



NSAI
Standards

Irish Standard
I.S. EN 61193-3:2013

Quality assessment systems -- Part 3: Selection and use of sampling plans for printed board and laminate end- product and in-process auditing (IEC 61193-3:2013 (EQV))

I.S. EN 61193-3:2013

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 61193-3:2013	<i>Published:</i> 26 April, 2013
This document was published under the authority of the NSAI and comes into effect on: 1 May, 2013		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 61193-3

April 2013

ICS 31.190

English version

**Quality assessment systems -
Part 3: Selection and use of sampling plans for printed board and laminate
end-product and in-process auditing
(IEC 61193-3:2013)**

Système d'assurance de la qualité -
Partie 3: Choix et utilisation de plans
d'échantillonnage pour cartes imprimées
et produits finis stratifiés et audits en
cours de fabrication
(CEI 61193-3:2013)

Qualitätsbewertungssysteme -
Teil 3: Auswahl und Anwendung von
Stichprobenanweisungen für Endprodukte
von Leiterplatten und Laminaten und
fertigungsbegleitende Auditierung
(IEC 61193-3:2013)

This European Standard was approved by CENELEC on 2013-02-28. 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, Former Yugoslav Republic of Macedonia, 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

Foreword

The text of document 91/1061/FDIS, future edition 1 of IEC 61193-3, prepared by IEC TC 91 "Electronics assembly technology" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 61193-3:2013.

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) 2013-11-28
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2016-02-28

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 61193-3:2013 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 60068-2-20	NOTE	Harmonized as EN 60068-2-20.
IEC 60068-2-38	NOTE	Harmonized as EN 60068-2-38.
IEC 61189-2	NOTE	Harmonized as EN 61189-2.
IEC 61189-3	NOTE	Harmonized as EN 61189-3.
IEC 61193-1	NOTE	Harmonized as EN 61193-1.
IEC 61193-2	NOTE	Harmonized as EN 61193-2.
IEC 62326-1	NOTE	Harmonized as EN 62326-1.
IEC 62326-4-1	NOTE	Harmonized as EN 62326-4-1.
ISO 14001	NOTE	Harmonized as EN ISO 14001.

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	2006	Printed board design, manufacture and assembly - Terms and definitions	EN 60194	2006
IEC 62326-4	1996	Printed boards - Part 4: Rigid multilayer printed boards with interlayer connections - Sectional specification	EN 62326-4	1997
ISO 9000	2005	Quality management systems - Fundamentals and vocabulary	EN ISO 9000	2005
ISO 14560	2004	Acceptance sampling procedures by attributes - Specified quality levels in nonconforming items per million	-	-

This page is intentionally left BLANK.

CONTENTS

FOREWORD.....	4
INTRODUCTION.....	6
1 Scope.....	7
2 Normative references.....	7
3 Terms and definitions	7
4 Sampling methodologies	9
4.1 General	9
4.2 Attribute sampling plans.....	10
4.2.1 General	10
4.2.2 Continuous sampling.....	10
4.2.3 Production lot attributes	10
4.2.4 Production lot variables.....	10
4.3 Non-statistical sampling plans.....	11
4.4 Defining $c = 0$ plans	11
5 Classification of attributes.....	16
5.1 General	16
5.2 Classification assignment	17
5.3 Classification and adjustment of sampling plan criteria.....	18
5.4 Process control.....	18
6 Defects and process deviation indicator (PDI) evaluation.....	19
6.1 General	19
6.2 Process control and process improvement requirements	19
7 Inspection plans.....	19
7.1 General	19
7.2 Zero acceptance number-based sampling plans.....	20
7.3 Responsible authority	20
7.4 Application.....	20
7.5 Sampling plan specification.....	20
7.6 Submission of product	21
8 Classification of defects	23
8.1 General	23
8.2 Customers detail specification (CDS) data	23
9 Percent defectives per million opportunities.....	23
9.1 General	23
9.2 Classes of DPMO	24
9.2.1 General	24
9.2.2 DPMO-1 – Functional non-conformances only	24
9.2.3 DPMO-2 – Electrical non-conformances	24
9.2.4 DPMO-3 – Visual/mechanical non-conformances	24
9.2.5 DPMO-4 – hermetic non-conformances	24
9.2.6 DPMO-5 – all non-conformances.....	24
9.3 Estimation of DPMO	24
9.3.1 General	24
9.3.2 DPMO reporting	24
9.4 DPMO calculations	25

I.S. EN 61193-3:2013

61193-3 © IEC:2013

– 3 –

9.4.1	General	25
9.4.2	Sampling requirements	25
10	Use of sampling plans	25
10.1	General	25
10.2	Grouping of tests	25
10.3	Categorization	26
10.4	In-process testing and control	26
10.5	Indirect measuring methods	27
Annex A (informative) Example of consensus sampling plan for three levels of conformance to requirements of IEC 62326-4 multilayer printed boards		28
Annex B (informative) Example of consensus sampling plan		49
Annex C (informative) Operating characteristics curves and values		52
Bibliography		60
Figure 1 – Typical OC curve for $c \geq 0$ plan		13
Figure 2 – OC curve comparisons between $c \geq 0$ and $c = 0$ plans		14
Figure 3 – Systematic path for implementing process control		19
Figure 4 – Non-conforming attributes with specification requirements		22
Figure C.1 – Lot size 2 to 8		53
Figure C.2 – Lot size 9 to 15		53
Figure C.3 – Lot size 16 to 25		54
Figure C.4 – Lot size 26 to 50		54
Figure C.5 – Lot size 51 to 90		55
Figure C.6 – Lot size 91 to 150		55
Figure C.7 – Lot size 151 to 280		56
Figure C.8 – Lot size 281 to 500		56
Figure C.9 – Lot size 501 to 1 200		57
Figure C.10 – Lot size 1 201 to 3 200		57
Figure C.11 – Lot size 3 201 to 10 000		58
Figure C.12 – Lot size 10 001 to 35 000		58
Figure C.13 – Lot size 35 000 to 150 000		59
Figure C.14 – Lot size 150 001 to 500 000		59
Table 1 – Inspection plan comparison		14
Table 2 – Risk management index values (Associated AQ Limits)		15
Table 3 – Sample size selection guideline		16
Table 4 – Worst-case use environments		17
Table 5 – General sample plan criteria per industry markets/technology sectors		21
Table 6 – Process control		27
Table A.1 – Performance requirements		28
Table B.1 – Guideline for qualification and conformance inspection		50
Table C.1 – Lot sizes		52
Table C.2 – Small lot characteristics		52

INTERNATIONAL ELECTROTECHNICAL COMMISSION

QUALITY ASSESSMENT SYSTEMS –

**Part 3: Selection and use of sampling plans for printed board
and laminate end-product and in-process auditing**

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 61193-3 has been prepared by IEC technical committee 91: Electronics assembly technology.

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

FDIS	Report on voting
91/1061/FDIS	91/1080/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.

I.S. EN 61193-3:2013

61193-3 © IEC:2013

– 5 –

A list of all parts of the IEC 61193 series, under the general title *Quality assessment systems*, can be found on the IEC website.

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 document using a colour printer.

INTRODUCTION

A clear description in IEC standards and specifications and their reference to sampling plans in order to insure adherence to customer requirements is essential. All the details should be clear as to their implementation or adjustment for evaluation of the product to be shipped, the use of process control and SPC, or the applicability for using these principles in controlled experimentation. The general characteristics of these principles relate to a gradual reduction that might be needed in examining the product being manufactured. As such, they are sometimes referred to as the logical steps to process improvement. These steps are as follows.

a) **STATISTICAL SAMPLING:** where, when, and why

- To determine a proper amount of examples from a given lot of product and using statistics to evaluate the occurrence of anomalies.

b) **ZERO DEFECT STANDARDS:** role of specifications

- To adopt the role of attempting to achieve no defects in a production lot through the recommendations identified in standards or specifications that define the product requirements.

c) **ECONOMICS:** AQL versus cost of defects

- To establishing the highest level of non-conforming product characteristics, determining the cost that is incurred when these are discovered or delivered accidentally to the customer (cost of quality) and establishing an acceptable quality assessment methodology in order to reduce these occurrences.

d) **SPC REDUCED INSPECTION:** rules for use and control

- To create a process control program that is based on reject criteria, followed by controlled experimentation to improve the process and then using statistical analysis in order to determine that the process improvement has reduced the occurrences of these reject criteria.

The explosion of the electronics industry has led to a situation where the design of the printed board mounting structure or the material used to produce the product is so complex, that the quality level of these items delivered with known failures are no longer acceptable. The acceptable number of non-conforming products should be directed toward approaching zero in producer-customer contracts.

This has led to the development of new methods of quality assurance like the application of Statistical Process Control (SPC). The low number of permitted non-conforming product according to the AQL tables caused many to resort to 100 % testing or inspection.

At the same time the quality thinking has developed so that the idea to accept failures has become impossible, and the use of the AQL tables in the traditional way has been diminishing very rapidly.

QUALITY ASSESSMENT SYSTEMS –

Part 3: Selection and use of sampling plans for printed board and laminate end-product and in-process auditing

1 Scope

This part of IEC 61193 establishes sampling plans for inspection by attributes, including sample plan selection criteria and implementation procedures for printed board and laminate end-product and in-process auditing. The principles established herein permit the use of different sampling plans that may be applied to an individual attribute or set of attributes, according to classification of importance with regard to form, fit and function.

2 Normative references

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.

IEC 60194:2006, *Printed board design, manufacture and assembly – Terms and definitions*

IEC 62326-4:1996, *Printed boards – Part 4: Rigid multilayer printed boards with interlayer connections – Sectional specification*

ISO 9000:2005, *Quality management systems – Fundamentals and vocabulary*

ISO 14560:2004, *Acceptance sampling procedures by attributes – Specified quality levels in non-conforming items per million*

3 Terms and definitions

For purposes of this document, the terms and definitions given in IEC 60194:2006, ISO 9000:2005 and the following apply.

3.1

attribute

aspect or characteristic of a unit of a defined product in terms of actual requirement and allowable deviation

Note 1 to entry: An actual requirement signifies the following:

- a requirement that is stated as a measurement with an allowable more and/or less deviation;
- a requirement stated as an absolute desired condition with allowable anomalies;
- a requirement stated as an absolute without exception (go/ no-go).

3.1.1

critical attribute

attribute where a defect, that judgment and experience indicate, is likely to result in hazardous or unsafe conditions for individuals using, maintaining, or depending upon the product; or where a defect is likely to prevent performance or function of a major end item such as a ship, aircraft, computer, medical equipment, or telecommunication satellite

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
-