

This is a preview of "IEC 60068-2-21 Ed. 6...". [Click here to purchase the full version from the ANSI store.](#)

# INTERNATIONAL STANDARD

# IEC 60068-2-21

Sixth edition  
2006-06

---

---

## Environmental testing –

### Part 2-21: Tests – Test U: Robustness of terminations and integral mounting devices

© IEC 2006 — Copyright - all rights reserved

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 the publisher.

International Electrotechnical Commission, 3, rue de Varembé, PO Box 131, CH-1211 Geneva 20, Switzerland  
Telephone: +41 22 919 02 11 Telefax: +41 22 919 03 00 E-mail: [inmail@iec.ch](mailto:inmail@iec.ch) Web: [www.iec.ch](http://www.iec.ch)



Commission Electrotechnique Internationale  
International Electrotechnical Commission  
Международная Электротехническая Комиссия

PRICE CODE

**U**

*For price, see current catalogue*

## CONTENTS

FOREWORD.....	4
1 Scope.....	6
2 Normative references .....	6
3 Test Ua <sub>1</sub> : tensile .....	7
3.1 Object .....	7
3.2 General description .....	7
3.3 Preconditioning .....	7
3.4 Initial measurements .....	7
3.5 Test method .....	7
3.6 Final measurements .....	8
3.7 Information to be given in the relevant specification .....	8
4 Test Ua <sub>2</sub> : thrust.....	9
4.1 Object .....	9
4.2 General description .....	9
4.3 Preconditioning .....	9
4.4 Initial measurements .....	9
4.5 Test method .....	9
4.6 Final measurements .....	10
4.7 Information to be given in the relevant specification .....	10
5 Test Ub: bending .....	10
5.1 Object .....	10
5.2 General description .....	11
5.3 Preconditioning .....	11
5.4 Initial measurements .....	11
5.5 Test method .....	11
5.6 Final measurements .....	13
5.7 Information to be given in the relevant specification .....	14
6 Test Uc: torsion .....	14
6.1 Object .....	14
6.2 Preconditioning .....	14
6.3 Initial measurements .....	14
6.4 Test method .....	14
6.5 Final measurements .....	15
6.6 Information to be given in the relevant specification .....	15
7 Test Ud: torque .....	15
7.1 Object .....	15
7.2 General description .....	15
7.3 Preconditioning .....	15
7.4 Initial measurements .....	15
7.5 Test method .....	16
7.6 Final measurements .....	16
7.7 Information to be given in the relevant specification .....	16

8	Test Ue: robustness of terminations for SMD in the mounted state .....	17
8.1	Object .....	17
8.2	General description .....	17
8.3	Mounting .....	18
8.4	Initial measurements .....	19
8.5	Test methods .....	19
8.6	Final measurements .....	21
8.7	Information to be given in the relevant specification .....	22
	Figure 1 – Clamp for the testing of short terminations .....	13
	Figure 2 – Sketches showing direction by arrow heads of application of forces Test Ua <sub>1</sub> : tensile and test Ua <sub>2</sub> : thrust.....	23
	Figure 3 – Sketches showing test procedure for test Ub: bending (see 5.5.2.1 and 5.5.2.3) .....	24
	Figure 4 – Diagrams showing test procedure for test Uc: torsion test for wire terminations....	25
	Figure 5 – Example of substrate for test method Ue <sub>1</sub> (also suitable for electrical test).....	26
	Figure 6 – Example of substrate for test methods Ue <sub>2</sub> and Ue <sub>3</sub> (also suitable for electrical test) .....	26
	Figure 7 – Bending jig for test Ue <sub>1</sub> .....	27
	Figure 8 – Example of a push-off test substrate .....	27
	Figure 9 – Force test Ue <sub>2</sub> – pull-off .....	28
	Figure 10 – Example of a force application pushing tool for test Ue <sub>2</sub> – push-off .....	28
	Figure 11 – Example of the shear (adhesion) test – Ue <sub>3</sub> .....	28
	Table 1 – Application .....	6
	Table 2 – Value of applied force for test Ua <sub>1</sub> .....	8
	Table 3 – Value of applied force for test Ua <sub>2</sub> .....	10
	Table 4 – Value of applied force for test Ub .....	12
	Table 5 – Torque severity .....	16

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

### ENVIRONMENTAL TESTING –

### Part 2-21: Tests – Test U: Robustness of terminations and integral mounting devices

#### 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 60068-2-21 has been prepared by IEC technical committee 91: Electronics assembly technology.

This sixth edition cancels and replaces the fifth edition, published in 1999, and constitutes a technical revision.

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

- Addition of torque severity for nominal thread diameter of 8 mm in Test Ud: torque in accordance with IEC 60252-2 (see table 5)
- Modification of substrate specification and mounting method describing lead-free solder in Test Ue (see Figure 5 and 8.3.3 et al.)

This is a preview of "IEC 60068-2-21 Ed. 6...". [Click here to purchase the full version from the ANSI store.](#)

- Modification of test jig and test condition in Test Ue<sub>1</sub>: substrate bending test (see Figure 7 et al.)
- Change of pushing force from 10 N to 5 N in Test Ue<sub>3</sub>: shear test (see 8.5.3.2)

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

FDIS	Report on voting
91/582/FDIS	91/607/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.

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

A complete list of all parts comprising 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 publication 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.

The contents of the corrigendum of January 2012 have been included in this copy.

## ENVIRONMENTAL TESTING –

### Part 2-21: Tests – Test U: Robustness of terminations and integral mounting devices

#### 1 Scope

This part of IEC 60068 is applicable to all electrical and electronic components whose terminations or integral mounting devices are liable to be submitted to stresses during normal assembly or handling operations.

Table 1 provides details of the applicable tests.

**Table 1 – Application**

Test	Type	Component	Mounted/not mounted
Ua <sub>1</sub>	Tensile	Leaded devices	Not mounted
Ua <sub>2</sub>	Thrust	Leaded devices	Not mounted
Ub	Bending	Leaded devices	Not mounted
Uc	Torsion	Leaded devices	Not mounted
Ud	Torque	Threaded stud or screw termination	Not mounted
Ue <sub>1</sub>	Bending	Surface mounted devices	Mounted
Ue <sub>2</sub>	Pull/push	Surface mounted devices	Mounted
Ue <sub>3</sub>	Shear	Surface mounted devices	Mounted

#### 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 60068-1:1988, *Environmental testing – Part 1: General and guidance*  
Amendment 1 (1992)

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

IEC 60068-2-58:2004, *Environmental testing – Part 2-58: Tests – Test Td – Test methods for solderability, resistance to dissolution of metallization and to soldering heat of surface mounting devices (SMD)*

IEC 60068-2-61:1991, *Environmental testing – Part 2: Tests – Test Z/ABDM: Climatic sequence*

IEC 61249-2-7:2002, *Materials for printed boards and other interconnecting structures – Part 2-7: Reinforced base materials clad and unclad – Epoxide woven E-glass laminated sheet of defined flammability (vertical burning test), copper-clad*

IEC 61188-5 (all parts), *Printed boards and printed board assemblies – Design and use*

IEC 61190-1-2:2002, *Attachment materials for electronic assembly – Part 1-2: Requirements for soldering pastes for high quality interconnections in electronics assembly*

This is a preview of "IEC 60068-2-21 Ed. 6...". [Click here to purchase the full version from the ANSI store.](#)

IEC 61191-2:1998, *Printed board assemblies – Part 2: Sectional specification – Requirements for surface mount soldered assemblies*

ISO 272:1982, *Fasteners – Hexagon products – Widths across flats*

ISO 9453:1990, *Soft solder alloys – Chemical compositions and forms*