SVENSK STANDARD

SS-EN 60115-1, utg 3:2024

Fastställd	Sida	Ansvarig kommitté
2024-01-24	1 (177)	SEK TK 40

Fasta motstånd för elektronikutrustningar – Del 1: Artspecifikation

Fixed resistors for use in electronic equipment – Part 1: Generic specification

Som svensk standard gäller europastandarden EN 60115-1:2023. Den svenska standarden innehåller den officiella engelska språkversionen av EN 60115-1:2023.

Nationellt förord

Europastandarden EN 60115-1:2023

består av:

– **europastandardens ikraftsättningsdokument,** utarbetat inom CENELEC
– **IEC 60115-1, Fifth edition, 2020 - Fixed resistors for use in electronic equipment – Part 1: Generic specification**

utarbetad inom International Electrotechnical Commission, IEC.

Tidigare fastställd svensk standard SS-EN 60115-1, utg 2:2012 med eventuella tillägg, ändringar och rättelser, gäller ej fr o m 2026-02-13.

ICS 31.040.10

Denna standard är fastställd av SEK Svensk Elstandard,
som också kan lämna upplysningar om **sakinnehållet** i standarden.
Postadress: Box 1284, 164 29 KISTA
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Standarder underlättar utvecklingen och höjer elsäkerheten

Det finns många fördelar med att ha gemensamma tekniska regler för bl a mätning, säkerhet och provning och för utförande, skötsel och dokumentation av elprodukter och elanläggningar.

Genom att utforma sådana standarder blir säkerhetsfordringar tydliga och utvecklingskostnaderna rimliga samtidigt som marknadens acceptans för produkten eller tjänsten ökar.

Många standarder inom elområdet beskriver tekniska lösningar och metoder som åstadkommer den elsäkerhet som föreskrivs av svenska myndigheter och av EU.

SEK är Sveriges röst i standardiseringsarbetet inom elområdet

SEK Svensk Elstandard svarar för standardiseringen inom elområdet i Sverige och samordnar svensk medverkan i internationell och europeisk standardisering. SEK är en ideell organisation med frivilligt deltagande från svenska myndigheter, företag och organisationer som vill medverka till och påverka utformningen av tekniska regler inom elektrotekniken.

SEK samordnar svenska intressenters medverkan i SEKs tekniska kommittéer och stödjer svenska experters medverkan i internationella och europeiska projekt.

Stora delar av arbetet sker internationellt

Utformningen av standarder sker i allt väsentligt i internationellt och europeiskt samarbete. SEK är svensk nationalkommitté av International Electrotechnical Commission (IEC) och Comité Européen de Normalisation Electrotechnique (CENELEC).

Standardiseringsarbetet inom SEK är organiserat i referensgrupper bestående av ett antal tekniska kommittéer som speglar hur arbetet inom IEC och CENELEC är organiserat.

Arbetet i de tekniska kommittéerna är öppet för alla svenska organisationer, företag, institutioner, myndigheter och statliga verk. Den årliga avgiften för deltagandet och intäkter från försäljning finansierar SEKs standardiseringsverksamhet och medlemsavgift till IEC och CENELEC.

Var med och påverka!

Den som deltar i SEKs tekniska kommittéarbete har möjlighet att påverka framtida standarder och får tidig tillgång till information och dokumentation om utvecklingen inom sitt teknikområde. Arbetet och kontakterna med kollegor, kunder och konkurrenter kan gynnsamt påverka enskilda företags affärsutveckling och bidrar till deltagarnas egen kompetensutveckling.

Du som vill dra nytta av dessa möjligheter är välkommen att kontakta SEKs kansli för mer information.

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 60115-1

March 2023

ICS 31.040.10

Supersedes EN 60115-1:2011;
EN 60115-1:2011/A11:2015

English Version

Fixed resistors for use in electronic equipment - Part 1: Generic specification (IEC 60115-1:2020, modified)

Résistances fixes utilisées dans les équipements électroniques - Partie 1: Spécification générique (IEC 60115-1:2020, modifiée)

Festwiderstände zur Verwendung in elektronischen Geräten - Teil 1: Fachgrundspezifikation (IEC 60115-1:2020, modifiziert)

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

Ref. No. EN 60115-1:2023 E

SEK Svensk Elstandard SS-EN 60115-1, utg 3:2024

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European foreword

This document (EN 60115-1:2023) consists of the text of IEC 60115-1:2020 prepared by IEC/TC 40, “Capacitors and resistors for electronic equipment”, together with the common modifications prepared by the CLC TC/40XB, “Resistors”.

The following dates are fixed:

- latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2024-02-13
- latest date by which the national standards conflicting with this document have to be withdrawn (dow) 2026-02-13

This document supersedes EN 60115-1:2011 + EN 60115-1:2011/A11:2015.

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

a) this edition employs a new document structure, where the tests of prior Clause 4 are given in Clauses 6 to 12 now, with an informative Annex ZX providing cross-references for references to the prior revision of this standard;

b) the terms and definitions have been revised and amended, supplemented by a new section on resistor technologies and a new section on product classification levels;

c) a new Subclause 4.7 on recommendations for permissible substitutions has been added;

d) the provisions for packaging, storage and transportation in Subclauses 4.8, 4.9 and 4.10 have been completely revised;

e) a new Subclause 5.3 on default tolerances for the most common test parameters has been added;

f) the generic method of measuring resistance, now Sublause 5.6, has been separated from the test for compliance with a prescribed resistance value in 6.1, as a revision of the prior 4.5;

g) the test for the temperature coefficient of resistance of Subclause 6.2 is a revision of the prior test 4.8, variation of resistance with temperature, where the special concessions for resistors below 10 Ω have been waived;

h) the single-pulse high-voltage overload test of Subclause 8.2 (prior 4.27) has been completely revised;

i) the periodic-pulse high-voltage overload test of Subclause 8.3 (prior 4.28) has been revised and a corrected table of severities provided;

j) the period-pulse overload test of Subclause 8.4 (prior 4.39) has been deprecated and streamlined to only offer the severity historically applied in subordinate specifications;

k) the Subclauses 9.1 on visual inspection, 9.2 on the gauging of dimensions, and 9.3 on the assessment of detail dimensions (all parts of prior 4.4) have been completely revised;

l) the tests for robustness of terminations (prior 4.16) have been revised and separated into tests for the robustness of solderable terminations, Subclause 9.5, and tests for the robustness of threaded stud or screw terminations, Subclause 9.6;

m) the bump test of Subclause 9.9 (prior 4.20) and the shock test of Subclause 9.10 (prior 4.21) have been revised to reflect the merged relevant test standard EN 60068-2-29;

n) the accelerated damp heat, steady-state test of Subclause 10.5 (prior 4.37) has been amended with an option for a reduced number of bias voltages;

o) the corrosion test of Subclause 10.6 has been completely revised in order to employ the better suitable test method of EN 60068-2-52 instead of the prior used EN 60068-2-11;

p) the whisker growth test of 10.7 has been revised to reflect the changes of the new revision of the test methods of EN IEC 60068-2-82;

q) the test methods for solderability of Subclause 11.1 (prior 4.17) and for resistance to soldering heat of Subclause 11.2 (prior 4.18) have been completely revised to incorporate the necessary option for the variety of lead-bearing and lead-free solder alloys and respective process conditions;

r) the solvent resistance test of 11.3 combines the prior tests 4.29, component solvent resistance, and 4.30, solvent resistance of marking, in one test;

s) the accidental overload test of Subclause 12.3 (prior 4.26) has been completely revised.

Preceding documents on the subject covered by this specification have been:

— EN 60115-1:2001 + EN 60115-1:2001/A1:2001 + EN 60115-1:2001/A11:2007

— EN 140000:1993-12

— CECC 40 000:1973-00, 1979-00.

Clauses, subclauses, annexes, notes, tables and figures which are additional to those in IEC 60115-1:2020 are prefixed “Z”.

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.

1 Modification to the Introduction

Add the following new paragraph after the existing first paragraph:

“The explanation given in this introduction uses IEC documents as examples. Anyhow, the same principles apply in unison to respective documents with EN or EN IEC prefix.”

2 Modification to Clause 1

Replace the first paragraph with the following:

“This part of EN 60115 is a generic specification and is applicable to fixed resistors for use in electronic equipment.”

3 Modification to Clause 2

3.1 Modify the normative reference to IECQ 03-1:2018 as follows:

IECQ 03-1:2020, *IEC Quality Assessment System for Electronic Components (IECQ System) – Rules of procedure — Part 1: General Requirements for all IECQ Schemes*

3.2 Add the following two entries:

IECQ 03-3:2018*, IEC Quality Assessment System for Electronic Components (IECQ System) – Rules of Procedure – Part 3: IECQ Approved Component Products, Related Materials and Assemblies Scheme*

IECQ 03-3-1:2018, *IEC Quality Assessment System for Electronic Components (IECQ System) – Rules of Procedure – Part 3-1: IECQ Approved Component Products, Related Materials and Assemblies Scheme, IECQ Approved Component – Technology Certification (IECQ AC-TC)*

4 Modification to Clause 5

In 5.1, replace the 4th paragraph with the following:

“The performance requirements prescribed by any relevant specification are absolute limits. The policy on uncertainty of measurements and inset limits, as given in IECQ 03-1:2020, Annex C, shall be applied.”

5 Modification to Clause 9

Replace the 1st paragraph in 9.2.2.1, as well as the 1st paragraph in 9.3.2.1, with the following:

“The limiting dimensions are generally prescribed as absolute limits. The policy on inset limits in accordance with IECQ 03-1:2020, Annex C, shall be applied to the preparation of gauges or other representations of the required acceptance windows.”

6 Modification to Annex B

Replace Annex B with the following:

“

Annex B
(normative)

Rules for the preparation of detail specifications for resistors and capacitors for electronic equipment for use within the IECQ system

B.1 The drafting of a complete detail specification, in line with the CEN/CENELEC Internal Regulations, shall begin only when all the following conditions have been met:

a) the generic specification has been approved;

b) the sectional specification, if appropriate, has been circulated for approval according to the relevant system rules (e.g. FDIS, or unanimously approved CDV, at IEC);

c) the associated blank detail specification has been circulated for approval according to the relevant system rules (e.g. FDIS, or unanimously approved CDV, at IEC);

B.2 Detail specifications shall use the standard or preferred values, ratings and characteristics, and severities for environmental tests, etc. which are given in the appropriate generic or sectional specifications.

An exception to this rule may only be granted for a specified detail specification, if agreed by the technical committee.

B.3 The detail specification should not be circulated for approval according to the relevant system rules (e.g. FDIS, or unanimously approved CDV, at IEC) until the sectional and blank detail specifications have been approved for publication.”

7 Modification to Annex C

Replace Annex C with the following:

“

Annex C
(informative)

Example of a certified test record

Component manufacturer	Veriohm Ltd.
Place of manufacture	Amper Lane 8, Voltville
Detail specification and issue	EN 140401-808:2021
Description of component	Fixed low power film surface mount (SMD) resistors, Rectangular
Current three months period	2021-01-01 – 2021-03-31

This Certified Test Record is a completed and accurate record of the tests carried out in accordance with the specified procedures.

Manufacturer	
Designated Management Representative	(T. Rustworthy)
IECQ Certification Body	
Supervising Inspector	(S. Crutiny)

	TEST REPORT THIN FILM RESISTORS	Detail Specification: EN 140401-808:2021
	-Style(s): RR1005M (abc0402) - RR1608M (abc0603) - RR2012M (abc0805) - RR3216M (abc1206)	Date: 2021-03-31

Resistance range: **0.22Ω to 10MΩ; 0.0Ω**	Resistance tolerance(s): **0.1% to 5%**	TCR(s): **10, 15 , 25 and 50 · 10^{-6}/K**

1. RESULTS OF QUALIFICATION AND QUALITY CONFORMANCE TESTS

Group[1)]	Test[1)]	Clause[2)]	Req.[1)]	Test results			
				Quarter: I/21		Period: I/88 - I/21	
				pcs tested	failures	pcs tested	failures
A1	Resistance value	6.1 [4.5]	E	400	0	350.223	1
A2	Visual examination	9.1 [4.4.1]	A	0	0	63.260	0
	Marking	9.1 [4.4.1]	B	140.459	0	2.500.533	5
	Dimensions (gauging)	9.2 [4.4.2]	D	0	0	2.840	0
B1	Insulation resistance	12.1 [4.6]	D	0	0	631	0
	Voltage proof	12.2 [4.7]	F	40	0	2.395	0
	Short time overload	8.1 [4.13]	D	50	0	177.370	1
B2	Solderability	11.1 [4.17]	G	1.135	0	3.422.323	57
C1	Substrate bending test	9.8 [4.33]	D	0	0	8.700	8
	Shear test	9.7 [4.32]	C	0	0	3.480	1
	Rapid change of temperature	10.1 [4.19]	D	0	0	3.740	0
	Climatic sequence	10.3 [4.23]	D	0	0	6.850	0
C2	Endurance at 70 °C - 1000 h	7.1 [4.25.1]	D	0	0	6.409	2
	Extended endurance - 8000 h	7.1.8 [4.25.1.8]	D	0	0	2.120	0
C3	Resistance to soldering heat	11.2 [4.18]	D	830	0	315.762	44
	Flammability	12.4 [4.35]	D	0	0	125	0
D1	Variation of resistance with temperature	6.2 [4.8]	H	28.022	0	383.252	20
D2	Damp heat, steady state	10.4 [4.24]	D	0	0	1.480	1
D3	Dimensions (detail)	9.3 [4.4.3]	D	40	0	1.645	0
	Endurance at UCT	7.3 [4.25.3]	D	0	0	480	0
	Temperature rise	6.7 [4.14]	D	0	0	50	0
E	Electrostatic discharge	8.5 [4.38]	D	0	0	1.060	1
	Component solvent resistance	11.3 [4.29]	C	0	0	26.342	0
	Solvent resistance of marking	11.3 [4.30]	B, C	0	0	1.307	0
	Vibration	9.11 [4.22]	D	0	0	0	0
	Periodic pulse overload	8.4 [4.39]	D	0	0	0	0
F	Rapid change of temperature	10.1 [4.19]	D	0	0	910	0
G	Single pulse high voltage overload	8.2 [4.27]	D	0	0	1.220	0

1) According to detail specification(s)

2) Clause numbers relate to EN 60115-1:2021, complemented with clause numbers related to EN 60115-1:2011 in square brackets [..].

Requirements :

A : Condition, workmanship and finish shall be satisfactory
B : Marking shall be legible
C : No visible damage or reduced usability
D : Parameter / resistance change as specified in the detail specification
E : Rated tolerance of resistance not to be exceeded at 20 °C
F : No break down or flashover
G : Good tinning (≥ 95 %) with wetting of the terminations
H : TCR between -55 °C and 20 °C and TCR between 20 °C and 125 °C less than rated TCR

Remarks:

none

“

8 Modification to Annex Q

8.1 Modify the indication of Annex Q from informative to normative, as follows:

"**Annex Q**
(normative)

Quality assessment procedures"

8.2 In Q.1.4, replace the 1st paragraph as follows:

"Rework is the rectification of a processing error, prior to the release of the component, by means not differing from those used in the current process, or by an explicitly permitted rework process."

8.3 In Q.1.9, replace the 1st paragraph as follows:

"Repair is the making good of an approved component which has been damaged or has become defective after its release, and is not permitted under the Rules of Procedure."

8.4 In Q.1.11, replace the paragraph as follows:

"An organisation may be covered by one certification for more than one location (site) (see IECQ 03-1:2020, Clause 5 and Annex D, and IECQ 03-3:2018, Clause 5)."

8.5 In Q.2.1, replace the 1st paragraph as follows:

"An IECQ Approved Component certification may be granted to a manufacturer meeting the requirements given in IECQ 03-1:2020, 9.2 and in IECQ 03-3:2018, Clause 8."

8.6 In Q.3.5, replace the paragraph as follows:

"QA shall be granted by the Certification Body (CB) when all requirements have been met (see IECQ 03-1:2020, 9.7)."

8.7 In Q.4.2, replace the 1st paragraph as follows:

"An IECQ Approved Component – Capability Certification may be granted to a manufacturer

meeting the requirements given in IECQ 03-1:2020, 9.2 and in IECQ 03-3:2018, D.8."

8.8 In Q.4.9, replace the 1st paragraph as follows:

"Quality conformance inspections shall be executed according to the provisions of IECQ 03-3:2018, 8.13.3 and to the respective descriptions of the CM."

8.9 In Q.5.2, replace the 1st paragraph as follows:

"An IECQ AC-TC may be granted to a manufacturer meeting the requirements given in IECQ 03-1:2018, 9.2 and in IECQ 03-3:2018, Clause 8."

9 Modification to Annex R

Modify the indication of Annex R from informative to normative, as follows:

"**Annex R**
(normative)

Failure rate level evaluation, determination and qualification"

In R.1.2, replace the 2nd dash item with the following:

"

— IECQ Qualification Approval (QA), according to IECQ 03-3:2018, Annex C";

10 Modification to Annex X

Replace the contents of Annex X with the following:

"This annex, providing cross references for references to IEC 60115-1:2008, has been deleted from this document. In lieu thereof, see Annex ZX, which is providing cross references for references to EN 60115-1:2011 and EN 60115-1:2011/A11:2015."

11 Addition of Annex ZA

Add the following new Annex ZA:

“

Annex ZA
(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 When 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.

Publication	Year	Title	EN/HD	Year
IEC 60027	series	Letters symbols to be used in electrical technology	-	-
IEC 60050	series	International electrotechnical vocabulary	-	-
IEC 60062	-	Marking codes for resistors and capacitors	EN 60062	-
IEC 60063	-	Preferred number series for resistors and capacitors	EN 60063	-
IEC 60068-1	2013	Environmental testing - Part 1: General and guidance	EN 60068-1	2014
IEC 60068-2-1	-	Environmental testing - Part 2–1: Tests - Test A: Cold	EN 60068-2-1	-
IEC 60068-2-2	-	Environmental testing - Part 2–2: Tests - Test B: Dry heat	EN 60068-2-2	-
IEC 60068-2-6	-	Environmental testing - Part 2–6: Tests - Test Fc: Vibration (sinusoidal)	EN 60068-2-6	-
IEC 60068-2-13	-	Environmental testing - Part 2–13: Tests - Test M: Low air pressure	EN 60068-2-13	-
IEC 60068-2-14	-	Environmental testing - Part 2–14: Tests - Test N: Change of temperature	EN 60068-2-14	-
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	EN 60068-2-20	2008
IEC 60068-2-21	2006	Environmental testing - Part 2–21: Tests - Test U: Robustness of terminations and integral mounting devices	EN 60068-2-21	2006
IEC 60068-2-27	2008	Environmental testing - Part 2–27: Tests - Test Ea and guidance: Shock	EN 60068-2-27	2009
IEC 60068-2-30	-	Environmental testing - Part 2–30: Tests - Test Db: Damp heat, cyclic (12 h + 12 h cycle)	EN 60068-2-30	-

Publication	Year	Title	EN/HD	Year
IEC 60068-2-45 + AMD 1	1980 1993	Basic environmental testing procedures - Part 2–45: Tests - Test XA and guidance: Immersion in cleaning solvents	EN 60068-2-45 + A1	1992 1993
IEC 60068-2-47	-	Environmental testing - Part 2–47: Test - Mounting of specimens for vibration, impact and similar dynamic tests	EN 60068-2-47	-
IEC 60068-2-52	-	Environmental testing - Part 2–52: Test – Test Kb: Salt mist, cyclic (sodium chloride solution)	EN IEC 60068-2-52	-
IEC 60068-2-58	-	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	-
IEC 60068-2-67	-	Environmental testing - Part 2–67: Tests - Test Cy: Damp heat, steady-state, accelerated test primarily intended for components	EN 60068-2-67	-
IEC 60068-2-78	-	Environmental testing - Part 2–78: Tests - Test Cab: Damp heat, steady-state	EN 60068-2-78	-
IEC 60068-2-82	2019	Environmental testing - Part 2–82: Tests - Test Xw1: Whisker test methods for components and parts used in electronic assemblies	EN IEC 60068-2-82	2019
IEC 60195	2016	Method of measurement of current noise generated in fixed resistors	EN 60195	2016
IEC 60286	series	Packaging of components for automatic handling	EN 60286	series
IEC 60294	-	Measurement of the dimensions of a cylindrical component with axial terminations	EN 60294	-
IEC 60440	2012	Method of measurement of nonlinearity in resistors	EN 60440	2012
IEC 60617-DB	-	Graphical symbols for diagrams	-	-
IEC 60695-11-5	-	Fire hazard testing - Part 11–5: Test flames - Needle-flame test method - Apparatus, confirmatory test arrangement and guidance	EN 60695-11-5	-
IEC 61191	series	Printed board assemblies	EN IEC 61191	series
IEC 61193-2	-	Quality assessment systems - Part 2: Selection and use of sampling plans for inspection of electronic components and packages	EN 61193-2	-
IEC 61340-3-1	-	Electrostatics - Part 3–1: Methods for simulation of electrostatic effects - Human body model (HBM) electrostatic discharge test waveforms	EN 61340-3-1	-
IEC 61760-1	-	Surface mounting technology - Part 1: Standard method for the specification of surface mounting components (SMDs)	EN IEC 61760-1	-
IEC 61760-2	-	Surface mounting technology - Part 2: Transportation and storage conditions of surface mounting devices (SMD) - Application guide	EN 61760-2	-

Publication	Year	Title	EN/HD	Year
IEC 62090	-	Product package labels for electronic components using bar code and two-dimensional symbologies	-	-
IEC 62812	2019	Low resistance measurements - Methods and guidance	EN IEC 62812	2019
IEC 80000	series	Quantities and units	EN 80000	series
IECQ 03-1	2020	IEC Quality Assessment System for Electronic Components (IECQ System) – Rules of procedure – Part 1: General Requirements for all IECQ Schemes	-	-
ISO 80000	series	Quantities and units	EN ISO 80000	series
IECQ 03-3	2018	IEC Quality Assessment System for Electronic Components (IECQ System) – Rules of Procedure – Part 3: IECQ Approved Component Products, Related Materials and Assemblies Scheme	-	-
IECQ 03-3-1	2018	IEC Quality Assessment System for Electronic Components (IECQ System) – Rules of Procedure – Part 3–1: IECQ Approved Component Products, Related Materials and Assemblies Scheme, IECQ Approved Component – Technology Certification (IECQ AC-TC)	-	-

“

12 Addition of a new Annex ZX

Add the following new Annex ZX:

“

Annex ZX
(informative)

Cross-references for references to the prior revision of this document

The revision of this generic specification has resulted in changes of the clause and annex numbering, the figure numbering and the table numbering. The following Table ZX.1 provides cross-references for all references to specific clauses or annexes of the prior revision of this generic specification.

Table ZX.1 — Cross-references for references to clauses

EN 60115-1:2011 + EN 60115-1:2011/A11:2015 (IEC 60115-1:2008, mod.)	**EN 60115-1:2021** (IEC 60115-1:2020, mod.)	**Notes**
1 1.1 1.2	— 1 2	The former Clause 1 is split into Clauses 1 and 2: — Scope — Normative references
2	—	The former Clause 2 is split into Clauses 3 and 4.
2.1	4.1	
2.2	3.1	
2.3	4.2	
2.4	4.4 4.5	
2.5	4.3	
2.6	4.8	
2.7	4.9	
2.8	4.10	
3	13 Annex Q	
4	—	The former Clause 4 is split into Clauses 5 to 12.
4.1	5.1	
4.2	5.2	
4.3	5.4	
4.4 4.4.1 4.4.2 4.4.3	— 9.1 9.2 9.3	The former Clause 4.4 is split into 9.1 to 9.3: — Visual examination; — Dimensions (Gauging); — Dimensions (Detail)
4.5 4.5.1 4.5.2	— 5.6 6.1	The former Clause 4.5 is split into 5.6 and 6.1: — general method of resistance measurement; — test for resistance and tolerance.
4.6	12.1	
4.7	12.2	

EN 60115-1:2011 + EN 60115-1:2011/A11:2015 (IEC 60115-1:2008, mod.)	EN 60115-1:2021 (IEC 60115-1:2020, mod.)	Notes
4.8	6.2	The title is changed to: Temperature coefficient of resistance
4.9	6.3	The title is changed to: Inductance
4.10	6.5	
4.11	6.4	
4.12	6.6	
4.13	8.1	The title is changed to: Short-term overload
4.14	6.7	
4.15	9.4	
4.16 4.16.2 4.16.3 4.16.4 4.16.5	— 9.5.4.2 9.5.4.3 9.5.4.4 9.6.4	The former Clause 4.16 is split into 9.5 and 9.6 for: — tensile test, e.g. for wire terminations; — bending test, e.g. for wire terminations; — torsion test, e.g. for wire terminations; — resistors with threaded stud or screw terminations.
4.17 4.17.2 a) 4.17.2 b) 4.17.2 c)	11.1 11.1.4.4 11.1.4.5 11.1.4.3	Solderability test for: — resistors for through-hole assembly; — resistors not for assembly on circuit boards; — SMD resistors.
4.18 4.18.2 a) 4.18.2 b) 4.18.2 c)	11.2 11.2.4.4 11.2.4.5 11.2.4.3	Resistance to soldering heat test for: — resistors for through-hole assembly; — resistors not for assembly on circuit boards; — SMD resistors.
4.19	10.1	
4.20	9.9	
4.21	9.10	
4.22	9.11	
4.23	10.3	
4.24	10.4	
4.25 4.25.1 4.25.2 4.25.3	— 7.1 7.2 7.3	Endurance tests are given in Clause 7: — Endurance at the rated temperature 70 °C; — Endurance at room temperature; — Endurance at a maximum temperature (e.g. UCT).
4.26	12.3	
4.27	8.2	
4.28	8.3	
4.29 4.30	11.3	The solvent resistance tests are merged into 11.3.
4.31	5.5.2	
4.32	9.7	
4.33	9.8	

EN 60115-1:2011 + EN 60115-1:2011/A11:2015 (IEC 60115-1:2008, mod.)	EN 60115-1:2021 (IEC 60115-1:2020, mod.)	Notes
4.34	10.6	The corrosion test employs a different test method.
4.35	12.4	
4.36	10.2	
4.37	10.5	
4.38	8.5	
4.39	8.4	This legacy test is presented only with a traditionally applied severity.
4.40	10.7	
4.41	10.8	
—	—	EN 60115-1:2011 does not contain Annexes A, D, E
Annex B	Annex B	
Annex C	—	The content of this Annex is merged into 8.3.
Annex F	Annex A	
Annex G	—	The overview on tests is given in the table of contents.
Annex Q	Annex Q	
Annex ZA	Annex C	
Annex ZR	Annex R	
Annex ZX	Annex ZX	

Table ZX.2 provides cross-references for all references to specific figures of the prior revision of this generic specification.

Table ZX.2 — Cross-references for references to figures

EN 60115-1:2011 + EN 60115-1:2011/A11:2015 (IEC 60115-1:2008, mod.)	EN 60115-1:2020 (IEC 60115-1:2020, mod.)	Notes
Figure 1	Figure 25	The designation is changed to: Parallel clamp fixture
Figure 2	Figure 26	The designation is changed to: V-clamp fixture
Figure 3	Figure 9	
Figure 4	Figure 10	
Figure 5	Figure 19	
Figure 6	Figure 12	
Figure 7	Figure 13	
Figure 8	Figure 14	
Figure 9	Figure 15	
Figure 10	Figure 27	
Figure 11	Figure 17	
Figure 12	Figure 18	
Figure C.1 Figure C.2	—	The subject is covered in 8.3.4.1.

Table ZX.3 provides cross-references for all references to specific tables of the prior revision of this generic specification.

Table ZX.3 — Cross reference for references to tables

EN 60115-1:2011 + EN 60115-1:2011/A11:2015 (IEC 60115-1:2008, mod.)	**EN 60115-1:2020** (IEC 60115-1:2020, mod.)	**Notes**
Table 1	Table 2	
Table 2	Table 9	
Table 3 Table 4	—	The subject is covered in 6.2.5.
Table 5	Table 13	
Table 6	Table 14	
Table 7	Table 20	
Table 8	Table 11	
Table 9	Table 12	
Table 10	—	The subject is covered in 8.4.4.
Table ZR.1	Table R.1	
Table ZR.2	Table R.2	
Table ZR.3	Table R.3	
Table ZR.4	Table R.4	

“

13 Modification of the Bibliography

Replace the Bibliography as follows:

EN 60060-1, *High-voltage test techniques - Part 1: General definitions and test requirements*

EN 60068-2-11, *Environmental testing - Part 2: Tests - Test Ka: Salt mist*

EN 60068-2-29[1)], *Environmental testing. Part 2: Tests. Test Eb and guidance: Bump* (IEC 60068-2-29)

EN 60068-2-69, *Environmental testing - Part 2-69: Tests - Test Te/Tc: Solderability testing of electronic components and printed boards by the wetting balance (force measurement) method*

EN IEC 60068-3-5, *Environmental testing - Part 3-5: Supporting documentation and guidance - Confirmation of the performance of temperature chambers*

EN 60068-3-13, *Environmental testing - Part 3-13: Supporting documentation and guidance on Test T - Soldering*

EN IEC 60721-3-1, *Classification of environmental conditions - Part 3-1: Classification of groups of environmental parameters and their severities - Storage*

EN IEC 60721-3-2, *Classification of environmental conditions - Part 3-2: Classification of groups of environmental parameters and their severities - Transportation and Handling*

EN IEC 60749-26, *Semiconductor devices - Mechanical and climatic test methods - Part 26: Electrostatic discharge (ESD) sensitivity testing - Human body model (HBM)*

EN 61000-4-5:2014, *Electromagnetic compatibility (EMC) - Part 4-5: Testing and measurement techniques - Surge immunity test*

EN IEC 61190-1-3, *Attachment materials for electronic assembly - Part 1-3: Requirements for electronic grade solder alloys and fluxed and non-fluxed solid solder for electronic soldering applications*

EN 61249-2-22, *Materials for printed boards and other interconnecting structures - Part 2-22: Reinforced base materials, clad and unclad - Modified non-halogenated epoxide woven E-glass laminated sheets of defined flammability (vertical burning test), copper-clad*

EN 61249-2-35, *Materials for printed boards and other interconnecting structures - Part 2-35: Reinforced base materials, clad and unclad - Modified epoxide woven E-glass laminate sheets of defined flammability (vertical burning test), copper-clad for lead-free assembly*

IEC/TR 60068-3-12, *Environmental testing - Part 3-12: Supporting documentation and guidance - Method to evaluate a possible lead-free solder reflow temperature profile*

IEC 60410[2)], *Sampling plans and procedures for inspection by attributes*

IEC CA 01, *IEC Conformity Assessment Systems – Basic Rules*

[1)] EN 60068-2-29:1993 has been withdrawn as its contents has been merged into EN 60068-2-27:2009.

[2)] IEC 60410:1973 has been withdrawn in 2015.

IEC QC 001002-3[3)], *IEC Quality Assessment System for Electronic Components (IECQ) - Rules of Procedure - Part 3: Approval procedures*

IEC Q 01[4)], *IEC Quality Assessment System for Electronic Components (IECQ System) – Basic Rules*

IECQ 01-S, *IEC Quality Assessment System for Electronic Components (IECQ System) – IECQ Supplement to Harmonized Basic Rules IEC CA 01*

EN ISO 9001, *Quality management systems - Requirements (ISO 9001:2015)*

ISO 3, *Preferred numbers — Series of preferred numbers*

ISO 17, *Guide to the use of preferred numbers and of series of preferred numbers*

ISO 497, *Guide to the choice of series of preferred numbers and of series containing more rounded values of preferred numbers*

ISO 1000[5)], *SI units and recommendations for the use of their multiples and of certain other units*

ISO 2533, *Standard Atmosphere*

AEC-Q100, *Failure mechanism based stress test qualification for integrated circuits*

AEC-Q100-002, *Human body model (HBM) electrostatic discharge (ESD) test*

AEC-Q101, *Failure mechanism based stress test qualification for discrete semiconductors in automotive applications*

AEC-Q101-001, *Electrostatic discharge test – Human body model*

AEC-Q200, *Stress test qualification for passive components*

AEC-Q200-002, *Human body model electrostatic discharge test*

ASTM B809, *Standard test method for porosity in metallic coatings by humid sulfur vapor ("Flowers-of-Sulfur") (Revision 1995, reapproved 2003, 2008, 2013, 2018)*

CECC 00 114 (all parts)[6)], *Rule of procedure: Quality assessment procedures*

CECC 240 001, *Technology Approval Schedule: Fixed low power film resistors (leaded / unleaded)*

EN 100114[7)], (all parts) *Rule of procedure: Quality assessment procedures*

[3)] IEC QC 001002-3:2005 has been succeeded in 2010 by the IECQ 03-1 rules of procedure.

[4)] IECQ 01:2014 has been withdrawn in 2017, and is succeeded by IEC CA 01, with the supplement IECQ 01-S for application in the IEC Quality Assessment System for Electronic Components (IECQ).

[5)] ISO 1000:1992 has been succeeded in 2009 by the ISO 80000 and IEC 80000 series of standards.

[6),] The CECC 00 114 rules of procedure have been succeeded by the series of EN 100114 documents.

[7)] The EN 100 114 rules of procedure have been succeeded by the IEC QC 001002 series of documents.

IPC-A-610, *Acceptability of electronic assemblies*

ITU-T K.21, *Resistibility of telecommunication equipment installed in customer premises to overvoltages and overcurrents*

ITU-T K.44, *Resistibility tests for telecommunication equipment exposed to overvoltages and overcurrents – Basic recommendation*

JESD22-A114, *Electrostatic discharge (ESD) sensitivity testing human body model (HBM)*

MIL-HDBK-217F (1991), *Military Handbook – Reliability prediction of electronic equipment,* with Notice 2 (1995)

MIL-STD-883, *Test method standard – Microcircuits, – Method 3015, Electrostatic discharge sensitivity classification*

IEC 60115-1

Edition 5.0 2020-03

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Fixed resistors for use in electronic equipment – Part 1: Generic specification

Résistances fixes utilisées dans les équipements électroniques – Partie 1: Spécification générique

INTERNATIONAL ELECTROTECHNICAL COMMISSION

COMMISSION ELECTROTECHNIQUE INTERNATIONALE

ICS 31.040.10

ISBN 978-2-8322-7904-5

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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FIXED RESISTORS FOR USE IN ELECTRONIC EQUIPMENT –

Part 1: Generic specification

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.
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International Standard IEC 60115-1 has been prepared by IEC technical committee 40: Capacitors and resistors for electronic equipment.

This fifth edition cancels and replaces the fourth edition published in 2008. This edition constitutes a technical revision.

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

a) this 5th edition employs a new document structure, where the tests of prior Clause 4 are given in Clauses 6 to 12 now, with an informative Annex X providing cross-references for references to the prior revision of this standard;
b) the terms and definitions have been revised and amended, supplemented by a new section on resistor technologies and a new section on product classification levels;
c) a new Subclause 4.7 on recommendations for permissible substitutions has been added;

d) the provisions for packaging, storage and transportation in Subclauses 4.8, 4.9 and 4.10 have been completely revised;

e) a new Subclause 5.3 on default tolerances for the most common test parameters has been added;

f) the generic method of measuring resistance, now Sublause 5.6, has been separated from the test for compliance with a prescribed resistance value in 6.1, as a revision of the prior 4.5;

g) the test for the temperature coefficient of resistance of Subclause 6.2 is a revision of the prior test 4.8, variation of resistance with temperature, where the special concessions for resistors below 10 Ω have been waived;

h) the test methods for endurance testing of Subclauses 7.1 to 7.3 (prior 4.25.1 to 4.25.3) have been completely revised;

i) the single-pulse high-voltage overload test of Subclause 8.2 (prior 4.27) has been completely revised, and now offers adjustable severities for the 1,2/50 and for the 10/700 pulse shape for the benefit of detail specifications with improved significance;

j) the periodic-pulse high-voltage overload test of Subclause 8.3 (prior 4.28) has been revised and a corrected table of severities provided;

k) the period-pulse overload test of Subclause 8.4 (prior 4.39) has been deprecated and streamlined to only offer the severity historically applied in subordinate specifications;

l) the Subclauses 9.1 on visual inspection, 9.2 on the gauging of dimensions, and 9.3 on the assessment of detail dimensions (all parts of prior 4.4) have been completely revised;

m) the tests for robustness of terminations (prior 4.16) have been revised and separated into tests for the robustness of solderable terminations, Subclause 9.5, and tests for the robustness of threaded stud or screw terminations, Subclause 9.6;

n) the bump test of Subclause 9.9 (prior 4.20) and the shock test of Subclause 9.10 (prior 4.21) have been revised to reflect the merged relevant test standard IEC 60068-2-29;

o) the dry heat and cold test of the climatic sequence of Subclause 10.3 (prior 4.23) have been revised to reflect the changes of the relevant test standards IEC 60068-2-2 and IEC 60068-2-1;

p) the accelerated damp heat, steady state test of Subclause 10.5 (prior 4.37) has been amended with an option for a reduced number of bias voltages;

q) the corrosion test of Subclause 10.6 has been completely revised in order to employ the better suitable test method of IEC 60068-2-52 instead of the prior used IEC 60068-2-11;

r) the whisker growth test of Subclause 10.7 has been revised to reflect the changes of the new revision of the test methods of IEC 60068-2-82;

s) the test methods for solderability of Subclause 11.1 (prior 4.17) and for resistance to soldering heat of Subclause 11.2 (prior 4.18) have been completely revised to incorporate the necessary option for the variety of lead-bearing and lead-free solder alloys and respective process conditions;

t) the solvent resistance test of Subclause 11.3 combines the prior tests 4.29, component solvent resistance, and 4.30, solvent resistance of marking, in one test;

u) the accidental overload test of Subclause 12.3 (prior 4.26) has been completely revised;

v) the Annex Q on quality assessment procedures has been completely revised;

w) a new Annex R on failure rate evaluation, determination and qualification has been added.

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

FDIS	Report on voting
40/2717/FDIS	40/2733/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 of the IEC 60115 series, under the general title *Fixed resistors for use in electronic equipment*, 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.

INTRODUCTION

The specification system for fixed resistors for use in electronic equipment is structured in a hierarchical system as shown in Figure 1, consisting of the following specification types.

Generic specification

The generic specification covers all subjects mainly common to the family of fixed resistors for use in electronic equipment, such as terminology, methods of measurement and tests. Where the individual subjects require the prescription conditions or parameters specific to the particular sub-family or type of fixed resistor, such prescriptions are required to be given by one of the subordinate specifications.

For the scope of fixed resistors, the numeric reference to the generic specification is IEC 60115-1.

Sectional specification

Sectional specifications cover all subjects additional to those given in the generic specification, which are specific to a defined sub-group of fixed resistors. These subjects normally are preferred values for dimensions and characteristics, additional test methods and relevant prescriptions for test methods given in the generic specification, prescriptions for sampling and for the preparation of specimen, recommended test severities and preferred acceptance criteria. The sectional specification also outlines the structure and scope of the test schedules which are to be applied in all subordinate detail specifications.

For the scope of fixed resistors, the numeric references to the sectional specifications reach from IEC 60115-2 for leaded fixed low power film resistors to currently IEC 60115-9 for fixed surface mount resistor networks with individually measurable resistors. The variety of sectional specifications may be adapted to the portfolio of different technologies of fixed resistors.

Detail specification

Detail specifications give directly, or by making reference to other documents, all information necessary to completely describe a given type and range of fixed resistors, including prescriptions of all values for dimensions and characteristics. They also give all information required for the quality assessment of the covered type and range of fixed resistors within a suitable quality assessment system, including prescriptions for all applied test severities and acceptance criteria, and the completed test schedules.

Detail specifications can be either specifications within the IEC system, another specification system linked to IEC, or specified by the manufacturer or user. For the scope of fixed resistors, the numeric references to detail specifications are e.g. IEC 60115-2-101; if related to the sectional specification, IEC 60115-2; and if related to the ancillary blank detail specification, IEC 60115-2-1.

Blank detail specification

The hierarchical system of specifications is supplemented by one or more blank detail specification to a sectional specification, which are used to ensure a uniform presentation of detail specifications. The blank detail specifications provide the specification writer with a template on the layout to be adopted and on the information to be given and with guidance for the preparation of detail specifications in line with the requirements of the superior generic or sectional specifications. Blank detail specifications are not considered as relevant specifications since they do not themselves describe any particular component.

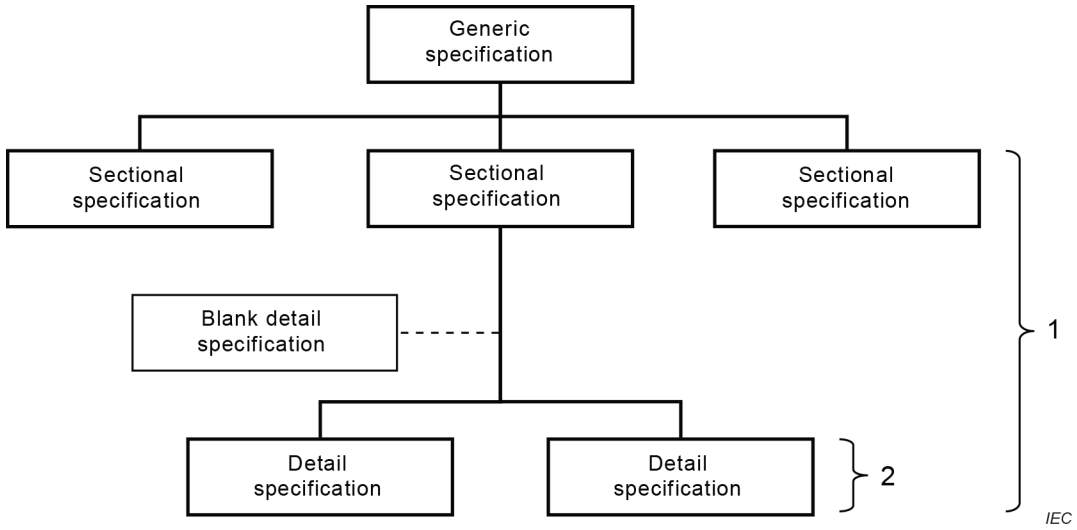
The presence of an established hierarchical specification system with blank detail specifications permits the preparation of detail specifications even outside of the relevant IEC technical committee.

For the scope of fixed resistors, the numeric references to blank detail specifications are e.g. IEC 60115-2-1: if related to the sectional specification, IEC 60115-2.

Relevant specification

In this system the term "relevant specification" addresses subordinate specifications containing specific requirements, where applicable.

Any generic or sectional specification may use abstract and universal references to subordinate specifications of either hierarchical level by use of the expression "relevant specification".



Key

1 Indicates the range of "Relevant specifications" to the superior generic specification, where applicable.

2 Indicates the range of "Relevant specifications" to the superior sectional specification, where applicable.

Figure 1 – Hierarchical system of specifications

FIXED RESISTORS FOR USE IN ELECTRONIC EQUIPMENT –

Part 1: Generic specification

1 Scope

This part of IEC 60115 is a generic specification and is applicable to fixed resistors for use in electronic equipment.

It establishes standard terms, inspection procedures and methods of test for use in sectional and detail specifications of electronic components for quality assessment or any other purpose.

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 60027 (all parts*), Letter symbols to be used in electrical technology*

IEC 60050 (all parts), *International Electrotechnical Vocabulary (IEV)* (available at www.electropedia.org)

IEC 60062, *Marking codes for resistors and capacitors*

IEC 60063, *Preferred number series for resistors and capacitors*

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

IEC 60068-2-1, *Environmental testing – Part 2-1: Tests – Tests A: Cold*

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

IEC 60068-2-6, *Environmental testing – Part 2-6: Tests – Test Fc: Vibration (sinusoidal)*

IEC 60068-2-13, *Basic environmental testing procedures – Part 2-13: Tests – Test M: Low air pressure*

IEC 60068-2-14, *Environmental testing – Part 2-14: Tests – Test N: Change of temperature*

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 60068-2-21:2006, *Environmental testing – Part 2-21: Tests – Test U: Robustness of terminations and integral mounting devices*

IEC 60068-2-27:2008, *Environmental testing – Part 2-27: Tests – Test Ea and guidance: Shock*

IEC 60068-2-30, *Environmental testing – Part 2-30: Tests – Test Db: Damp heat, cyclic (12 h + 12 h cycle)*

IEC 60068-2-45:1980, *Basic environmental testing procedures - Part 2-45: Tests - Test XA and guidance: Immersion in cleaning solvents*
IEC 60068-2-45:1980/AMD1:1993

IEC 60068-2-47, *Environmental testing – Part 2-47: Test – Mounting of specimens for vibration, impact and similar dynamic tests*

IEC 60068-2-52, *Environmental testing – Part 2-52: Tests – Test Kb: Salt mist, cyclic (sodium chloride solution)*

IEC 60068-2-58, *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 60068-2-67, *Environmental testing – Part 2-67: Tests – Test Cy: Damp heat, steady state, accelerated test primarily intended for components*

IEC 60068-2-78, *Environmental testing – Part 2-78: Tests – Test Cab: Damp heat, steady state*

IEC 60068-2-82:2019**,** *Environmental testing – Part 2-82: Tests – Test XW1: Whisker test methods for components and parts used in electronic assemblies*

IEC 60195:2016, *Method of measurement of current noise generated in fixed resistors*

IEC 60286 (all parts*), Packaging of components for automatic handling*

IEC 60294, *Measurement of the dimensions of a cylindrical component with axial terminations*

IEC 60440:2012*, Method of measurement of non-linearity in resistors*

IEC 60617, *Graphical symbols for diagrams* (available at http://www.graphical-symbols.info/equipment)

IEC 60695-11-5, *Fire hazard testing – Part 11-5: Test flames – Needle-flame test method – Apparatus, confirmatory test arrangement and guidance*

IEC 61191 (all parts), *Printed board assemblies*

IEC 61193-2, *Quality assessment systems – Part 2: Selection and use of sampling plans for inspection of electronic components and packages*

IEC 61340-3-1, *Electrostatics – Part 3-1: Methods for simulation of electrostatic effects – Human body model (HBM) electrostatic discharge test waveforms*

IEC 61760-1, *Surface mounting technology – Part 1: Standard method for the specification of surface mounting components (SMDs)*

IEC 61760-2, *Surface mounting technology – Part 2: Transportation and storage conditions of surface mounting devices (SMD) – Application guide*

IEC 62090, *Product package labels for electronic components using bar code and two-dimensional symbologies*

IEC 62812:2019, *Low resistance measurements – Methods and guidance*

IEC 80000 (all parts), *Quantities and units*

IECQ 03-1:2018, *IEC Quality Assessment System for Electronic Components (IECQ System) – Rules of procedure – Part 1: General Requirements for all IECQ Schemes*

ISO 80000 (all parts), *Quantities and units*