

INTERNATIONAL STANDARD

NORME INTERNATIONALE

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

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)



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2007 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester.

If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de la CEI ou du Comité national de la CEI du pays du demandeur.

Si vous avez des questions sur le copyright de la CEI ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de la CEI de votre pays de résidence.

IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

Useful links:

IEC publications search - www.iec.ch/searchpub

The advanced search enables you to find IEC publications by a variety of criteria (reference number, text, technical committee,...).

It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available on-line and also once a month by email.

Electropedia - www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing more than 30 000 terms and definitions in English and French, with equivalent terms in additional languages. Also known as the International Electrotechnical Vocabulary (IEV) on-line.

Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: csc@iec.ch.

A propos de la CEI

La Commission Electrotechnique Internationale (CEI) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications CEI

Le contenu technique des publications de la CEI est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Liens utiles:

Recherche de publications CEI - www.iec.ch/searchpub

La recherche avancée vous permet de trouver des publications CEI en utilisant différents critères (numéro de référence, texte, comité d'études,...).

Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

Just Published CEI - webstore.iec.ch/justpublished

Restez informé sur les nouvelles publications de la CEI. Just Published détaille les nouvelles publications parues. Disponible en ligne et aussi une fois par mois par email.

Electropedia - www.electropedia.org

Le premier dictionnaire en ligne au monde de termes électroniques et électriques. Il contient plus de 30 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans les langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (VEI) en ligne.

Service Clients - webstore.iec.ch/csc

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: csc@iec.ch.

INTERNATIONAL STANDARD

NORME INTERNATIONALE

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

**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)**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

PRICE CODE
CODE PRIX

XE

ICS 31.180

ISBN 978-2-83220-349-1

**Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.**

CONTENTS

FOREWORD.....	4
INTRODUCTION.....	6
1 Scope and object.....	7
2 Normative references.....	7
3 Accuracy, precision and resolution.....	8
4 Catalogue of approved test methods.....	11
5 P: Preparation/conditioning test methods.....	11
6 V: Visual test methods.....	11
7 D: Dimensional test methods.....	14
8 C: Chemical test methods.....	17
9 M: Mechanical test methods.....	30
10 E: Electrical test methods.....	48
11 N: Environmental test methods.....	75
12 X: Miscellaneous test methods.....	93
Annex A (informative) Worked examples.....	117
Figure 1 – Glow wire.....	19
Figure 2 – Test apparatus.....	20
Figure 3a – Horizontal specimen – Flame applied to surface.....	24
Figure 3b – Horizontal specimen – Flame applied to edge.....	24
Figure 3c – Vertical specimen – Lower edge horizontal – Flame applied to edge.....	25
Figure 3d – Vertical specimen – Lower edge horizontal – Flame applied to surface.....	25
Figure 3e – Needle burner test – Side views of test board and burner.....	26
Figure 3 – Needle burner test.....	26
Figure 4 – Flux type classification by copper mirror test.....	30
Figure 5a – Hold down clamping system.....	32
Figure 5b – Single load mode.....	32
Figure 5c – Multiple load mode.....	32
Figure 5d – Keyhole hold down fixture.....	33
Figure 5 – Copper foil for peel test.....	33
Figure 6 – Bow.....	36
Figure 7 – Twist.....	36
Figure 8 – Test set-up for bow measurement.....	37
Figure 9 – Specimen set-up for twist measurement.....	37
Figure 10a – Specimen set-up for referee test for twist, raised parallel surfaces.....	38
Figure 10b – Specimen set-up for referee test for twist, supporting jacks or blocks.....	39
Figure 10c – Specimen set-up for referee test for twist measurements.....	39
Figure 10 – Specimen set-up for referee test.....	39
Figure 11 – Bow measurement.....	39
Figure 12 – Twist measurement.....	40

Figure 13 – Measuring equipment for peel strength of flexible printed boards	43
Figure 14 – Pencil holder	46
Figure 15a – Location of test specimens	54
Figure 15b – Location of test specimens	55
Figure 15 – Composite test pattern	55
Figure 16 – Test specimen artwork	61
Figure 17 – Fluidized sand bath	64
Figure 18 – Possible equipment configuration	68
Figure 19 – Schematic showing undisturbed interval	68
Figure 20 – Test wave form example	70
Figure 21 – Incident wave voltage showing (2 X) air line delay	70
Figure 22 – Details of test specimen	72
Figure 23 – Circuit diagram for measurement of contact resistance	73
Figure 24 – Keypad contact patterns	75
Figure 25 – Plier fixture for thermal shock test, dip soldering	82
Figure 26 – Temperature cycles for moisture and insulation resistance test graph	92
Figure 27 – Insulation resistance coupon (μm)	92
Figure 28 – Typical “comb pattern”	93
Figure 29 – Suggested test specimen for surface mount features	104
Figure 30 – Suggested test specimen for plated through holes	104
Figure 31 – Rotary dip solderability test equipment	107
Figure 32 – Effectiveness of solder wetting of plated through holes	110
Figure 33 – Test specimen	116
Table 1 – Student’s “t” distribution	10
Table 2 – Preferred land, hole and wire dimensions	44
Table 3 – Resistance values	61
Table 4 – Chamber temperatures for one cycle	86
Table 5 – Accelerated ageing and test requirements	105
Table 6 – Maximum limits of solder bath contaminants	106

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**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.
- 2) The formal decisions or agreements of 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 IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with an IEC Publication.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. 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 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).

This bilingual version (2012-09) corresponds to the monolingual English version, published in 2007-10.

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.

The French version of this standard has not been voted upon.

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 4: Test methods for electronic components assembling characteristics
 - Part 5: Test methods for 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.

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

STANDARD PREVIEW
(standards.iteh.ai)

[IEC 61189-3:2007](https://standards.iteh.ai/catalog/standards/sist/2cf229b0-a823-428f-b156-a1e93e6ac01f/iec-61189-3-2007)

<https://standards.iteh.ai/catalog/standards/sist/2cf229b0-a823-428f-b156-a1e93e6ac01f/iec-61189-3-2007>

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 61188-1-2:1988, *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)*¹

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.

¹ 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.

<https://standards.iteh.ai/catalog/standards/sist/2cf229b0-a823-428f-b156->

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

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 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	t value	Sample size	t value	t value
	95 %	99 %		95 %	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: $\pm 1,5 \%$
- b) Voltage > 1 kV: $\pm 2,5 \%$
- c) Current < 20 A: $\pm 1,5 \%$
- d) Current > 20 A: $\pm 2,5 \%$

Resistance

- e) Earth and continuity: $\pm 10 \%$

- f) Insulation: $\pm 10 \%$
- g) Frequency: $\pm 0,2 \%$

Time

- h) Interval < 60 s: $\pm 1 \text{ s}$
- i) Interval > 60 s: $\pm 2 \%$
- j) Mass < 10 g: $\pm 0,5 \%$
- k) Mass 10 g to 100 g: $\pm 1 \%$
- l) Mass > 100 g: $\pm 2 \%$
- m) Force: $\pm 2 \%$
- n) Dimension < 25 mm: $\pm 0,5 \%$
- o) Dimension > 25 mm: $\pm 0,1 \text{ mm}$
- p) Temperature < 100 °C: $\pm 1,5 \%$
- q) Temperature > 100 °C: $\pm 3,5 \%$
- r) Humidity 30 to 75 % RH: $\pm 5 \%$ RH

Plating thicknesses

- s) Backscatter method: $\pm 10 \%$
- t) Microsection: $\pm 2 \text{ } \mu\text{m}$
- u) Ionic contamination: $\pm 10 \%$

4 Catalogue of approved test methods

<https://standards.iteh.ai/catalog/standards/sist/2cf229b0-a823-428f-b156-60068-60068/iec-61189-3-2007>

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: Visual examination, 3× magnification****6.1.1 Object**

This method describes the procedure for visual examination of materials and finished printed boards, where 3× magnification is required by the relevant sectional specification (SS) or customer detail specification (CDS).

6.1.2 Test specimen

Finished printed board(s), portion of finished printed board, or test coupon(s), as specified by the relevant sectional specification (SS) or customer detail specification (CDS).

6.1.3 Test apparatus and materials

The following test apparatus and materials shall be used:

- a) Optical device capable of providing 3× magnification.
- b) Referee optical device capable of providing 10× magnification.

6.1.4 Procedure

The following steps shall be taken:

- a) The product shall be carefully examined, per the specified requirement, under 3× magnification device.
- b) In the case of a questionable evaluation at 3×, a referee examination may be performed at 10×.

6.1.5 Report

The report shall include:

- a) the test method number and revision;
- b) the date of evaluation;
- c) identification and description of specimen;
- d) the magnification used for the examination;
- e) the referee magnification examination, if applicable;
- f) the results of evaluation, including requirement(s) failed, failure modes and degree of failure, in case of failure;
- g) any deviation from this test method;
- h) the name of the person that conducted the test.

6.1.6 Additional information

In addition to stated requirements, any other objective evidence of defective and/or substandard conditions should be noted, such as dirt, oil, corrosion, fingerprints, foreign matter, etc.

6.2 Test 3V02: Visual examination, 10× magnification

6.2.1 Object

This method describes the procedure for visual examination of materials and finished printed boards where 10× magnification is required by the relevant sectional specification (SS) or customer detail specification (CDS).

6.2.2 Test specimen

Finished printed board(s) or test coupon(s), as specified in the relevant specification.

6.2.3 Test apparatus and materials

The following test apparatus and materials shall be used:

- a) Optical device capable of providing 10× magnification.
- b) Referee optical device capable of providing 50× magnification.

6.2.4 Procedure

The following steps shall be taken:

- a) The product shall be carefully examined, per the specified requirement, under 10× magnification device.
- b) In the case of a questionable evaluation at 10×, a referee examination may be performed at 50×.

6.2.5 Report

The report shall include:

- a) the test method number and revision;
- b) the date of evaluation;
- c) identification and description of specimen;
- d) the magnification used for the examination;
- e) the referee magnification examination, if applicable;
- f) results of evaluation, including requirement(s) failed, failure modes and degree of failure, in case of failure;
- g) any deviation from this test method;
- h) the name of the person that conducted the test.

6.2.6 Additional information

In addition to stated requirements, any other objective evidence of defective and/or sub-standard conditions should be noted such as dirt, oil, corrosion, fingerprints, foreign matter, etc.

6.3 Test 3V03: Visual examination, 250× magnification

6.3.1 Object

This method describes the procedure for visual examination of materials and finished printed boards, where 250× magnification is required by the relevant sectional specification (SS) or customer detail specification (CDS).

6.3.2 Test specimen

Finished printed board(s), portion of finished printed board, or test coupon(s), as specified in the relevant specification.

6.3.3 Test apparatus and materials

The following test apparatus and materials shall be used:

- a) Optical device capable of providing 250× magnification.
- b) Referee optical device capable of providing at least double the power magnification.

NOTE Caution is advised not to falsely identify problems at this magnification.

6.3.4 Procedure

The following steps shall be taken: