

# SLOVENSKI STANDARD

## SIST EN 61189-3:2008

01-junij-2008

Nadomešča:

SIST EN 61189-3:2001

SIST EN 61189-3:2001/A1:2001

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**Preskusne metode za električne materiale, tiskane plošče, povezovalne strukture in sestave - 3. del: Preskusne metode za povezovalne strukture (tiskanih plošč) (IEC 61189-3:2007)**

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 61189-3:2008**

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**ICS:**

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

**SIST EN 61189-3:2008**

**en,de**

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EUROPEAN STANDARD

**EN 61189-3**

NORME EUROPÉENNE

EUROPÄISCHE NORM

January 2008

ICS 31.180

Supersedes EN 61189-3:1997 + A1:1999

English version

**Test methods for electrical materials, printed boards  
and other interconnection structures and assemblies -  
Part 3: Test methods for interconnection structures (printed boards)  
(IEC 61189-3:2007)**

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)  
(CEI 61189-3:2007)

Prüfverfahren für Elektromaterialien,  
Leiterplatten und andere Verbindungs-  
strukturen und Baugruppen -  
Teil 3: Prüfverfahren für Verbindungs-  
strukturen (Leiterplatten)  
(IEC 61189-3:2007)

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SIST EN 61189-3:2008

This European Standard was approved by CENELEC on 2007-12-01. 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, Bulgaria, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the 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**

## Foreword

The text of document 91/698/FDIS, future edition 2 of IEC 61189-3, prepared by IEC TC 91, Electronics assembly technology, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 61189-3 on 2007-12-01.

This European Standard supersedes EN 61189-3:1997 + A1:1999.

The major technical changes with regard to EN 61189-3:1997 + A1:1999 concern the addition of 25 new tests, as follows:

- 6 V: Visual test methods: 3V01, 3V02 and 3V03;
- 7 D: Dimensional test methods: 3D03;
- 8 C: Chemical test methods: 3C02, 3C13 and 3C14;
- 9 M: Mechanical test methods: 3M01, 3M03, 3M04, 3M07 and 3M09;
- 10 E: Electrical test methods: 3E03, 3E04, 3E05, 3E11, 3E12, 3E13, 3E16, 3E17 and 3E18;
- 11 N: Environmental test methods: 3N03, 3N07 and 3N12;
- 12 X: Miscellaneous test methods: 3X01.

EN 61189-3:2007 also includes the deletion of Annex B: Conversion table, as the referred documents have been withdrawn. Should anyone wish to consult such information, they should refer to EN 61189-3:1997.

The new general title of EN 61189 series is *Test methods for electrical materials, printed boards and other interconnection structures and assemblies*. Titles of existing standards in this series will be updated at the time of revision.

This standard should be used in conjunction with the following parts:

Part 1: General test methods and methodology

Part 2: Test methods for materials for interconnection structures

Part 5: Test methods for printed board assemblies

Part 6: Test methods for materials used in manufacturing electronic assemblies

It should also be read in conjunction with the series EN 60068, Environmental testing.

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) | 2008-09-01 |
| – latest date by which the national standards conflicting with the EN have to be withdrawn   | (dow) | 2010-12-01 |

Annex ZA has been added by CENELEC.

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## Endorsement notice

The text of the International Standard IEC 61189-3:2007 was approved by CENELEC as a European Standard without any modification.

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## Annex ZA (normative)

### Normative references to international publications with their corresponding European publications

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.

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

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60051	Series	Direct acting indicating analogue electrical measuring instruments and their accessories	EN 60051	Series
IEC 60068-1	1988	Environmental testing - Part 1: General and guidance	EN 60068-1	1994 <sup>1)</sup>
IEC 60068-2-20 + A2	1979 1987	Environmental testing - Part 2: Tests - Test T: Soldering	HD 323.2.20 S3	1988
IEC 60068-2-78	- <sup>2)</sup>	Environmental testing - Part 2-78: Tests - Test Cab: Damp heat, steady state	EN 60068-2-78	2001 <sup>3)</sup>
IEC 60169-15	- <sup>2)</sup>	Radio-frequency connectors - Part 15: R.F. coaxial connectors with inner diameter of outer conductor 4,13 mm (0,163 in) with screw coupling - Characteristic impedance 50 ohms (Type SMA)	-	-
IEC 60454-1	1992	Specifications for pressure-sensitive adhesive tapes for electrical purposes - Part 1: General requirements	EN 60454-1	1994
IEC 60454-3-1	1998	Pressure-sensitive adhesive tapes for electrical purposes - Part 3-1: Specifications for individual materials - PVC film tapes with pressure-sensitive adhesive	EN 60454-3-1	1998
IEC 60584-1	- <sup>2)</sup>	Thermocouples - Part 1: Reference tables	EN 60584-1	1995 <sup>3)</sup>
IEC 60695-11-5	- <sup>2)</sup>	Fire hazard testing - Part 11-5: Test flames - Needle-flame test method - Apparatus, confirmatory test arrangement and guidance	EN 60695-11-5	2005 <sup>3)</sup>

<sup>1)</sup> EN 60068-1 includes corrigendum October 1988 + A1:1992 to IEC 60068-1.

<sup>2)</sup> Undated reference.

<sup>3)</sup> Valid edition at date of issue.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 61188-1-2	1998	Printed boards and printed board assemblies - Design and use - Part 1-2: Generic requirements - Controlled impedance	EN 61188-1-2	1998
IEC 61189-1	1997	Test methods for electrical materials, interconnection structures and assemblies - Part 1: General test methods and methodology	EN 61189-1	1997
IEC 61190-1-1	- <sup>2)</sup>	Attachment materials for electronic assembly - Part 1-1: Requirements for soldering fluxes for high quality interconnections in electronics assembly	EN 61190-1-1	2002 <sup>3)</sup>
IEC 61190-1-2	- <sup>2)</sup>	Attachment materials for electronic assembly - Part 1-2: Requirements for soldering paste for high quality interconnects in electronics assembly	EN 61190-1-2	2007 <sup>3)</sup>
IEC 62326-4	1996	Printed boards - Part 4: Rigid multilayer printed boards with interlayer connections - Sectional specification	EN 62326-4	1997
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	EN 62326-4-1	1997
ISO 4046	1978 <sup>4)</sup>	Paper, board, pulp and related terms - Vocabulary	-	-
ISO 9002 <sup>5)</sup>	1994	Quality systems - Model for quality assurance in production, installation and servicing	EN ISO 9002 <sup>5)</sup>	1994
ISO 9453	2006	Soft solder alloys - Chemical compositions and forms	EN ISO 9453	2006

<sup>4)</sup> ISO 4046 has been withdrawn and replaced by ISO 4046, Parts 1 to 5.

<sup>5)</sup> Withdrawn.



IEC 61189-3

Edition 2.0 2007-10

# INTERNATIONAL STANDARD

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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)**

SIST EN 61189-3:2008

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INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

PRICE CODE

**XE**

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

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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)**

## FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of 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, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). 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. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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International Standard IEC 61189-3 has been prepared by IEC technical committee 91: Electronics assembly technology.

This second edition cancels and replaces the first edition, published in 1997, its amendment 1 (1999) and constitutes a technical revision.

The document 91/698/FDIS, circulated to the National Committees as Amendment 2, led to the publication of the new edition.

The major technical changes with regard to the previous edition concern the addition of 25 new tests, as follows:

- 6 V: Visual test methods: 3V01, 3V02 and 3V03;
- 7 D: Dimensional test methods: 3D03;

- 8 C: Chemical test methods: 3C02, 3C13 and 3C14;
- 9 M: Mechanical test methods: 3M01, 3M03, 3M04, 3M07 and 3M09;
- 10 E: Electrical test methods: 3E03, 3E04, 3E05, 3E11, 3E12, 3E13, 3E16, 3E17 and 3E18;
- 11 N: Environmental test methods: 3N03, 3N07 and 3N12;
- 12 X: Miscellaneous test methods: 3X01

This edition also includes the deletion of Annex B: Conversion table, as the referred documents were disbanded in 2005 and do not officially exist. Should any one wish to consult such information, they should refer to the first edition of IEC 61189-3 (1997).

The text of this standard is based on the first edition, its Amendment 1 and the following documents:

FDIS	Report on voting
91/698/FDIS	91/727/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.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all the parts in the IEC 61189 series, under the general title *Test methods for electrical materials, printed boards and other interconnection structures and assemblies*, can be found on the IEC website.

NOTE Future standards in this series will carry the new general title as cited above. Titles of existing standards in this series will be updated at the time of the next edition.

This standard should be used in conjunction with the following parts:

- 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
  - Part 6: Test methods for materials used in manufacturing electronic assemblies
- IEC 60068 (all parts), Environmental testing

The committee has decided that the contents of the base publication and its amendments will remain unchanged until the maintenance result date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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

## 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, PRINTED BOARDS AND OTHER INTERCONNECTION STRUCTURES AND ASSEMBLIES –

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

#### 1 Scope

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 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.

IEC 60051 (all parts), *Direct acting indicating analogue electrical measuring instruments and their accessories*

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

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

IEC 60068-2-78, *Environmental testing – Part 2-78: Tests – Test Cab: Damp heat, steady state*

IEC 60169–15, *Radio-frequency connectors – Part 15: RF coaxial connectors with inner diameter of outer conductor 4,13 mm (0,163 in) with screw coupling – Characteristic impedance 50 ohms (Type SMA)*

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

IEC 60454-3-1:1998, *Pressure-sensitive adhesive tapes for electrical purposes – Part 3: Specifications for individual materials – Sheet 1: PVC film tapes with pressure-sensitive adhesive*

IEC 60584-1, *Thermocouples – Part 1: reference tables*

IEC 60695-11-5, *Fire hazard testing – Part 11-5: Test flames – Needle flame test method – Apparatus, confirmatory test arrangement and guidance*

IEC 61188-1-2:1998, *Printed boards and printed board assemblies – Design and use – Part 1-2: Generic requirements – Controlled impedance*

IEC 61189-1:1997, *Test methods for electrical materials, interconnection structures and assemblies – Part 1: General test methods and methodology*

IEC 61190-1-1, *Attachment materials for electronic assembly – Part 1-1: Requirements for soldering fluxes for high quality interconnections in electronics assembly*

IEC 61190-1-2, *Attachment materials for electronic assembly – Part 1-2: Requirements for*

*solder pastes for high quality interconnections in electronic assembly*

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 (withdrawn)*<sup>1</sup>

ISO 9002:1994, *Quality systems – Model for quality assurance in production, installation and servicing (withdrawn)*

ISO 9453:2006, *Soft solder alloys – Chemical compositions and forms*

### 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  $\pm$  % deviation) in order that uncertainties of measurement can be aggregated and determined.

<sup>1</sup> ISO 4046 has been withdrawn and replaced by ISO 4046: Parts 1 to 5.

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.

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

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)

$F$  is the standard deviation ( $F_{n-1}$ )

### 3.3 Resolution

It is paramount that the test equipment used is capable of sufficient resolution. Measurement