



NSAI
Standards

Irish Standard
I.S. EN 62137-3:2012

Electronics assembly technology -- Part 3: Selection guidance of environmental and endurance test methods for solder joints (IEC 62137-3:2011 (EQV))

I.S. EN 62137-3:2012

Incorporating amendments/corrigenda issued since publication:

The National Standards Authority of Ireland (NSAI) produces the following categories of formal documents:

I.S. xxx: Irish Standard – national specification based on the consensus of an expert panel and subject to public consultation.

S.R. xxx: Standard Recommendation - recommendation based on the consensus of an expert panel and subject to public consultation.

SWiFT xxx: A rapidly developed recommendatory document based on the consensus of the participants of an NSAI workshop.

<i>This document replaces:</i>	<i>This document is based on:</i> EN 62137-3:2012	<i>Published:</i> 20 January, 2012
This document was published under the authority of the NSAI and comes into effect on: 26 January, 2012		ICS number: 31.190
NSAI 1 Swift Square, Northwood, Santry Dublin 9	T +353 1 807 3800 F +353 1 807 3838 E standards@nsai.ie W NSAI.ie	Sales: T +353 1 857 6730 F +353 1 857 6729 W standards.ie
Údarás um Chaighdeáin Náisiúnta na hÉireann		

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 62137-3

January 2012

ICS 31.190

English version

**Electronics assembly technology -
Part 3: Selection guidance of environmental and endurance test methods
for solder joints
(IEC 62137-3:2011)**

Techniques d'assemblage des
composants électroniques -
Partie 3: Guide de choix des méthodes
d'essai d'environnement et d'endurance
des joints brasés
(CEI 62137-3:2011)

Montageverfahren für elektronische
Baugruppen -
Teil 3: Leitfaden für die Auswahl von
Umwelt- und (Lebens)dauerprüfungen für
Lötverbindungen
(IEC 62137-3:2011)

This European Standard was approved by CENELEC on 2011-12-13. 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, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

CENELEC

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

Management Centre: Avenue Marnix 17, B - 1000 Brussels

I.S. EN 62137-3:2012

EN 62137-3:2012

- 2 -

Foreword

The text of document 91/986/FDIS, future edition 1 of IEC 62137-3, prepared by IEC/TC 91 "Electronics assembly technology" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 62137-3:2012.

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) 2012-09-13
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2014-12-13

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

Endorsement notice

The text of the International Standard IEC 62137-3:2011 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 60068-1:1988 + A1:1992	NOTE Harmonized as EN 60068-1:1994 (not modified).
IEC 60068-2-2	NOTE Harmonized as EN 60068-2-2.
IEC 60068-2-14	NOTE Harmonized as EN 60068-2-14.
IEC 60068-2-78	NOTE Harmonized as EN 60068-2-78.
IEC 61760-1	NOTE Harmonized as EN 61760-1.
IEC 62137:2004	NOTE Harmonized as EN 62137:2004 (not modified).

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60194	-	Printed board design, manufacture and assembly - Terms and definitions	EN 60194	-
IEC 61188-5	Series	Printed boards and printed board assemblies - Design and use - Part 5: Attachment (land/joint) considerations	-EN 61188-5	Series
IEC 61249-2-7	-	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	EN 61249-2-7	-
IEC 62137-1-1	2007	Surface mounting technology - Environmental and endurance test methods for surface mount solder joint - Part 1-1: Pull strength test	EN 62137-1-1	2007
IEC 62137-1-2	2007	Surface-mounting technology - Environmental and endurance test methods for surface mount solder joint - Part 1-2: Shear strength test	EN 62137-1-2	2007
IEC 62137-1-3	2008	Surface mounting technology - Environmental and endurance test methods for surface mount solder joint - Part 1-3: Cyclic drop test	EN 62137-1-3	2009
IEC 62137-1-4	2009	Surface mounting technology - Environmental and endurance test methods for surface mount solder joint - Part 1-4: Cyclic bending test	EN 62137-1-4	2009
IEC 62137-1-5	2009	Surface mounting technology - Environmental and endurance test methods for surface mount solder joint - Part 1-5: Mechanical shear fatigue test	EN 62137-1-5	2009

This page is intentionally left BLANK.

CONTENTS

FOREWORD.....	5
1 Scope.....	7
2 Normative references	7
3 Terms and definitions	7
4 General remarks.....	9
5 Procedure of selecting the applicable test method	10
5.1 Stress to solder joints in the field and test methods	10
5.2 Selection of test methods based on the shapes and terminations/leads of electronic devices.....	12
5.2.1 Surface mount devices	12
5.2.2 Lead insertion type device	13
6 Common subjects in each test method	14
6.1 Mounting device and materials used.....	14
6.2 Soldering condition.....	15
6.2.1 General	15
6.2.2 Reflow soldering	15
6.2.3 Wave soldering	17
6.3 Accelerated stress conditioning	18
6.3.1 Rapid temperature change (applies to all solder alloys in this document)	18
6.3.2 Dry heat (applies to Bi58Sn42 alloy solder only).....	19
6.3.3 Damp heat (steady state) (applies to Sn91Zn9 and Sn89Zn8Bi3 alloy solder)	19
6.4 Selection of test conditions and judgement of test results.....	19
7 Evaluation test method	19
7.1 Solder joint strength test of SMD	19
7.1.1 General	19
7.1.2 Pull strength test	19
7.1.3 Shear strength test	20
7.1.4 Torque shear strength test.....	21
7.1.5 Monotonic bending strength test.....	21
7.2 Cyclic bending strength test	22
7.3 Mechanical shear fatigue test.....	23
7.4 Cyclic drop test and cyclic steel ball drop strength test.....	24
7.4.1 Overview	24
7.4.2 Cyclic steel ball drop strength test	25
7.5 Solder joint strength test for lead insertion type device.....	26
7.5.1 Pull strength test for insertion type device	26
7.5.2 Creep strength test for lead insertion type device	26
Annex A (informative) Condition of rapid temperature change.....	28
Annex B (informative) Electrical continuity test for solder joint	30
Annex C (informative) Torque shear strength test	31
Annex D (informative) Monotonic bending strength test	34
Annex E (informative) Cyclic steel ball drop strength test.....	36
Annex F (informative) Pull strength test.....	38
Annex G (informative) Creep strength test.....	39

Annex H (informative) Evaluation method for the fillet lifting phenomenon of a lead insertion type device solder joint.....	41
Bibliography.....	43
Figure 1 – Joint regions for the reliability tests.....	9
Figure 2 – Factors affecting the joint reliability made by lead-free solder	10
Figure 3 – An example of the mounting position of SMD for monotonic bending and cyclic bending tests	15
Figure 4 – An example of reflow soldering temperature profile (Sn96,5Ag3Cu,5)	16
Figure 5 – Examples of reflow soldering temperature profile other than Sn96,5Ag3Cu,5	16
Figure 6 – An example of wave soldering temperature profile (Sn96,5Ag3Cu,5).....	17
Figure 7 – An example of wave soldering temperature profile	18
Figure 8 – Pull strength test.....	20
Figure 9 – Shear strength test.....	20
Figure 10 – Torque shear strength test	21
Figure 11 – Monotonic bending strength test.....	21
Figure 12 – Cyclic bending strength test	22
Figure 13 – Structure of cyclic bending strength test.....	23
Figure 14 – Schematic diagram of mechanical shear fatigue for solder joint.....	24
Figure 15 – Cyclic drop test	25
Figure 16 – Cyclic steel ball drop test	25
Figure 17 – Pull strength test.....	26
Figure 18 – Creep strength test	27
Figure A.1 – Stress relation curve for a given strain to a solder joint (Sn96,5Ag3Cu,5)	28
Figure A.2 – Time to reach steady state in the temperature cycle chamber	29
Figure B.1 – Example of the test circuit for an electrical continuity test of a solder joint	30
Figure C.1 – Fixing of substrate for torque shear strength test	32
Figure C.2 – Torque shear strength test jig and position adjustment	33
Figure C.3 – Torque shear strength test for a connector	33
Figure D.1 – Example of a board bending jig.....	34
Figure E.1 – Cyclic steel ball drop test.....	37
Figure E.2 – Comparison of cyclic drop test and cyclic steel ball drop test.....	37
Figure F.1 – Pull strength test.....	38
Figure G.1 – Creep strength test.....	39
Figure H.1 – Fillet lifting phenomenon of solder joint.....	41
Figure H.2 – Example of an electrical continuity test circuit for a lead insertion type device solder joint.....	42
Table 1 – Correlations between test methods and actual stresses in the field	11
Table 2 – Recommended test methods suitable for specific shapes and terminations/leads of SMDs	12
Table 3 – Recommended test methods suitable for application and mass of the lead insertion type device	13
Table 4 – Solder alloy composition	14

I.S. EN 62137-3:2012

– 4 –

62137-3 © IEC:2011

Table 5 – Diameters of through holes and lands in respect to the nominal cross section and nominal diameter of lead wire	15
Table 6 – Temperature condition for rapid temperature change.....	18

INTERNATIONAL ELECTROTECHNICAL COMMISSION

ELECTRONICS ASSEMBLY TECHNOLOGY –

Part 3: Selection guidance of environmental and endurance test methods for solder joints

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 62137-3 has been prepared by IEC technical committee 91: Electronics assembly technology.

This first edition cancels and replaces IEC/PAS 62137-3, published in 2008, and includes some editorial revisions. The main changes with respect to the PAS include the following:

- no technical changes;
- some editorial changes and corrections;
- for the sake of convenience some constitutive changes.

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

FDIS	Report on voting
91/986/FDIS	91/1011/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 list of all parts of IEC 62137 under the general title *Electronics assembly technology* can be found in the IEC website.

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.

The committee has decided that the contents of this publication will remain unchanged until the stability 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.

IMPORTANT – The “colour inside” logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this publication using a colour printer.

This is a free preview. Purchase the entire publication at the link below:

[Product Page](#)

-
- Looking for additional Standards? Visit Intertek Inform Infostore
 - Learn about LexConnect, All Jurisdictions, Standards referenced in Australian legislation
-