

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



BSI Standards Publication

Environmental testing

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

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

National foreword

This British Standard is the UK implementation of EN IEC 60068-2-21:2021. It is identical to IEC 60068-2-21:2021. It supersedes BS EN 60068-2-21:2006, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee EPL/501, Electronic Assembly Technology.

A list of organizations represented on this committee can be obtained on request to its committee manager.

Contractual and legal considerations

This publication has been prepared in good faith, however no representation, warranty, assurance or undertaking (express or implied) is or will be made, and no responsibility or liability is or will be accepted by BSI in relation to the adequacy, accuracy, completeness or reasonableness of this publication. All and any such responsibility and liability is expressly disclaimed to the full extent permitted by the law.

This publication is provided as is, and is to be used at the recipient's own risk.

The recipient is advised to consider seeking professional guidance with respect to its use of this publication.

This publication is not intended to constitute a contract. Users are responsible for its correct application.

© The British Standards Institution 2021
Published by BSI Standards Limited 2021

ISBN 978 0 580 99121 9

ICS 19.040; 31.190

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 30 September 2021.

Amendments/corrigenda issued since publication

Date	Text affected
------	---------------

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

EUROPÄISCHE NORM

September 2021

ICS 19.040; 31.190

Supersedes EN 60068-2-21:2006, EN 60068-2-77:1999
and all of its amendments and corrigenda (if any)

English Version

Environmental testing - Part 2-21: Tests - Test U: Robustness of terminations and integral mounting devices (IEC 60068-2-21:2021)

Essais d'environnement - Partie 2-21: Essais - Essai U:
Robustesse des sorties et des dispositifs de montage
incorporés
(IEC 60068-2-21:2021)

Umgebungseinflüsse - Teil 2-21: Tests - Test U:
Widerstandsfähigkeit der Anschlüsse und integrierter
Befestigungsmittel
(IEC 60068-2-21:2021)

This European Standard was approved by CENELEC on 2021-08-12. 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 CEN-CENELEC Management Centre 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 CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.



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

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

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

European foreword

The text of document 91/1732/FDIS, future edition 7 of IEC 60068-2-21, prepared by IEC/TC 91 "Electronics assembly technology" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 60068-2-21:2021.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2022-05-12
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2024-08-12

This document supersedes EN 60068-2-21:2006 and EN 60068-2-77:1999 and all of its amendments and corrigenda (if any).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC shall not be held responsible for identifying any or all such patent rights.

Any feedback and questions on this document should be directed to the users' national committee. A complete listing of these bodies can be found on the CENELEC website.

Endorsement notice

The text of the International Standard IEC 60068-2-21:2021 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 60068-2-61 NOTE Harmonized as EN 60068-2-61

IEC 60068-2-77:1999 NOTE Harmonized as EN 60068-2-77:1999 (not modified)

IEC 61190-1-3:2017 NOTE Harmonized as EN IEC 61190-1-3:2018 (not modified)

IEC 61249-2-22 NOTE Harmonized as EN 61249-2-22

IEC 61249-2-35 NOTE Harmonized as EN 61249-2-35

This is a preview of "BS EN IEC 60068-2-21...". Click here to purchase the full version from the ANSI store.

(normative)

Normative references to international publications with their corresponding European publications

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.

NOTE 1 Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60068-1	2013	Environmental testing - Part 1: General and guidance	EN 60068-1	2014
IEC 60068-2-58	2015	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)	EN 60068-2-58	2015
IEC 60194-2	-	Printed boards design, manufacture and-assembly - Vocabulary - Part 2: Common usage in electronic technologies as well as printed board and electronic assembly technologies	-	-
IEC 61191-2	-	Printed board assemblies - Part 2: Sectional specification - Requirements for surface mount soldered assemblies	EN 61191-2	-

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

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

CONTENTS

FOREWORD.....	5
1 Scope.....	7
2 Normative references	7
3 Terms and definitions	8
4 Tests Ua: Robustness of terminals against axial stresses.....	8
4.1 Object.....	8
4.2 Application.....	8
4.3 General description.....	8
4.4 Preconditioning.....	8
4.5 Initial measurements.....	8
4.6 Test procedures.....	9
4.6.1 Test Ua ₁ : Tensile.....	9
4.6.2 Test Ua ₂ : Thrust.....	10
4.7 Final measurements.....	11
4.8 Information to be given in the relevant specification.....	11
5 Tests Ub: Robustness of terminals against bending stresses.....	11
5.1 Object.....	11
5.2 Application.....	12
5.2.1 General.....	12
5.2.2 Pliable terminations.....	12
5.2.3 Rigid and all other terminations.....	12
5.3 General description.....	13
5.4 Preconditioning.....	14
5.5 Initial measurements.....	14
5.6 Test procedures.....	14
5.6.1 Test Ub ₁ (for wire and strip terminations).....	14
5.6.2 Test Ub ₂ (for tag terminations).....	16
5.6.3 Test Ub ₃ Simultaneous bending.....	17
5.7 Final measurements.....	17
5.8 Information to be given in the relevant specification.....	17
6 Test Uc: Torsion.....	18
6.1 Object.....	18
6.2 Application.....	18
6.3 General description.....	18
6.4 Preparation of the specimen.....	18
6.5 Initial measurements.....	18
6.6 Test procedure.....	19
6.7 Final measurements.....	20
6.8 Information to be given in the relevant specification.....	20
7 Test Ud: Torque.....	20
7.1 Object.....	20
7.2 Application.....	20
7.3 General description.....	21
7.4 Preconditioning.....	21
7.5 Initial measurements.....	21

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

7.6	Test procedure.....	21
7.6.1	Terminations with threaded studs or screws	21
7.6.2	Other test configurations.....	23
7.7	Final measurements.....	23
7.8	Information to be given in the relevant specification	23
8	Test Ue: Robustness of terminations for SMD in the mounted state	24
8.1	Object.....	24
8.2	Application	24
8.3	Substrate for test method Ue	24
8.4	Mounting.....	26
8.4.1	Dimensions.....	26
8.4.2	Possible mounting methods	26
8.4.3	Mounting method for substrate bending, pull-off, push-off and shear	26
8.5	Preconditioning.....	27
8.6	Initial measurements.....	27
8.7	Test methods	27
8.7.1	Test Ue ₁ : Substrate bending test	27
8.7.2	Test Ue ₂ : Pull-off and push-off test.....	28
8.7.3	Test Ue ₃ : Shear test	30
8.8	Final measurements.....	32
8.8.1	Recovery	32
8.8.2	Visual examination of terminations	32
8.8.3	Electrical characteristics	32
8.8.4	Hidden defect	32
8.9	Information to be given in the relevant specification	32
9	Test Uf: Robustness of component body.....	34
9.1	Object.....	34
9.2	Application	34
9.3	General description.....	34
9.4	Preconditioning.....	34
9.5	Initial measurement	34
9.6	Test procedure.....	34
9.6.1	Test Uf ₁ : Body strength	34
9.6.2	Test Uf ₂ : Impact shock	36
9.7	Final measurements.....	38
9.7.1	Recovery	38
9.7.2	Visual examination	39
9.7.3	Electrical characteristics	39
9.7.4	Hidden defect	39
9.8	Information to be given in the relevant specification	39
Annex X (informative) Cross-reference for references to the previous editions of this document.....		40
X.1	Cross-reference for references to the previous edition of IEC 60068-2-21.....	40
X.2	Cross-reference for references to the last edition of IEC 60068-2-77	41
Bibliography.....		43

Figure 1 – Direction of the applied pull force F_p in test Ua₁.....9

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

Figure 2 – Direction of the applied thrust F_t in test Ua_2	10
Figure 3 – Displacement of pliable lead wires in test Ub	12
Figure 4 – Bending force applied to a specimen with non-pliable terminations	13
Figure 5 – Sequential test procedure of test Ub , Method 1	15
Figure 6 – Sequential test procedure of test Ub , Methods 2 and 3.....	16
Figure 7 – Clamp for the testing of short terminations	17
Figure 8 – Preparatory bending of a lead wire for test Uc	18
Figure 9 – Torsion test method 1: Rotation of clamped specimen body	19
Figure 10 – Torsion test method 2: Rotation of clamped other lead wire.....	20
Figure 11 – Assembly for the torque test applied to a threaded stud	22
Figure 12 – Preparation of a threaded termination for the torque test.....	22
Figure 13 – Assembly for the torque test applied to an embedded nut.....	23
Figure 14 – Example of substrate for test method Ue	25
Figure 15 – Substrate bending test	28
Figure 16 – Test Ue_2 , pull-off test	29
Figure 17 – Test Ue_2 , push-off test	30
Figure 18 – Test Ue_3 , shear test	31
Figure 19 – SMD Body strength test Uf_1 applied to a rectangular specimen	35
Figure 20 – SMD Body strength test Uf_1 applied to a MELF specimen	36
Figure 21 – Example of an apparatus for test Uf_2	37
Figure 22 – Example of a piston.....	37
Figure 23 – Examples of the application of the SMD Body impact shock test Uf_2	38
Table 1 – Selection of test methods suitable for specific terminations/leads	7
Table 2 – Value of applied pull force for test Ua_1	10
Table 3 – Value of applied thrust for test Ua_2	11
Table 4 – Value of applied force for test Ub	13
Table 5 – Torque severity	21
Table X.1 – Cross-reference to clauses	40
Table X.2 – Cross-reference to figures.....	41
Table X.3 – Cross reference to tables	41
Table X.4 – Cross-reference to clauses	42
Table X.5 – Cross-reference to figures.....	42

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

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 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.

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

This seventh edition cancels and replaces the sixth edition, published in 2006, and IEC 60068-2-77:1999. This edition constitutes a technical revision.

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

- a) integration of parts of IEC 60068-2-77 (see Annex X); IEC 60068-2-77 is withdrawn with the publication of this document;
- b) Annex X is added to show the correlation of the clauses and subclauses in this edition of IEC 60068-2-21 with the clauses in IEC 60068-2-21:2006 and IEC 60068-2-77:1999.

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

The text of this International Standard is based on the following documents:

FDIS	Report on voting
91/1732/FDIS	91/1742/RVD

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

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

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 document will remain unchanged until the stability date indicated on the IEC website under 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.

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

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 and is also applicable to surface mount devices (SMDs).

The recommended test methods suitable for specific terminations/lead of devices are shown in Table 1.

Table 1 – Selection of test methods suitable for specific terminations/leads

Test method		Component	Mounted/not mounted	See Clause
Test	Type			
Ua ₁	Tensile	Leaded devices	Not mounted	Clause 4
Ua ₂	Thrust	Leaded devices	Not mounted	Clause 4
Ub	Bending	Leaded devices	Not mounted	Clause 5
Uc	Torsion	Leaded devices	Not mounted	Clause 6
Ud	Torque	Threaded stud, screw or other terminations	Not mounted	Clause 7
Ue ₁	Substrate bending	Surface mount devices	Mounted	Clause 8
Ue ₂	Pull/push	Surface mount devices	Mounted	Clause 8
Ue ₃	Shear	Surface mount devices	Mounted	Clause 8
Uf ₁	Body strength	Surface mount devices	Not mounted	Clause 9
Uf ₂	Impact shock	Surface mount devices	Not mounted	Clause 9

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 60068-1:2013, *Environmental testing – Part 1: General and guidance*

IEC 60068-2-58:2015, *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 60194-2, *Printed board design, manufacture and assembly – Vocabulary – Part 2: Common usage in electronic technologies as well as printed board and electronic assembly technologies*