IEC 60068-2-69

Edition 3.0 2017-03

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE

## Environmental testing –
## Part 2-69: Tests – Test Te/Tc: Solderability testing of electronic components and printed boards by the wetting balance (force measurement) method

iTeh STANDARD PREVIEW
(standards.iteh.ai)
IEC 60068-2-69:2017
https://standards.iteh.ai/catalog/standards/sist/e68969aa-37cf-4c19-9d1f-9aad1d8b7d08/iec-60068-2-69-2017

## Essais d'environnement –
## Partie 2-69: Essais – Essai Te/Tc: Essai de brasabilité des composants électroniques et cartes imprimées par la méthode de la balance de mouillage (mesure de la force)

IEC 60068-2-69:2017-03(en-fr)

**THIS PUBLICATION IS COPYRIGHT PROTECTED**
**Copyright © 2017 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 l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

IEC Central Office
3, rue de Varembé
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.

**IEC Catalogue - webstore.iec.ch/catalogue**
The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

**IEC publications search - www.iec.ch/searchpub**
The advanced search enables 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 online and also once a month by email.

**Electropedia - www.electropedia.org**
The world's leading online dictionary of electronic and electrical terms containing 20 000 terms and definitions in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

**IEC Glossary - std.iec.ch/glossary**
65 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

**IEC 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.

iTeh STANDARD PREVIEW
(standards.iteh.ai)
IEC 60068-2-69:2017
https://standards.iteh.ai/catalog/standards/sist/e68969aa-37cf-4c19-9d1f-9acd1d867dcd/iec-60068-2-69-2017

**A propos de l'IEC**
La Commission Electrotechnique Internationale (IEC) 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 IEC**
Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

**Catalogue IEC - webstore.iec.ch/catalogue**
Application autonome pour consulter tous les renseignements bibliographiques sur les Normes internationales, Spécifications techniques, Rapports techniques et autres documents de l'IEC. Disponible pour PC, Mac OS, tablettes Android et iPad.

**Recherche de publications IEC - www.iec.ch/searchpub**
La recherche avancée permet de trouver des publications IEC 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.

**IEC Just Published - webstore.iec.ch/justpublished**
Restez informé sur les nouvelles publications IEC. 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 de termes électroniques et électriques. Il contient 20 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans 16 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

**Glossaire IEC - std.iec.ch/glossary**
65 000 entrées terminologiques électrotechniques, en anglais et en français, extraites des articles Termes et Définitions des publications IEC parues depuis 2002. Plus certaines entrées antérieures extraites des publications des CE 37, 77, 86 et CISPR de l'IEC.

**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.

# IEC 60068-2-69

Edition 3.0 2017-03

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE

iTeh STANDARD PREVIEW
(standards.iteh.ai)

## Environmental testing –
## Part 2-69: Tests – Test Te/Tc: Solderability testing of electronic components and printed boards by the wetting balance (force measurement) method

IEC 60068-2-69:2017
https://standards.iteh.ai/catalog/standards/sist/e68969aa-37cf-4c19-9d1f-9aef1f867fed/iec-60068-2-69-2017

## Essais d'environnement –
## Partie 2-69: Essais – Essai Te/Tc: Essai de brasabilité des composants électroniques et cartes imprimées par la méthode de la balance de mouillage (mesure de la force)

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 19.040; 31.190

ISBN 978-2-8322-3994-0

**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.**

® Registered trademark of the International Electrotechnical Commission
Marque déposée de la Commission Electrotechnique Internationale

CONTENTS

FOREWORD ........ 5
1 Scope ........ 7
2 Normative references ........ 7
3 Terms and definitions ........ 7
4 General description of the method ........ 8
4.1 General ........ 8
4.2 Components ........ 8
4.3 Printed boards ........ 8
4.4 Measurement ........ 8
5 Description of the test apparatus ........ 8
6 Preparation of specimens ........ 10
6.1 Cleaning ........ 10
6.2 Preconditioning ........ 10
7 Materials ........ 11
7.1 Solder ........ 11
7.1.1 General ........ 11
7.1.2 Solder alloy containing lead ........ 11
7.1.3 Lead-free solder alloy ........ 11
7.1.4 Solder contamination control ........ 11
7.1.5 Solder mass for solder globule wetting balance method ........ 12
7.2 Flux ........ 13
7.2.1 Rosin based flux ........ 13
7.2.2 Flux maintenance ........ 13
7.2.3 Test flux selection criteria ........ 13
8 Procedure ........ 13
8.1 Test temperature ........ 13
8.1.1 Solder alloy containing lead ........ 13
8.1.2 Lead-free solder alloy ........ 13
8.2 Test procedure ........ 13
8.2.1 Applicable test procedure ........ 13
8.2.2 Solder bath wetting balance procedure ........ 14
8.2.3 Solder globule wetting balance procedure ........ 17
8.2.4 Procedure for testing printed board specimens ........ 20
9 Presentation of results ........ 21
9.1 Form of force versus time trace ........ 21
9.2 Test requirements ........ 22
10 Information to be given in the relevant specification ........ 23
Annex A (normative) Equipment specification ........ 24
A.1 Characteristics of the apparatus ........ 24
A.2 Solder bath ........ 24
A.3 Globule support blocks ........ 25
Annex B (informative) Use of the wetting balance for SMD solderability testing ........ 26
B.1 Definition of the measure of solderability ........ 26
B.2 Gauge R&R – Test protocol for wetting balance gauge repeatability and reproducibility using copper foil coupons ........ 26

iTeh STANDARD PREVIEW
(standards.iteh.ai)
IEC 60068-2-69:2017
https://standards.iteh.ai/catalog/standards/sist/e68969aa-37cf-4c19-9d1f-9acd1d867dcd/iec-60068-2-69-2017

B.2.1 Test coupon ..... 26
B.2.2 Test parameters ..... 27
B.2.3 Known good coupon ..... 27
B.3 Solder globule mass and pin size ..... 28
B.4 Specimen orientation and immersion depth ..... 28
B.4.1 General ..... 28
B.4.2 Resistors and capacitors ..... 29
B.4.3 Small-leaded components ..... 29
B.4.4 Multi-leaded devices ..... 29
B.5 Test flux ..... 30
B.6 Test temperature ..... 30
B.6.1 Solder alloy containing lead ..... 30
B.6.2 Solder alloy without lead ..... 31
B.7 Characteristics of the test apparatus ..... 31
B.7.1 Recording device ..... 31
B.7.2 Balance system ..... 32
B.7.3 Lifting mechanism and controls ..... 32
B.7.4 Parameters to be measured from the force-time trace ..... 37
B.7.5 Reference wetting force ..... 37
B.7.6 Equipment location ..... 38
B.7.7 Globule pins ..... 38
B.7.8 Globule modules ..... 38
B.8 Test flux – IPC-J-STD-002/J-STD-003 activated solderability test flux rationale committee letter ..... 38
B.8.1 General ..... 38
B.8.2 Proactive solderability testing approach to the implementation of non-tin finishes ..... 39
B.8.3 Reduced solderability test variability ..... 39
B.8.4 Standardization of solderability test flux composition on a global scale ..... 39
Annex C (normative) Test methods for SMD components sizes 0603M (0201) or smaller ..... 40
C.1 General ..... 40
C.2 General description of the test method ..... 40
C.3 Preconditioning ..... 40
C.3.1 Preparation of the specimens ..... 40
C.3.2 Ageing ..... 40
C.4 Materials ..... 40
C.4.1 Solder ..... 40
C.4.2 Flux ..... 41
C.5 Method 1 ..... 41
C.5.1 Description of the test apparatus ..... 41
C.5.2 Procedures ..... 41
C.5.3 Presentation of results ..... 44
C.5.4 Information to be given in the relevant specification ..... 45
C.6 Method 2 ..... 46
C.6.1 Test apparatus ..... 46
C.6.2 Observation equipment ..... 46
C.6.3 Test method 2 ..... 46
C.6.4 Presentation of results ..... 47

iTeh STANDARD PREVIEW
(standards.iteh.ai)
IEC 60068-2-69:2017
https://standards.iteh.ai/catalog/standards/sist/e68969aa-37cf-4c19-9d1f-9acd1d867dcd/iec-60068-2-69-2017

Annex D (informative) Evaluation criteria – Guidance ........ 48
D.1 General considerations ........ 48
D.2 Evaluation criteria for components ........ 48
D.3 Evaluation criteria for printed boards ........ 49
Annex E (informative) Method of calculating the maximum theoretical force and integrated value of the area of the wetting curve for leaded non-SMD ........ 50
E.1 Method of calculating the maximum theoretical force ........ 50
E.2 Method of calculating the integrated value of the area of the wetting curve ........ 50
Bibliography ........ 52

Figure 1 – Arrangement for the test apparatus (solder bath wetting balance method) ........ 9
Figure 2 – Arrangement for the test apparatus (solder globule wetting balance method) ........ 9
Figure 3 – Immersion conditions for solder bath method ........ 16
Figure 4 – Immersion conditions for solder globule method ........ 19
Figure 5 – Suggested wetting balance test specimens and soldering immersion ........ 20
Figure 6 – Printed board immersion ........ 21
Figure 7 – Typical wetting balance trace ........ 22
Figure B.1 – Understanding wetting curves ........ 35
Figure B.2 – Typical wetting curve ........ 35
Figure B.3 – Representative force-time curves ........ 36
Figure C.1 – Cross-section of aluminium body ........ 41
Figure C.2 – Dipping position and relative position ........ 42
Figure C.3 – Time and test sequence ........ 44
Figure C.4 – Typical wetting balance trace ........ 45
Figure D.1 – Set A wetting curve ........ 49
Figure D.2 – Set B wetting curve ........ 49

Table 1 – Preconditioning ........ 10
Table 2 – Maximum limits of solder bath contaminants ........ 12
Table 3 – Globule and pellet sizes ........ 12
Table 4 – Rosin based flux compositions ........ 13
Table 5 – Recommended solder bath wetting balance test conditions ........ 15
Table 6 – Time sequence of the test (solder bath) ........ 17
Table 7 – Recommended solder globule wetting balance test conditions ........ 18
Table 8 – Time sequence of the test (solder globule) ........ 20
Table B.1 – Carboxylic acid based flux (water solution) ........ 30
Table B.2 – Carboxylic acid based flux (alcohol solution) ........ 30
Table C.1 – Time sequence of the test procedure ........ 43
Table D.1 – Wetting balance parameter and suggested evaluation criteria ........ 48
Table D.2 – Printed board test parameter and suggested criteria ........ 49

iTeh STANDARD PREVIEW
(standards.iteh.ai)
IEC 60068-2-69:2017
https://standards.iteh.ai/catalog/standards/sist/e68969aa-37cf-4c19-9d1f-
f0e61f8f57cd/iec-60068-2-69-2017

INTERNATIONAL ELECTROTECHNICAL COMMISSION

___________

**ENVIRONMENTAL TESTING –**

**Part 2-69: Tests – Test Te/Tc: Solderability testing of electronic components and printed boards by the wetting balance (force measurement) method**

## 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 itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
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.

iTeh STANDARD PREVIEW
(standards.iteh.ai)
IEC 60068-2-69:2017
https://standards.iteh.ai/catalog/standards/sist/e68060ea-37e6-4a10-9d16-9acd1d867dcd/iec-60068-2-69-2017

International Standard IEC 60068-2-69 has been prepared by IEC technical committee 91: Electronics assembly technology.

This third edition cancels and replaces the second edition published in 2007 as well as the second edition of IEC 60068-2-54 published in 2006 and constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- integration of IEC 60068-2-54;
- inclusion of tests of printed boards;
- inclusion of new component types, and updating test parameters for the whole component list;

- inclusion of a new gauge R & R test protocol to ensure that the respective wetting balance equipment is correctly calibrated.

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

| FDIS | Report on voting |
|---|---|
| 91/1405/FDIS | 91/1426/RVD |

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

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

A list of all parts in the IEC 60068 series, under the general title *Environmental testing*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

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

iTeh STANDARD PREVIEW
(standards.iteh.ai)

The contents of the corrigendum of January 2018 have been included in this copy.

IEC 60068-2-69:2017
https://standards.iteh.ai/catalog/standards/sist/e68969aa-37cf-4c19-9d1f-9acd1d867dcd/iec-60068-2-69-2017

**ENVIRONMENTAL TESTING –**

**Part 2-69: Tests – Test Te/Tc: Solderability testing of electronic components and printed boards by the wetting balance (force measurement) method**

## 1 Scope

This part of IEC 60068 outlines test Te/Tc, the solder bath wetting balance method and the solder globule wetting balance method to determine, quantitatively, the solderability of the terminations. Data obtained by these methods are not intended to be used as absolute quantitative data for pass–fail purposes.

The procedures describe the solder bath wetting balance method and the solder globule wetting balance method. They are applicable to components and printed boards with metallic terminations and metallized solder pads.

This document provides the measurement procedures for solder alloys both with and without lead (Pb).

iTeh STANDARD PREVIEW
(standards.iteh.ai)

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 60068-2-69:2017
https://standards.iteh.ai/catalog/standards/sist/e1686f9a-37c1-4c19-9d1f-9acd1d867dcd/iec-60068-2-69-2017

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

IEC 60068-2-2, *Environmental testing – Part 2-2: Tests – Test B: Dry heat*

IEC 60068-2-20:2008, *Environmental testing – Part 2-20: Tests – Test T: Test methods for solderability and resistance to soldering heat of devices with leads*

IEC 60068-2-66, *Environmental testing − Part 2: Test methods − Test Cx: Damp heat, steady state (unsaturated pressurized vapour)*

IEC 61190-1-3:2007, *Attachment materials for electronic assembly – Part 1-3: Requirements for electronic grade solder alloys and fluxed and non-fluxed solid solders for electronic soldering applications*
IEC 61190-1-3:2007/AMD1:2010

ISO 683 (all parts), *Heat-treatable steels, alloy steels and free-cutting steels*

ISO 6362 (all parts), *Wrought aluminium and aluminium alloys – Extruded rods/bars, tubes and profiles*

## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60068-1 and IEC 60068-2-20 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

# 4 General description of the method

## 4.1 General

The user should note that the test method specified in this document is intended to provide consistent and discriminatory data between various test sites. Hence the choice of alloy, temperature and flux shall be controlled.

Using this test method to control a production process is encouraged. However, as each production process will employ different alloys, temperatures and fluxes, such test results shall be agreed upon between user and supplier. In case of a dispute, the procedures of this document shall prevail.

NOTE Information regarding wetting balance for SMD solderability testing is described in Annex B.

## 4.2 Components

The test specimen shall be a sample from the intended production batch. The test specimen is mounted into a suitable holder that is suspended from a sensitive balance. Liquid flux is then applied to the specimen that is brought into contact with the cleaned surface of the liquid solder within a solder bath, or the apex of a solder globule. The solder in either case is at a controlled temperature, and the lead or termination under test is immersed to the prescribed depth.

iTeh STANDARD PREVIEW
(standards.iteh.ai)
IEC 60068-2-69:2017
https://standards.iteh.ai/catalog/standards/sist/e68969aa-37cf-4c19-9d1f-9acd1d867dcd/iec-60068-2-69-2017

## 4.3 Printed boards

The test specimen should be a representative test specimen, a portion of the printed board being tested, or a whole board if within size limits, such that an immersion depth defined in the individual method is possible. Test specimens may be used for rigid board surface solderability and plated-through-hole solderability.

Liquid flux is then applied to the specimen that is brought into contact with the cleaned surface of a solder bath, or the apex of a solder globule, that is at a controlled temperature and immersed to the prescribed depth.

## 4.4 Measurement

The resultant forces, measured in mN, of buoyancy and surface tension acting upon the immersed termination are detected by a transducer and converted into a signal that is continuously monitored as a function of time, and recorded and displayed on a computer screen.

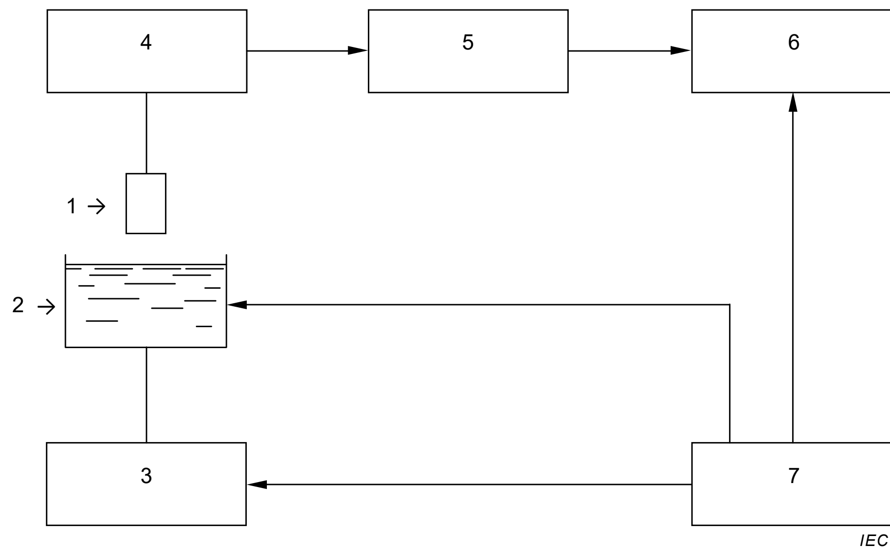
The wetting speed and the extent of wetting are derived from the force against time curve. The trace may be compared with that derived from a perfectly wetted specimen of the same nature and dimensions.

# 5 Description of the test apparatus

Figure 1 and Figure 2 show a suitable arrangement for the test apparatus.

The apparatus specifications are given in Annex A.

The specimen is suspended from a sensitive balance and a mechanism used to either raise the solder to meet the specimen or lower the specimen into the solder. After conditioning, the transducer signal is passed to a computer, where the force against time curve may be displayed and analysed.

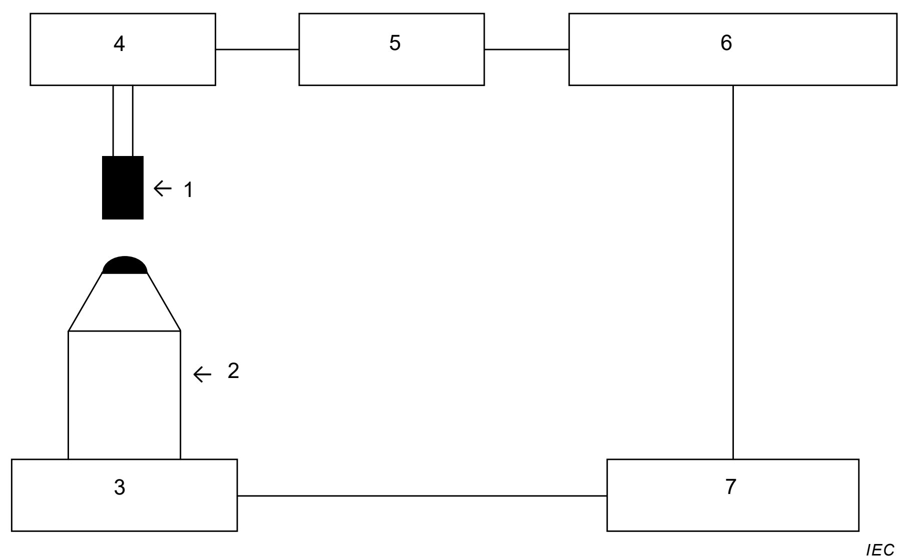



**Key**

| | | | |
|---|---|---|---|
| 1 | Specimen | 2 | Solder bath |
| 3 | Solder bath lifting mechanism | 4 | Balance and transducer |
| 5 | Signal conditioner | 6 | Computer |
| 7 | Control box | | |

iTeh STANDARD PREVIEW
(standards.iteh.ai)
IEC 60068-2-69:2017
https://standards.iteh.ai/catalog/standards/sist/e68969aa-37cf-4c19-9d1f-

**Figure 1 – Arrangement for the test apparatus (solder bath wetting balance method)**




**Key**

| | | | |
|---|---|---|---|
| 1 | Specimen | 2 | Globule block |
| 3 | Lift mechanism | 4 | Balance and transducer |
| 5 | Signal conditioner | 6 | Computer |
| 7 | Control box | | |

**Figure 2 – Arrangement for the test apparatus (solder globule wetting balance method)**

# 6 Preparation of specimens

## 6.1 Cleaning

Unless otherwise specified, the specimen shall be tested in the as-received condition and care should be taken to ensure that no part of the surface to be tested becomes contaminated, particularly by contact with the fingers, during the preparation and handling of the specimen.

If required by the component specification, the specimen may be cleaned by immersion in a neutral organic solvent at room temperature. The specimen should be allowed to dry in air before testing. No other cleaning is permitted.

## 6.2 Preconditioning

If required by the component specification, the component may be subjected to preconditioning before testing. This shall be performed for 4 h at 155 °C unless otherwise agreed between user and supplier (Table 1, condition F).

In the past, it had been practice to use the term accelerated ageing which, as given in IEC 60068-2-20:2008, 4.1.1, has six alternative conditions that may be used as an alternative if agreed between user and supplier:

A – ageing 1a of IEC 60068-2-20;

B – ageing 1b of IEC 60068-2-20;

C – ageing 1b of IEC 60068-2-20, but for 8 h;

D – ageing 1b of IEC 60068-2-20, but for 16 h;

E – ageing 4 of IEC 60068-2-20;

F – ageing 3a of IEC 60068-2-20.

iTeh STANDARD PREVIEW
(standards.iteh.ai)
IEC 60068-2-69:2017
https://standards.iteh.ai/catalog/standards/sist/e68969aa-37cf-4c19-9d1f-9acd1d867dcd/iec-60068-2-69-2017

Refer to Table 1, for preconditioning.

**Table 1 – Preconditioning**

| Condition category | Precondition type | Exposure parameters | Use recommendation | Applicability by finish |
|---|---|---|---|---|
| A | Steam | 1 h ± 5 min | Preferred | Non-tin and non-tin alloy containing finishes |
| B | | 4 h ± 10 min | Preferred | Non-tin and non-tin alloy containing finishes |
| C | | 8 h ± 15 min | Optional | Non-tin and non-tin alloy containing finishes |
| D | | 16 h ± 30 min | Optional | Non-tin and non-tin alloy containing finishes |
| E | Unsaturated pressurized vapour (120 °C,85 % RH) | 4 h ± 10 min | Preferred | All finishes |
| F | 155 °C dry bake | 4 h ± 15 min | Preferred | All finishes |

# 7 Materials

## 7.1 Solder

### 7.1.1 General

The solder to be used for both the solder bath and for the solder globule wetting balance test shall be as specified in 7.1.2 or 7.1.3.

### 7.1.2 Solder alloy containing lead

The solder shall be Sn60Pb40A, Sn63Pb37A or Sn62Pb36Ag02B (refer to the IEC 61190-1-3 alloy name).

NOTE The presence of silver in the solder reduces the dissolution effect on silver containing metallization on components and therefore can be used when required by the relevant component specification.

### 7.1.3 Lead-free solder alloy

The preferred alloy composition to be used should consist of either a mass fraction of 3,0 % Ag, 0,5 % Cu, 96,5 % Sn (Sn96,5Ag3Cu,5) or 0,7 % Cu, 99,3 % Sn (Sn99,3Cu,7). (Refer to IEC 61190-1-3 for the alloy name.)

NOTE Sn96,5Ag3Cu,5 is also known as SAC 305.

Other lead-free solder alloys may be used upon agreement between user and supplier.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

### 7.1.4 Solder contamination control

IEC 60068-2-69:2017
https://standards.iteh.ai/catalog/standards/sist/e6896baa-37cf-4c19-9d1f-9acd1d867dcd/iec-60068-2-69-2017

The solder in solder baths used for solderability testing shall be chemically or spectrographically analyzed or replaced each 30 operating days. The levels of contamination and Sn content shall be within those shown in Table 2. The intervals between analyses may be lengthened if the test results indicate that the contamination limits are not being approached. The composition of the lead-free solder, including contamination levels, shall be maintained during testing with the silver and copper element levels adjusted for alloy requirements.

An operating day consists of any eight-hour period, or any portion thereof, during which the solder is liquefied and used. If contamination exceeds the limits specified in Table 2, then the solder shall be changed and the intervals between analysis shall be shortened. A sampling plan shall be developed, implemented, and documented. It shall also indicate the process control of the solder contamination.

**Table 2 – Maximum limits of solder bath contaminants**

| Contaminant | Maximum mass fraction contaminant limit | |
|---|---|---|
| | SnPb alloys [a, b] % | Lead-free alloys [c, d] % |
| Copper | 0,300 | 1,100 |
| Gold | 0,200 | 0,200 |
| Cadmium | 0,005 | 0,005 |
| Zinc | 0,005 | 0,005 |
| Aluminium | 0,006 | 0,006 |
| Antimony | 0,500 | 0,200 |
| Iron | 0,020 | 0,020 |
| Arsenic | 0,030 | 0,030 |
| Bismuth | 0,250 | 0,250 |
| Silver | 0,100 | 4,000 |
| Nickel | 0,010 | 0,050 |
| Lead | N/A | 0,100 |

[a] The tin content of the solder shall be maintained within ±1,5 % of the nominal alloy being used. Tin content shall be tested at the same frequency as testing for copper/gold contamination. The balance of the bath shall be lead and/or the items listed above.

[b] The total of copper, gold, cadmium, zinc, and aluminium contaminants shall not exceed 0,4 %. Not applicable to lead-free alloys.

[c] The tin content of the solder shall be maintained within ±1 % of the nominal alloy being used. Tin content shall be tested at the same frequency as testing for copper/silver concentration. The balance of the bath shall be the items listed above.

[d] Maximum contamination limits are applicable for Sn96,5Ag3Cu,5. Other lead-free solder alloy contamination limits may be used upon agreement between user and vendor.

iTeh STANDARD PREVIEW
(standards.iteh.ai)
IEC 60068-2-69:2017
https://standards.iteh.ai/catalog/standards/sist/e08969aa-37cf-4c19-9d11-9acd1d867dcd/iec-60068-2-69-2017

### 7.1.5 Solder mass for solder globule wetting balance method

For the solder globule wetting balance method, the solder shall be in the form of pellets or cut wire with a mass of 200 mg ± 10 mg for use on a 4 mm diameter pin globule support block, 100 mg ± 10 mg for use on a 3,2 mm diameter pin support block, 25 mg ± 2,5 mg for use on a 2 mm diameter pin globule support block, and 5 mg ± 0,5 mg for use on a 1 mm diameter globule support block. Refer to Table 3.

**Table 3 – Globule and pellet sizes**

| Pin diameter mm | Pellet mass mg | Pellet mass tolerance mg |
|---|---|---|
| 1 | 5 | ±0,5 |
| 2 | 25 | ±2,5 |
| 3,2 | 100 | ±10 |
| 4 | 200 | ±10 |

A new solder pellet shall be used for each test except in the case of a step and repeat technique. Separate dedicated globule support blocks should be used for tin-lead and lead-free alloys to avoid cross-contamination. Refer to Annex C regarding dimple globule.

### 7.2 Flux

#### 7.2.1 Rosin based flux

The preferred fluxes for the test are rosin based as shown below. See Table 4 for the details.

a) Non-activated
b) Low activated
c) High activated

**Table 4 – Rosin based flux compositions**

| Constituent [a] | Composition by mass fraction % | | |
|---|---|---|---|
| | Non-activated | Low activated | High activated |
| Colophony | 25 ± 0,5 | 25 ± 0,5 | 25 ± 0,5 |
| Diethylammonium hydrochloride (CAS No. 660-68-4) | None | 0,15 ± 0,01 | 0,39 ± 0,01 |
| 2-propanol (Isopropyl alcohol) (CAS No. 67-63-0) or ethyl alcohol (CAS No. 64-17-5) as an alternative | 75 ± 0,5 | 74,85 ± 0,5 | 74,61 ± 0,5 |
| Mass of chlorine of solids [b] | 0 | 0,2 | 0,5 |

[a] See IEC 60068-2-20:2008, Annex B for specification.

[b] Expressed as free chlorine based on the colophony content.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

#### 7.2.2 Flux maintenance

The flux to be used for testing should be taken from the supplied container and poured into a small cup (beaker). Flux applied for testing should be taken from this cup. After use the unused flux left in the cup should be discarded.

IEC 60068-2-69:2017
https://standards.iteh.ai/catalog/standards/sist/e68969aa-37cf-4c19-9d1f-9acd1d867dcd/iec-60068-2-69-2017

#### 7.2.3 Test flux selection criteria

Refer to Clauses B.5 and B.8 for information regarding the adoption and use of these test fluxes.

## 8 Procedure

### 8.1 Test temperature

#### 8.1.1 Solder alloy containing lead

Solder temperature prior to test and during test shall be 235 °C ± 3 °C.

#### 8.1.2 Lead-free solder alloy

Unless otherwise specified in the relevant specification, the temperature of the solder prior to the test shall be 245 °C ± 3 °C for Sn96,5 Ag3 Cu,5 and 250 °C ± 3 °C for Sn99,3 Cu,7 alloys.

### 8.2 Test procedure

#### 8.2.1 Applicable test procedure

Subclause 8.2.2 applies for leaded non-SMD.

Subclause 8.2.2 or 8.2.3 applies for non-leaded SMD or leaded SMD as applicable.

Subclause 8.2.4 applies for printed boards.