wetting balance method

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BASIC ENVIRONMENTAL TESTING PROCEDURES  
PART 2: TESTS  
TEST Ta: SOLDERING  
SOLDERABILITY TESTING BY THE WETTING BALANCE METHOD

Essais fondamentaux climatiques  
et de robustesse mécanique  
Deuxième partie: Essais  
Essai Ta: Soudure  
Essai de soudabilité  
par la méthode de la  
balance de mouillage

Grundlegende  
Umweltprüfverfahren  
Teil 2: Prüfungen  
Prüfung Ta: Löten  
Prüfung der Lötbarkeit  
mit der Benetzungswaage

BODY OF THE HD  
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The Harmonization Document consists of:

- IEC 68-2-54 (1985) ed 1; IEC/TC 50, not appended

This Harmonization Document was approved by CENELEC on 1986-02-27.

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 1987-02-01

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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COMMISSION ÉLECTROTECHNIQUE INTERNATIONALE  
NORME DE LA CEI

A

INTERNATIONAL ELECTROTECHNICAL COMMISSION  
IEC STANDARD

Publication 68-2-54  
Première édition — First edition  
1985

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Essais fondamentaux climatiques et de robustesse mécanique  
Deuxième partie: Essais  
Essai Ta: Soudure  
Essai de soudabilité par la méthode de la balance de mouillage

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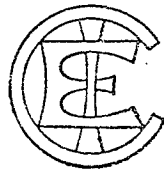
Basic environmental testing procedures

Part 2: Tests

Test Ta: Soldering

Solderability testing by the wetting balance method

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Bureau Central de la Commission Electrotechnique internationale

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Genève, Suisse

## Révision de la présente publication

Le contenu technique des publications de la C E I est constamment revu par la Commission afin d'assurer qu'il reflète bien l'état actuel de la technique.

Les renseignements relatifs à ce travail de révision, à l'établissement des éditions révisées et aux mises à jour peuvent être obtenus auprès des Comités nationaux de la C E I et en consultant les documents ci-dessous:

- Bulletin de la C E I
  - Annuaire de la C E I
  - Catalogue des publications de la C E I
- Publié annuellement

## Terminologie

En ce qui concerne la terminologie générale, le lecteur se reportera à la Publication 50 de la C E I: Vocabulaire Electrotechnique International (VEI), qui est établie sous forme de chapitres séparés traitant chacun d'un sujet défini, l'Index général étant publié séparément. Des détails complets sur le VEI peuvent être obtenus sur demande.

Les termes et définitions figurant dans la présente publication ont été soit repris du VEI, soit spécifiquement approuvés aux fins de cette publication.

## Symboles graphiques et littéraux

Pour les symboles graphiques, symboles littéraux et signes d'usage général approuvés par la C E I, le lecteur consultera:

- la Publication 27 de la C E I: Symboles littéraux à utiliser en électrotechnique;
- la Publication 617 de la C E I: Symboles graphiques pour schémas.

Les symboles et signes contenus dans la présente publication ont été soit repris des Publications 27 ou 617 de la C E I, soit spécifiquement approuvés aux fins de cette publication.

## Publications de la C E I établies par le même Comité d'Etudes

L'attention du lecteur est attirée sur les pages 3 et 4 de la couverture, qui énumèrent les publications de la C E I préparées par le Comité d'Etudes qui a établi la présente publication.

## Revision of this publication

The technical content of I E C publications is kept under constant review by the I E C, thus ensuring that the content reflects current technology.

Information on the work of revision, the issue of revised editions and amendment sheets may be obtained from I E C National Committees and from the following I E C sources:

- I E C Bulletin
  - I E C Yearbook
  - Catalogue of I E C Publications
- Published yearly

## Terminology

For general terminology, readers are referred to I E C Publication 50: International Electrotechnical Vocabulary (IEV), which is issued in the form of separate chapters each dealing with a specific field, the General Index being published as a separate booklet. Full details of the IEV will be supplied on request.

The terms and definitions contained in the present publication have either been taken from the IEV or have been specifically approved for the purpose of this publication.

## Graphical and letter symbols

For graphical symbols, and letter symbols and signs approved by the I E C for general use, readers are referred to:

- I E C Publication 27: Letter symbols to be used in electrical technology;
- I E C Publication 617: Graphical symbols for diagrams.

The symbols and signs contained in the present publication have either been taken from I E C Publications 27 or 617, or have been specifically approved for the purpose of this publication.

## I E C publications prepared by the same Technical Committee

The attention of readers is drawn to pages 3 and 4 of the cover, which list I E C publications issued by the Technical Committee which has prepared the present publication.

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

## BASIC ENVIRONMENTAL TESTING PROCEDURES

Part 2: Tests — Test Ta: Soldering  
Solderability testing by the wetting balance method

## FOREWORD

- 1) The formal decisions or agreements of the I E C 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 I E C expresses the wish that all National Committees should adopt the test of the I E C recommendation for their national rules in so far as national conditions will permit. Any divergence between the I E C 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 I E C Technical Committee No. 50: Environmental Testing.

It forms an addition to the fourth edition (1979) of I E C Publication 68-2-20: Basic Environmental Testing Procedures, Part 2: Tests — Test T: Soldering.

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

Six Months' Rule	Report on Voting
50C(CO)31	50C(CO)37

Further information can be found in the Report on Voting indicated in the table above.



## BASIC ENVIRONMENTAL TESTING PROCEDURES

### Part 2: Tests — Test Ta: Soldering Solderability testing by the wetting balance method

#### 1. Object

This test is to determine the solderability of component terminations of any shape. It is specially suitable for reference testing and for components that cannot be quantitatively tested by other methods.

#### 2. General description of the test

The specimen is suspended from a sensitive balance (typically a spring system) and immersed edgewise to a set depth in a bath of molten solder at a controlled temperature. The resultant of the vertical forces of buoyancy and surface tension acting upon the immersed specimen is detected by a transducer and converted into a signal which is continuously recorded as a function of time on a high-speed chart recorder. The trace may be compared with that derived from a perfectly-wetted specimen of the same nature and dimensions.

Two modes of testing exist:

- The stationary mode, intended to study the solderability of a particular place on the specimen. It is this mode which is standardized in this standard.
- The scanning mode, intended to study the homogeneity of the solderability of an extended region of the surface of the specimen. The standardization of this mode is still under consideration.

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#### 3. Description of the test apparatus

A diagram of an arrangement suitable for the test is shown in Figure 1.

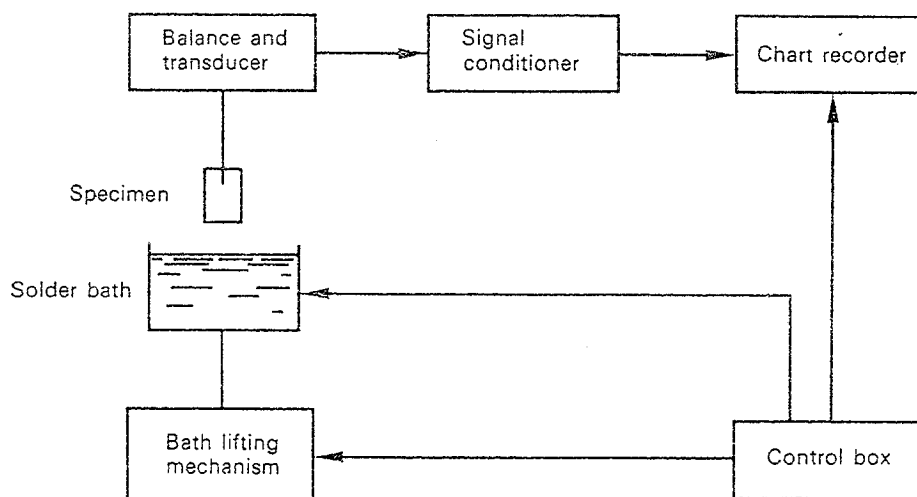


FIGURE 1

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Any other system capable of measuring the vertical forces acting on the specimen is admissible, provided that the system has the characteristics given in Appendix A

#### 4. Preparation of specimens

Care shall be taken to ensure that no part of the surface to be tested becomes contaminated, especially by contact with the fingers, during preparation of the specimen. The specimen may be cleaned by immersion in a neutral organic solvent at room temperature, but only if required by the relevant specification; no other cleaning is permitted. Accelerated ageing, if required, shall be done in accordance with Sub-clause 4.5 of the fourth edition (1979) of I E C Publication 68-2-20: Basic Environmental Testing Procedures, Part 2: Tests — Test T: Soldering.

#### 5. Conditions of test

##### 5.1 Solder

The solder to be used shall be as defined in I E C Publication 68-2-20, fourth edition (1979), Appendix B.

##### 5.2 Flux

The flux to be used shall be one of those defined in I E C Publication 68-2-20, fourth edition (1979), Appendix C.

##### 5.3 Procedure

After mounting the specimen in a suitable holder, the portion of the surface specified shall be immersed in flux at room temperature. Excess flux is immediately drained off by standing the specimen vertically on clean filter paper for 1 s to 5 s.

The temperature of the solder prior to test shall be  $235 \pm 3^\circ\text{C}$ . The specimen is then suspended vertically with lower edge  $20 \pm 5$  mm above the bath for  $30 \pm 15$  s to allow most of the flux solvent to evaporate, before initiating the test. During this drying period the suspension and the chart recorder trace shall be adjusted to the desired zero position, and immediately before starting the test the surface of the solder bath is scraped with a blade of suitable material to remove oxides.

The specimen is then immersed at a speed of  $20 \pm 5$  mm/s to the specified depth in the molten solder and held in this position for a specified time and then withdrawn at a speed of  $20 \pm 5$  mm/s. The relevant part of the recorder trace of force versus time is obtained when the specimen is held stationary in the immersed position.

#### 6. Presentation of results

##### 6.1 Form of chart-recorder trace

The trace may be recorded in two forms, the only difference being the polarity of the force readings.

In Figure 2, page 11, upward forces (non-wetting) are shown as positive and downward forces (wetting) are negative. Usually, force at *C* is equal to force at *B* indicating stable

wetting conditions. If force at *C* is less than at *B*, some instability in wetting is present (see Appendix B, Sub-clause B6.1.3).

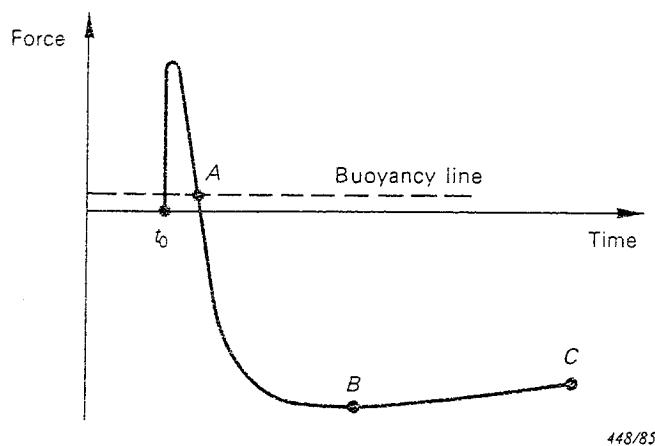


FIGURE 2

## 6.2 Points of significance

- 6.2.1 Time  $t_0$  is the time at which the solder surface and the specimen first make contact, as indicated by movement of the trace from the zero force line.
- 6.2.2 The point *A* is reached at the moment when the force acting on the specimen is equal to the calculated buoyancy. In calculating the buoyancy, the depth of immersion is taken to be the depth below the undisturbed solder level. All forces are measured with respect to the horizontal line through point *A*.
- 6.2.3 The point *B* is the maximum value of the resultant downward force attained during the specified immersion period.
- 6.2.4 The point *C* is the point at the end of the specified immersion period. Points *C* and *B* may have the same force value on the same specimen. (See Appendix B, Sub-clause B6.1.3.)
- 6.2.5 Interpretation of the trace formed during the withdrawal of the specimen is not considered in the stationary mode.

## 6.3 Reference wetting force

In order to obtain a practical reference against which to compare experimental results the following procedure shall be carried out, for each kind of component to be tested.

A specimen is taken from the sample to be tested and is pre-tinned under optimum conditions using the activated flux of I E C, Publication 68-2-20, fourth edition (1979). This pre-tinning can be done on the wetting balance, set at the same conditions as are used for the wetting test. The procedure of pre-tinning shall be repeated on the same specimen till the maximum force reading does not further increase. The reference wetting force is this maximum force.

In order to investigate the general suitability for soldering of a certain material the reference wetting force can be compared with the theoretical wetting force, obtained by calculation under the assumptions of an appropriate surface tension constant and density of the solder alloy, together with the occurrence of "perfect" wetting.