SIST

SLOVENSKI STANDARD
SIST EN 61189-3:2001

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Test methods for electrical materials, printed boards and other interconnection structures and assemblies -- Part 3: Test methods for interconnection structures (printed boards)

Test methods for electrical materials, printed boards and other interconnection structures and assemblies -- Part 3: Test methods for interconnection structures (printed boards)

Prüfverfahren für Elektromaterialien, Leiterplatten und andere Verbindungsstrukturen und Baugruppen -- Teil 3: Prüfverfahren für Verbindungsstrukturen (Leiterplatten)

Méthodes d'essai pour les matériaux électriques, les cartes imprimées et autres structures d'interconnexion et ensembles -- Partie 3: Méthodes d'essai des structures d'interconnexion (cartes imprimées)

Ta slovenski standard je istoveten z: **EN 61189-3:1997**

ICS:

31.180	Tiskana vezja (TIV) in tiskane plošče	Printed circuits and boards
31.190	Sestavljeni elektronski elementi	Electronic component assemblies

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EUROPEAN STANDARD

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Descriptors: Printed boards, interconnection structures, electrical materials, assemblies, test methods for interconnection structures, catalogue of approved, test methods

English version

Test methods for electrical materials, interconnection structures and assemblies Part 3: Test methods for interconnection structures (printed boards) (IEC 61189-3:1997)

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)
(CEI 61189-3:1997)

Prüfverfahren für Elektromaterialien, Verbindungsstrukturen und Baugruppen
Teil 3: Prüfverfahren für Verbindungsstrukturen (Leiterplatten)
(IEC 61189-3:1997)

This European Standard was approved by CENELEC on 1997-03-11. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

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

CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

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Foreword

The text of document 52/627/FDIS, future edition 1 of IEC 61189-3, prepared by IEC TC 52 Printed circuits, in cooperation with IEC TC 91, Surface mounting technology, and IEC TC 50, Environmental testing, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 61189-3 on 1997-03-11.

The following dates were fixed:

- latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 1998-01-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 1998-01-01

This part 3 of EN 61189 is to be used in conjunction with the other parts of EN 61189 and with the EN 60068 series.

Annexes designated "normative" are part of the body of the standard.
Annexes designated "informative" are given for information only.
In this standard, annex ZA is normative and annexes A and B are informative.
Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 61189-3:1997 was approved by CENELEC as a European Standard without any modification.

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

NOTE: When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

Publication	Year	Title	EN/HD	Year
IEC 60068-1	1988	Environmental testing Part 1: General and guidance	EN 60068-1[1)]	1994
IEC 60068-2-3	1969	Part 2: Tests - Test Ca: Damp heat, steady state	HD 323.2.3 S2[2)]	1987
IEC 60068-2-20 + A2	1979 1987	Part 2: Tests - Test T: Soldering	HD 323.2.20 S3	1988

1) EN 60068-1 includes the corrigendum October 1988 and A1:1992 to IEC 60068-1.

2) HD 323.2.3 S2 includes A1:1984 to IEC 60068-2-3.

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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)

Test methods for electrical materials, interconnection structures and assemblies –

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

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

TEST METHODS FOR ELECTRICAL MATERIALS, INTERCONNECTION STRUCTURES AND ASSEMBLIES –

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

FOREWORD

1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, the IEC publishes International Standards. Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. The IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.

2) The formal decisions or agreements of the IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested National Committees.

3) The documents produced have the form of recommendations for international use and are published in the form of standards, technical reports or guides and they are accepted by the National Committees in that sense.

4) In order to promote international unification, IEC National Committees undertake to apply IEC International Standards transparently to the maximum extent possible in their national and regional standards. Any divergence between the IEC Standard and the corresponding national or regional standard shall be clearly indicated in the latter.

5) The IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with one of its standards.

6) Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. The IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 61189-3 has been prepared by IEC technical committee 52: Printed circuits, in cooperation with technical committee 91: Surface mounting technology, and technical committee 50: Environmental testing.

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

FDIS	Report on voting
52/627/FDIS	52/698/RVD

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

Annexes A and B are for information only.

This standard should be used in conjunction with the following parts of IEC 61189, under generic title *Test methods for electrical materials, interconnection structures and assemblies*:

Part 1: General test methods and methodology
Part 2: Test methods for materials for interconnection structures
Part 3: Test methods for electronic components assembling characteristics
Part 5: Test methods printed board assemblies

and also the following standard

IEC 60068 *Environmental testing*

INTRODUCTION

IEC 61189 relates to test methods for printed boards and printed board assemblies, as well as related materials or component robustness, irrespective of their method of manufacture.

The standard is divided into separate parts, covering information for the designer and the test methodology engineer or technician. Each part has a specific focus; methods are grouped according to their application and numbered sequentially as they are developed and released.

In some instances test methods developed by other TCs (e.g.TC 50) have been reproduced from existing IEC standards in order to provide the reader with a comprehensive set of test methods. When this situation occurs, it will be noted on the specific test method; if the test method is reproduced with minor revision, those paragraphs that are different are identified.

This part of IEC 61189 contains test methods for evaluating printed boards and other forms of interconnection structures. The methods are self-contained, with sufficient detail and description so as to achieve uniformity and reproducibility in the procedures and test methodologies.

The tests shown in this standard are grouped according to the following principles:

- P: preparation/conditioning methods
- V: visual test methods
- D: dimensional test methods
- C: chemical test methods
- M: mechanical test methods
- E: electrical test methods
- N: environmental test methods
- X: miscellaneous test methods

To facilitate reference to the tests, to retain consistency of presentation, and to provide for future expansion, each test is identified by a number (assigned sequentially) added to the prefix (group code) letter showing the group to which the test method belongs.

The test method numbers have no significance with respect to an eventual test sequence; that responsibility rests with the relevant specification that calls for the method being performed. The relevant specification, in most instances, also describes pass/fail criteria.

The letter and number combinations are for reference purposes, to be used by the relevant specification. Thus "3D02" represents the second dimensional test method described in this publication.

In short, for this example, 3 is the part of IEC standard (61189-3), D is the group of methods, and 02 is the test number.

A list of all test methods included in this standard, as well as those under consideration is given in annex B. This annex will be reissued whenever new tests are introduced.

TEST METHODS FOR ELECTRICAL MATERIALS, INTERCONNECTION STRUCTURES AND ASSEMBLIES –

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

1 Scope and object

This part of IEC 61189 is a catalogue of test methods representing methodologies and procedures that can be applied to test materials used for manufacturing interconnection structures (printed boards) and assemblies.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 61189. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this part of IEC 61189 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 60068-1: 1988, *Environmental testing – Part 1: General and guidance*

IEC 60068-2-3: 1969, *Environmental testing – Part 2: Tests – Test Ca: Damp heat, steady state*

IEC 60068-2-20: 1979, *Environmental testing – Part 2: Tests – Test T: Soldering*
Amendment 2 (1987)

3 Accuracy, precision and resolution

Errors and uncertainties are inherent in all measurement processes. The information given below enables valid estimates of the amount of error and uncertainty to be taken into account.

Test data serve a number of purposes which include:

- to monitor a process;
- to enhance confidence in quality conformance;
- to arbitrate between customer and supplier.

In any of these circumstances, it is essential that confidence can be placed upon the test data in terms of:

- accuracy: calibration of the test instruments and/or system;
- precision: the repeatability and uncertainty of the measurement;
- resolution: the suitability of the instruments and/or system for the test.

3.1 *Accuracy*

The regime by which routine calibration of the test equipment is undertaken shall be clearly stated in the quality documentation of the supplier or agency conducting the test, and shall meet the requirements of 4.11 of ISO 9002.

The calibration shall be conducted by an agency having accreditation to a national or international measurement standard institute. There should be an uninterrupted chain of calibration to a national or international standard.

Where calibration to a national or international standard is not possible, "round robin" techniques may be used, and documented, to enhance confidence in measurement accuracy.

The calibration interval shall normally be one year. Equipment consistently found to be outside acceptable limits of accuracy shall be subject to shortened calibration intervals. Equipment consistently found to be well within acceptable limits may be subject to relaxed calibration intervals.

A record of the calibration and maintenance history shall be maintained for each instrument. These records should state the uncertainty of the calibration technique (in ± % deviation) in order that uncertainties of measurement can be aggregated and determined.

A procedure shall be implemented to resolve any situation where an instrument is found to be outside calibration limits.

3.2 *Precision*

The uncertainty budget of any measurement technique is made up of both systematic and random uncertainties. All estimates shall be based upon a single confidence level, the minimum being 95 %.

Systematic uncertainties are usually the predominant contributor, and will include all uncertainties not subject to random fluctuation. These include:

- calibration uncertainties;
- errors due to the use of an instrument under conditions which differ from those under which it was calibrated;
- errors in the graduation of a scale of an analogue meter (scale shape error).

Random uncertainties result from numerous sources but can be deduced from repeated measurement of a standard item. Therefore, it is not necessary to isolate the individual contributions. These may include:

- random fluctuations such as those due to the variation of an influence parameter. Typically, changes in atmospheric conditions reduce the repeatability of a measurement;
- uncertainty in discrimination, such as setting a pointer to a fiducial mark, or interpolating between graduations on an analogue scale.

Aggregation of uncertainties: Geometric addition (root-sum-square) of uncertainties may be used in most cases. Interpolation error is normally added separately and may be accepted as being 20 % of the difference between the finest graduations of the scale of the instrument.

$$U_t = \pm\sqrt{(U_s^2 + U_r^2)} + U_i$$

where

U_t is the total uncertainty

U_s is the systematic uncertainty

U_r is the random uncertainty

U_i is the interpolation error

Determination of random uncertainties: Random uncertainty can be determined by repeated measurement of a parameter and subsequent statistical manipulation of the measured data. The technique assumes that the data exhibits a normal (Gaussian) distribution.

$$U_r = t\sigma/\sqrt{n}$$

where

U_r is random uncertainty

n is the sample size

t is the percentage point of the "t" distribution (from 3.5, statistic tables)

σ is the standard deviation (σ_{n-1})

3.3 *Resolution*

It is paramount that the test equipment used is capable of sufficient resolution. Measurement systems used should be capable of resolving 10 % (or better) of the test limit tolerance.

It is accepted that some technologies will place a physical limitation upon resolution (e.g.: optical resolution)

3.4 *Report*

In addition to requirements detailed in the test specification, the report shall detail:

- the test method used;
- the identity of the sample(s);
- the test instrumentation;
- the specified limit(s);
- an estimate of measurement uncertainty, and resultant working limit(s) for the test;
- the detailed test results;
- the test date and operators' signature.

3.5 *Student's "t" distribution*

Table 1 gives values of the factor "t" for 95 % and 99 % confidence levels, as a function of the number of measurements. It is sufficient to use 95 % limits, as in the case of the worked examples shown in annex A.

Table 1 – Student's "*t*" distribution

Sample size	*t* value 95 %	*t* value 99 %		Sample size	*t* value 95 %	*t* value 99 %
2	12,7	63,7		14	2,16	3,01
3	4,3	9,92		15	2,14	2,98
4	3,18	5,84		16	2,13	2,95
5	2,78	4,6		17	2,12	2,92
6	2,57	4,03		18	2,11	2,9
7	2,45	3,71		19	2,1	2,88
8	2,36	3,5		20	2,09	2,86
9	2,31	3,36		21	2,08	2,83
10	2,26	3,25		22	2,075	2,82
11	2,23	3,17		23	2,07	2,81
12	2,2	3,11		24	2,065	2,8
13	2,18	3,05		25	2,06	2,79

3.6 *Suggested uncertainty limits*

The following target uncertainties are suggested:

a) Voltage < 1 kV: ± 1,5 %
b) Voltage > 1 kV: ± 2,5 %
c) Current < 20 A: ± 1,5 %
d) Current > 20 A: ± 2,5 %

Resistance

e) Earth and continuity: ± 10 %
f) Insulation: ± 10 %
g) Frequency: ± 0,2 %

Time

h) Interval < 60 s: ± 1 s
i) Interval > 60 s: ± 2 %

j) Mass < 10 g: ± 0,5 %
k) Mass 10 g to 100 g: ± 1 %
l) Mass > 100 g: ± 2 %

m) Force: ± 2 %
n) Dimension < 25 mm: ± 0,5 %
o) Dimension > 25 mm: ± 0,1 mm

p) Temperature < 100 °C: ± 1,5 %
q) Temperature > 100 °C: ± 3,5 %

r) Humidity 30 to 75 % RH: ± 5 % RH

Plating thicknesses

s) Backscatter method: ± 10 %
t) Microsection: ± 2 µm
u) Ionic contamination: ± 10 %

4 Catalogue of approved test methods

This standard provides specific test methods in complete detail to permit implementation with minimal cross-referencing to other specific procedures. The use of generic conditioning exposures is accomplished in the methods by reference, for example IEC 61189-1 and IEC 60068 and when applicable, is a mandatory part of the test method standard.

Each method has its own title, number and revision status to accommodate updating and improving the methods as industry requirements change or demand new methodology. The methods are organized in test method groups and individual tests.

5 P: Preparation/conditioning test methods

6 V: Visual test methods

6.1 **Test 3V01: 3 X magnification** (under consideration)

6.2 **Test 3V02: 10 X magnification** (under consideration)

6.3 **Test 3V03: 250 X magnification** (under consideration)

6.4 **Test 3V04: General visual** (under consideration)

7 D: Dimensional test methods

7.1 **Test 3D01: Optical method** (under consideration)

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

7.3 **Test 3D03: Automated optical inspection** (under consideration)

7.4 **Test 3D04: Dimensional examination, general** (under consideration)