

Harmonized system of quality
assessment for electronic components

Varistors for use in electronic equipment: Generic specification

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Electronic Components Standards Policy Committee (ECL/-) to Technical Committee ECL/4, upon which the following bodies were represented:

- EEA (The Association of the Electronics, Telecommunications and Business Equipment Industries)
- Electronic Components Industry Federation
- Ministry of Defence
- National Supervising Inspectorate

The following bodies were also represented in the drafting of the standard, through subcommittees and panels:

- BEAMA Ltd.
- ERA Technology Ltd.

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National foreword

This British Standard has been prepared under the direction of the Electronic Components Standards Policy Committee. It is identical with IEC 1051-1:1991 (QC 420000) *Varistors for use in electronic equipment — Part 1 : Generic specification*, published by the International Electrotechnical Commission (IEC) and is a harmonized specification within the IECQ system of quality assessment for electronic components.

Cross-references

International Standard	Corresponding British Standard
ISO 3:1973 } ISO 497:1973 }	BS 2045:1965 <i>Preferred numbers</i> (Technically equivalent)
ISO 1000:1981	BS 5555:1981 <i>Specifications for SI units and recommendations for the use of their multiples and of certain other units</i> (Identical)
IEC 62:1974	BS 1852:1975 <i>Specification for marking codes for resistors and capacitors</i> (Identical)
IEC 60-2:1973	BS 9231 <i>Guide on high-voltage testing techniques</i> Part 2:1980 <i>Test procedures</i> (Identical)
IEC 68	BS 2011 <i>Environmental testing</i>
IEC 68-1:1988	Part 1.1:1989 <i>General and guidance</i> (Identical)
IEC 68-2-1:1974	Part 2.1A:1990 <i>Test A. Cold</i> (Technically equivalent)
IEC 68-2-2:1974	Part 2.1B:1977 <i>Test B. Dry heat</i> (Identical)
IEC 68-2-3:1969	Part 2.1Ca:1977 <i>Test Ca. Damp heat, steady state</i> (Identical)
IEC 68-2-6:1982	Part 2.1Fc:1983 <i>Test Fc. Vibration (sinusoidal)</i> (Identical)
IEC 68-2-13:1983	Part 2.1M:1984 <i>Test M. Low air pressure</i> (Identical)
IEC 68-2-14:1974	Part 2.1N:1985 <i>Test N. Change of temperature</i> (Identical)
IEC 68-2-20:1979	Part 2.1T:1981 <i>Test T. Soldering</i> (Identical)
IEC 68-2-21:1983	Part 2.1U:1984 <i>Test U. Robustness of terminations and integral mounting devices</i> (Identical)
IEC 68-2-27:1987	Part 2.1Ea:1988 <i>Test Ea. Shock</i> (Identical)
IEC 68-2-29:1968	Part 2.1Eb:1987 <i>Test Eb. Bump</i> (Identical)
IEC 68-2-30:1969	Part 2.1Db:1981 <i>Test Db and guidance: Damp heat, cyclic (12 + 12 hour cycle)</i> (Identical)
IEC 68-2-45:1980	Part 2.1XA:1981 <i>Test XA and guidance. Immersion in cleaning solvents</i> (Identical)

International Standard	Corresponding British Standard
IEC 294:1969	BS 5692:1979 <i>Method for measurement of the dimensions of a cylindrical electronic component having two axial terminations</i> (Identical)
IEC 410:1973	BS 6001 <i>Specification for sampling procedures for inspection by attributes</i> Part 1:1991 <i>Specification for sampling plans indexed by acceptable quality level (AQL) for lot-by-lot inspection</i> (Technically equivalent)
IEC 617	BS 3939 <i>Graphic symbols for electrical power, telecommunications and electronics diagrams</i> (Most Parts are identical)
IEC 695-2-2:1980	BS 6458 <i>Fire hazard testing for electrotechnical products</i> Section 2.2:1984 ^a <i>Needle flame test</i> (Identical)
IEC 717:1981	BS 6303:1982 <i>Method for determination of the space required by capacitors and resistors with unidirectional terminations</i> (Identical)
QC 001002:1986	BS QC 001002:1991 <i>Rules of Procedure of the IEC Quality Assessment System for Electronic Components (IECQ)</i> (Identical)

^a BS 6458-2.2:1984 is related to IEC 695-2-2:1991.

The British Standard which implements the IECQ Rules of Procedure is BS 9000 *General requirements for a system for electronic components of assessed quality Part 3:1991 Specification for the national implementation of the IECQ system*.

The Technical Committee has reviewed the provisions of IEC 27-1 and IEC 50 to which normative reference is made in the text, and has decided that they are acceptable for use in conjunction with this standard.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 20, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

Section 1. Scope

1 Scope

This standard is applicable to varistors with symmetrical voltage-current characteristics for use in electronic equipment.

It establishes standard terms, inspection procedures and methods of test for use in sectional and detail specifications for Qualification Approval and for Quality Assessment Systems for electronic components.

Section 2. General

2 General

2.1 Related documents

IEC Publications:

Publication 27-1:1971	<i>Letter Symbols to be Used in Electrical Technology: — Part 1: General</i>
Publication 50	<i>International Electrotechnical Vocabulary (IEV)</i>
Publication 60-2:1973	<i>High Voltage Test Techniques: — Part 2: Test Procedures</i>
Publication 62:1974	<i>Marking Codes for Resistors and Capacitors</i>
Publication 68	<i>Environmental Testing</i>
Publication 68-1:1982	<i>Part 1: General</i>
Publication 68-2-1 (1974)	<i>Tests A: Cold.</i>
68-2-1A:1976	<i>First supplement</i>
Publication 68-2-2:1974:	<i>Tests B: Dry Heat.</i>
68-2-2A:1976	<i>First supplement</i>
Publication 68-2-3:1969	<i>Test Ca: Damp Heat, Steady State</i>
Publication 68-2-6:1970	<i>Test Fc: Vibration (sinusoidal)</i>
Publication 68-2-13:1966	<i>Test M: Low Air Pressure</i>
Publication 68-2-14:1974	<i>Test N: Change of Temperature</i>
Publication 68-2-20:1979	<i>Test T: Soldering</i>
Publication 68-2-21:1983	<i>Test U: Robustness of Terminations and Integral Mounting Devices</i>
	<i>Amendment No. 1 (1985)</i>
Publication 68-2-27:1972	<i>Test Ea: Shock</i>
Publication 68-2-29:1968	<i>Test Eb: Bump</i>
Publication 68-2-30:1980	<i>Test Db: Damp Heat, Cyclic (12 + 12 hour cycle)</i>
Publication 68-2-45:1980	<i>Test XA and Guidance: Immersion in Cleaning Solvents</i>
Publication 294:1969	<i>Measurement of the Dimensions of a Cylindrical Component having Two Axial Terminations</i>
Publication 410:1973	<i>Sampling Plans and Procedures for Inspection by Attributes</i>
Publication 617	<i>Recommended Graphical Symbols for Diagrams</i>
Publication 695-2-2:1980	<i>Fire Hazard Testing. — Part 2: Test Methods. Needle-Flame Test</i>
Publication 717:1981	<i>Method for the Determination of the Space Required by Capacitors and Resistors with Unidirectional Terminations</i>
Publication QC 001001:1986	<i>Basic Rules of the IEC Quality Assessment System for Electronic Components (IECQ)</i>
Publication QC 001002:1986	<i>Rules of Procedure of the IEC Quality Assessment System for Electronic Components (IECQ)</i>

ISO Standards:

ISO 3:1973	<i>Preferred Numbers — Series of Preferred Numbers</i>
ISO 497:1973	<i>Guide to the Choice of Series of Preferred Numbers and of Series Containing more Rounded Values of Preferred Numbers</i>
ISO 1000:1973	<i>SI Units and Recommendations for the Use of their Multiples and of Certain Other Units</i>

NOTE The above references apply to the current editions, except for IEC 68 for which the referenced edition must be used.

2.2 Units, symbols and terminology**2.2.1 General**

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

- ISO Standard 1000
- IEC Publication 27
- IEC Publication 617
- IEC Publication 50

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

2.2.2 Type

A group of components having similar design features and the similarity of whose manufacturing techniques enables them to be grouped together either for qualification approval or for quality conformance inspection.

They are generally covered by a single detail specification.

NOTE Components described in several detail specifications may, in some cases, be considered as belonging to the same type and may therefore be grouped together for approval and quality conformance inspection.

2.2.3 Style

A sub-division of a type, generally based on dimensional factors.

A style may include several variants, generally of a mechanical order.

2.2.4 Varistor (Voltage dependent resistor, VDR) (Graphical symbol ∇)

A component whose conductance, at a given temperature, increases rapidly with voltage. This property is expressed by either of the following formulae:

$$U = CI^\beta \quad (1)$$

or

$$I = AU^{\nu} \quad (2)$$

where I: current flowing through the varistor

U: voltage applied across the varistor

β : current index

ν : voltage index

A and C: constants.

2.2.5 Non-linearity indices**1) Current index β**

Starting from formula (1) of Sub-clause 2.2.4, it is defined by the formula: $\beta = \frac{I}{U} \times \frac{dU}{dI}$

For the convenience of calculation, the following formula may be used: $\beta = \frac{\lg(U_1/U_2)}{\lg(I_1/I_2)}$

β is always less than 1.

2) Voltage index γ

Starting from formula (2) of Sub-clause 2.2.4, it is defined by the formula: $\gamma = \frac{U}{I} \times \frac{dI}{dU}$

For the convenience of calculation, the following formula may be used: $\gamma = \frac{\lg(I_1/I_2)}{\lg(U_1/U_2)}$

γ is always greater than 1.

2.2.6 *Maximum continuous a.c. voltage*

The maximum a.c. r.m.s. voltage of a substantially sinusoidal waveform (less than 5 % total harmonic distortion) which can be applied to the component under continuous operating conditions at 25 °C. At temperatures greater than 25 °C the detail specification shall give full information on derating requirements.

NOTE Normally this voltage value shall be 1,1 times the supply voltage.

2.2.7 *Maximum continuous d.c. voltage*

The maximum d.c. voltage (with less than 5 % ripple) which can be applied to the component under continuous operating conditions at an ambient temperature of 25 °C. At temperatures greater than 25 °C the detail specification shall give full information on derating requirements.

2.2.8 *Supply voltage*

The voltage by which the system is designated and to which certain operating characteristics of the system are referred.

2.2.9 *Voltage (at specified current)*

The voltage, at specified d.c. current used as a reference point in the component characteristic.

2.2.10 *Voltage under pulse conditions*

Peak value of the voltage which appears at the terminations of the varistor when a specified current pulse is applied to it.

2.2.11 *Voltage at class current (protection level)*

The peak voltage developed across the varistor terminations under standard atmospheric conditions when passing an 8/20 class current pulse (see 2.2.15).

2.2.12 *Isolation voltage (applicable only to insulated varistors)*

The maximum peak voltage which may be applied under continuous operating conditions between the varistor terminations and any conducting mounting surface.

2.2.13 *Leakage current*

The current passing through the varistor at the maximum d.c. voltage, and at a temperature of 25 °C or at any other specified temperature.

2.2.14 *Maximum peak current*

The maximum current per pulse which may be passed by a varistor at an ambient temperature of 25 °C, for a given number of pulses.

2.2.15 *Class current*

A peak value of current which is 1/10 of the maximum peak current for 100 pulses at two per minute for the 8/20 pulse.

2.2.16 *Pulse or impulse*

A unidirectional wave of voltage or current without appreciable oscillations.

NOTE In IEC Publication 60-2, the word "impulse" is used, however for this specification, only the word "pulse" is used.