

INTERNATIONAL STANDARD

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

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

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COMMISSION

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CONTENTS

FOREWORD.....	7
1 General.....	9
1.1 Scope.....	9
1.2 Normative references.....	9
2 Technical data.....	11
2.1 Units and symbols.....	11
2.2 Terms and definitions.....	11
2.3 Preferred values.....	15
2.3.1 General.....	15
2.3.2 Preferred values of nominal resistance.....	15
2.4 Marking.....	15
2.5 Coding.....	16
2.6 Packaging.....	16
2.7 Storage.....	16
2.8 Transportation.....	16
3 Quality assessment procedures.....	16
4 Test and measurement procedures.....	17
4.1 General.....	17
4.2 Standard atmospheric conditions.....	17
4.2.1 Standard atmospheric conditions for testing.....	17
4.2.2 Recovery conditions.....	17
4.2.3 Referee conditions.....	17
4.2.4 Reference conditions.....	18
4.3 Drying.....	18
4.4 Visual examination and checking of dimensions.....	18
4.4.1 Visual examination.....	18
4.4.2 Dimensions (gauging).....	18
4.4.3 Dimensions (detail).....	19
4.5 Resistance.....	19
4.5.1 Test methods.....	19
4.5.2 Requirements.....	20
4.6 Insulation resistance.....	20
4.6.1 Test methods.....	20
4.6.2 Measuring conditions.....	22
4.6.3 Requirements.....	23
4.7 Voltage proof.....	23
4.7.1 Test methods.....	23
4.7.2 Test conditions.....	23
4.7.3 Requirements.....	23
4.8 Variation of resistance with temperature.....	23
4.8.1 Preconditioning.....	23
4.8.2 Measuring temperatures.....	23
4.8.3 Measuring procedures.....	23
4.8.4 Calculation of temperature coefficient of resistance α	24
4.8.5 Requirements.....	24
4.9 Reactance.....	25

4.9.1	Test procedures.....	25
4.9.2	Pulse generator specification	25
4.9.3	Oscilloscope specification.....	25
4.9.4	Measurements	26
4.9.5	Impedance analyzer.....	26
4.10	Non-linear properties	26
4.11	Voltage coefficient.....	26
4.11.1	Preconditioning	26
4.11.2	Measuring methods	26
4.11.3	Calculation of voltage coefficient.....	27
4.11.4	Requirements	27
4.12	Noise.....	27
4.13	Short time overload	27
4.13.1	Initial measurements.....	27
4.13.2	Test procedures.....	27
4.13.3	Final inspection, measurements and requirements	27
4.14	Temperature rise.....	27
4.14.1	Object.....	27
4.14.2	Mounting.....	27
4.14.3	Test procedures.....	28
4.14.4	Requirements	28
4.15	Robustness of the resistor body.....	28
4.15.1	Object.....	28
4.15.2	Test procedure	28
4.15.3	Requirements	28
4.16	Robustness of terminations.....	29
4.16.1	Test methods.....	29
4.16.2	Test Ua ₁ – Tensile.....	29
4.16.3	Test Ub – Bending.....	30
4.16.4	Test Uc – Torsion	30
4.16.5	Test Ud – Torque.....	30
4.16.6	Final measurements	30
4.17	Solderability.....	30
4.17.1	Preconditioning	31
4.17.2	Test procedures.....	31
4.17.3	Final inspection, measurements and requirements	31
4.18	Resistance to soldering heat.....	31
4.18.1	Preconditioning	31
4.18.2	Test procedures.....	32
4.18.3	Recovery	32
4.18.4	Final inspection, measurements and requirements	32
4.19	Rapid change of temperature.....	32
4.19.1	Initial measurements.....	32
4.19.2	Test procedures.....	32
4.19.3	Final inspection, measurements and requirements	32
4.20	Bump	33
4.20.1	Mounting.....	33
4.20.2	Initial measurements.....	33
4.20.3	Test procedures.....	33

4.20.4	Final inspection, measurements and requirements	33
4.21	Shock	33
4.21.1	Mounting.....	33
4.21.2	Initial measurements.....	33
4.21.3	Test procedures.....	33
4.21.4	Measurements under test.....	33
4.21.5	Final inspection, measurements and requirements	33
4.22	Vibration.....	33
4.22.1	Mounting.....	33
4.22.2	Initial measurements.....	34
4.22.3	Test procedures.....	34
4.22.4	Final inspection, measurements and requirements	34
4.23	Climatic sequence	34
4.23.1	Initial measurements.....	34
4.23.2	Dry heat.....	34
4.23.3	Damp heat, cyclic, test Db, first cycle.....	34
4.23.4	Cold.....	34
4.23.5	Low air pressure	34
4.23.6	Damp heat, cyclic, test Db, remaining cycles.....	35
4.23.7	DC load	35
4.23.8	Final inspection, measurements and requirements	35
4.24	Damp heat, steady state	35
4.24.1	Initial measurements.....	35
4.24.2	Test procedures.....	35
4.24.3	DC load.....	36
4.24.4	Final inspection, measurements and requirements	36
4.25	Endurance	36
4.25.1	Endurance at 70 °C.....	36
4.25.2	Endurance at room temperature.....	38
4.25.3	Endurance at upper category temperature.....	39
4.26	Accidental overload test.....	40
4.26.1	Object.....	40
4.26.2	Gauze cylinder test method.....	40
4.26.3	Conditions of test.....	41
4.26.4	Test procedure	42
4.26.5	Requirement.....	42
4.27	Single-pulse high-voltage overload test.....	42
4.27.1	Object.....	42
4.27.2	Terminology.....	42
4.27.3	Test procedure	42
4.28	Periodic-pulse high-voltage overload test	45
4.28.1	Object.....	45
4.28.2	Terminology.....	45
4.28.3	Test procedure	45
4.29	Component solvent resistance	47
4.29.1	Initial measurement	47
4.29.2	Test conditions	47
4.29.3	Requirements	47
4.30	Solvent resistance of marking.....	48

4.30.1	Test conditions	48
4.30.2	Requirements	48
4.31	Mounting of surface mount resistors	48
4.31.1	Substrate	48
4.31.2	Wave soldering	48
4.31.3	Reflow soldering	49
4.32	Shear test	51
4.32.1	Mounting	51
4.32.2	Severities	51
4.32.3	Requirements	51
4.33	Substrate bending test	51
4.33.1	Preparation	51
4.33.2	Initial measurements	51
4.33.3	Test procedures	51
4.33.4	Final inspection and requirements	51
4.34	Corrosion	52
4.34.1	Test method	52
4.34.2	Requirements	52
4.35	Flammability	52
4.35.1	Test conditions	52
4.35.2	Requirements	52
4.36	Operation at low temperature	52
4.36.1	Initial measurements	52
4.36.2	Test procedures	52
4.36.3	Final inspection, measurements and requirements	52
4.37	Damp heat, steady state, accelerated	52
4.37.1	Initial measurements	52
4.37.2	Test methods	52
4.37.3	Test procedures	53
4.37.4	Final inspection, measurements and requirements	53
4.38	Electrostatic discharge	53
4.38.1	Test methods	53
4.38.2	Initial measurements	53
4.38.3	Test procedures	53
4.38.4	Final inspection, measurements and requirements	53
4.39	Periodic-pulse overload test	53
4.39.1	Preconditioning	53
4.39.2	Mounting	53
4.39.3	Initial measurements	54
4.39.4	Severities	54
4.39.5	Recovery	54
4.39.6	Final inspection, measurements and requirements	54
4.40	Whisker growth test	54
4.40.1	General	54
4.40.2	Preparation of specimen	54
4.40.3	Initial measurement	54
4.40.4	Test procedures	55
4.40.5	Test severities	55
4.40.6	Final inspection, measurements and requirements	55

4.41 Hydrogen sulphide test	55
Annex A (normative) Interpretation of sampling plans and procedures as described in IEC 60410 for use within the IECQ system	56
Annex B (normative) Rules for the preparation of detail specifications for resistors and capacitors for electronic equipment for use within the IECQ system	57
Annex C (informative) Example of test equipment for the periodic-pulse high-voltage overload test	58
Annex D (normative) Layout of the first page of a PCP/CQC specification	60
Annex E (normative) Requirements for capability approval test report	61
Annex F (informative) Letter symbols and abbreviations	62
Annex G (informative) Index table for test and measurement procedures	64
Annex Q (normative) Quality assessment procedures	66
Figure 1 – Insulation resistance and voltage proof test jig for rectangular surface mount resistors	21
Figure 2 – Insulation resistance and voltage proof test jig for cylindrical surface mount resistors	22
Figure 3 – Test circuit	25
Figure 4 – Oscilloscope trace	26
Figure 5 – Testing of resistor body robustness	29
Figure 6 – Gauze cylinder fixture	41
Figure 7 – Pulse generator 1,2/50	43
Figure 8 – Pulse generator 10/700	43
Figure 9 – Suitable substrate for mechanical and electrical tests (may not be suitable for impedance measurements)	50
Figure 10 – Suitable substrate for electrical tests	50
Figure C.1 – Block diagram of test equipment	58
Figure C.2 – Tolerances on the pulse shape	59
Figure Q.1 – General scheme for capability approval	69
Table 1 – Referee conditions	18
Table 2 – Measuring voltages	19
Table 3 – Calculation of resistance value (R) and change in resistance (ΔR)	24
Table 4 – Calculation of temperature differences (ΔT)	24
Table 5 – Tensile force for wire terminations	30
Table 6 – Torque	30
Table 7 – Number of cycles	35
Table 8 – Severities (see Note 2)	44
Table 9 – List of preferred severities	46
Table 10 – Periodic-pulse overload test condition	54

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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 fourth edition cancels and replaces the third edition issued in 1999 and Amendment 1 (2001). It constitutes a technical revision.

This standard cancels and replaces IEC 61045-1 (1991), IEC 61045-2 (1991) and IEC 61045-2-1 (1991).

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

- a) implementation of Annex Q which replaces Clause 3;
- b) addition of new tests procedures in 4.34 through 4.38;
- c) removal of the property "temperature characteristics" from 4.8;

- d) introduction of a new system of test severities for the shear test in 4.32;
- e) introduction of new bias voltages for the damp heat steady-state test in 4.24;
- f) furthermore, this fourth edition cancels and replaces the third edition published in 1999 and constitutes minor revisions related to tables, figures and references.

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

FDIS	Report on voting
40/1907/FDIS	40/1922/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.

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.

All sectional specifications mentioned above do have one or more blank detail specifications being a supplementary document, containing requirements for style, layout and minimum content of detail specifications.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

FIXED RESISTORS FOR USE IN ELECTRONIC EQUIPMENT –

Part 1: Generic specification

1 General

1.1 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.

1.2 Normative references

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

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

IEC 60050 (all parts), *International Electrotechnical Vocabulary*

IEC 60060-1:1989, *High-voltage test techniques – Part 1: General definitions and test requirements*

IEC 60062:2004, *Marking codes for resistors and capacitors*

IEC 60063:1963, *Preferred number series for resistors and capacitors*

Amendment 1(1967)

Amendment 2(1977)

IEC 60068-1:1988, *Environmental testing – Part 1: General and guidance*

Amendment 1(1992)

IEC 60068-2-1:1990, *Environmental testing – Part 2: Tests – Tests A: Cold*

Amendment 1(1993)

Amendment 2(1994)

IEC 60068-2-2:1974, *Environmental testing – Part 2: Tests – Tests B: Dry heat*

Amendment 1(1993)

Amendment 2(1994)

IEC 60068-2-6:2007, *Environmental testing – Part 2: Tests – Test Fc: Vibration (sinusoidal)*

IEC 60068-2-11:1981, *Environmental testing – Part 2: Tests – Test Ka: Salt mist*

IEC 60068-2-13:1983, *Environmental testing – Part 2: Tests – Test M: Low air pressure*

IEC 60068-2-14:1984, *Environmental testing – Part 2: Tests – Test N: Change of temperature*

Amendment 1(1986)

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

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

IEC 60068-2-27:1987, *Environmental testing – Part 2: Tests – Test Ea and guidance: Shock*

IEC 60068-2-29:1987, *Environmental testing – Part 2: Tests – Test Eb and guidance: Bump*

IEC 60068-2-30:2005, *Environmental testing – Part 2: Tests – Test Db: Damp heat, cyclic (12 h+ 12 h cycle)*

IEC 60068-2-45:1980, *Environmental testing – Part 2: Tests – Test XA and guidance: Immersion in cleaning solvents*
Amendment 1(1993)

IEC 60068-2-54: 2006, *Environmental testing – Part 2.54: Tests – Test Ta: Solderability testing of electronic components by the wetting balance method*

IEC 60068-2-58:2005, *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 60068-2-67:1995, *Environmental testing – Part 2-67: Tests – Test Cy: Damp heat, steady state, accelerated test primarily intended for components*

IEC 60068-2-78:2001, *Environmental testing – Part 2-78: Tests – Test Cab: Damp heat, steady state*

IEC 60195:1965, *Method of measurement of current noise generated in fixed resistors*

IEC 60286, *Packaging of components for automatic handling*

IEC 60294:1969, *Measurement of the dimensions of a cylindrical component having two axial terminations*

IEC 60410:1973, *Sampling plans and procedures for inspection by attributes*

IEC 60440:1973, *Method of measurement of non-linearity in resistors* IEC 60617:2007, *Graphical symbols for diagrams*

IEC 60617, *Graphical symbols for diagrams*

IEC 60695-11-5:2004, *Fire hazard testing – Part 11-5: Test flames – Needle-flame test method – Apparatus, confirmatory test arrangement and guidance*

IEC 61193-2:2007, *Quality assessment systems – Part 2: Selection and use of sampling plans for inspection of electronic components and packages*

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

IEC 61249-2-22: 2005, *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*

IEC 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 laminated sheets of defined flammability (vertical burning test), copper-clad for lead-free assembly¹*

IEC 61340-3-1:2006, *Electrostatics – Part 3-1: Methods for simulation of electrostatic effects – Human body model (HBM) electrostatic discharge test waveforms*

IEC 61760-1:2006, *Surface mounting technology – Part 1: Standard method for the specification of surface mounting components (SMDs)*

IEC QC 001002-3:2005, *IEC Quality Assessment System for Electronic Components (IECQ) – Rules of procedure – Part 3: Approval procedures*

ISO 1000:1992, *SI units and recommendations for the use of their multiples and of certain other units*

2 Technical data

2.1 Units and symbols

Units, graphical symbols and letter symbols should, whenever possible, be taken from the following publications:

- IEC 60027;
- IEC 60050;
- IEC 60617;
- ISO 1000.

When further items are required they shall be derived in accordance with the principles of the publications listed above.

2.2 Terms and definitions

For the purposes of this document, the following terms and definitions apply, in alphabetical order:

2.2.1

category dissipation

fraction of the rated dissipation exactly defined in the detail specification, applicable at the upper category temperature, taking account of the derating curve prescribed in the detail specification

NOTE 1 For resistors the category dissipation is zero, where the upper category temperature is the maximum element temperature.

NOTE 2 Related terminology: rated dissipation, upper category temperature, derating curve

2.2.2

category temperature range

range of ambient temperatures for which the resistor has been designed to operate continuously; this is given by the lower and upper category temperature

¹ To be published.

NOTE Related terminology: lower category temperature, upper category temperature

2.2.3

critical resistance

resistance value at which the rated voltage is equal to the limiting element voltage (see 2.2.18 and 2.2.11)

NOTE 1 At an ambient temperature of 70 °C, the maximum voltage which may be applied across the terminations of a resistor is either the calculated rated voltage, if the resistance is less than the critical resistance, or the limiting element voltage, if the resistance is equal to or greater than the critical resistance. At temperatures other than 70 °C, it is important that account be taken of the derating curve and of the limiting element voltage in the calculation of any voltage to be applied.

NOTE 2 Related terminology: Rated voltage, limiting element voltage

2.2.4

derating curve

curve which shows the maximum allowable dissipation at ambient temperatures between the upper and lower category temperature

NOTE 1 In the range between lower category temperature and rated temperature, it shows the rated dissipation, and between rated temperature and maximum element temperature it shows a linear slope down to zero dissipation at the maximum element temperature. The slope depends on the thermal properties of the resistor, i.e. its capability to abduct the dissipation to the environment.

NOTE 2 Related terminology: rated dissipation, rated temperature, maximum element temperature

2.2.5

family (of electronic components)

group of components which predominantly displays a particular physical attribute and/or fulfils a defined function

NOTE Related terminology: subfamily

2.2.6

grade

term indicating additional general characteristics concerning the intended application, for example, long-life applications

NOTE 1 The term "grade" may be used only in combination with one or more words (for example, long-life grade) and not with a single letter or number.

NOTE 2 Related terminology: stability class

2.2.7

heat-sink resistor

resistor type designed for mounting on a separate heat-sink

NOTE Related terminology: insulated resistor

2.2.8

insulated resistor

resistor which fulfils the voltage proof and insulation resistance test requirements and the damp-heat, steady-state test with a polarizing voltage applied when mounted on a metal plate

NOTE Related terminology: heat-sink resistor

2.2.9

insulation resistance

resistance of the encapsulation of the insulated resistor measured between the resistor terminations connected together and any conducting mounting surface

NOTE Related terminology: insulated resistor