

Fixed inductors for electromagnetic interference suppression —

Part 1: Generic specification

The European Standard EN 60938-1:2000, incorporating amendment A1:2007, has the status of a British Standard

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National foreword

This British Standard was published by BSI. It is the UK implementation of EN 60938-1:2000, incorporating amendment A1:2007. It is identical with IEC 60938-1:1999, incorporating amendment 1:2006. It supersedes BS EN 138000:1997 which is withdrawn.

The start and finish of text introduced or altered by amendment is indicated in the text by tags **A1** **A1**. Tags indicating changes to IEC text carry the number of the IEC amendment. For example, text altered by IEC amendment 1 is indicated by **A1** **A1**.

The UK participation in its preparation was entrusted to Technical Committee EPL/40, Capacitors and resistors for electronic equipment.

A list of organizations represented on this committee can be obtained on request to its secretary.

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This British Standard, having been prepared under the direction of the Electrotechnical Sector Committee, was published under the authority of the Standards Committee and comes into effect on 15 April 2000

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Part 1: Generic specification
(IEC 60938-1:1999)

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(CEI 60938-1:1999)

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Foreword

The text of document 40/1110/FDIS, future edition 2 of IEC 60938-1, prepared by IEC TC 40, Capacitors and resistors for electronic equipment, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60938-1 on 1999-12-01.

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The following dates were fixed:

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Annexes designated "normative" are part of the body of the standard.
In this standard, annexes A, B, C and ZA are normative.
Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 60938-1:1999 was approved by CENELEC as a European Standard without any modification.

Foreword to amendment A1

The text of amendment 1:2007 to the International Standard IEC 60938-1:1999, prepared by IEC TC 40, Capacitors and resistors for electronic equipment, was submitted to the formal vote and was approved by CENELEC as amendment A1 to EN 60938-1:1999 on 2007-02-01 without any modification.

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- latest date by which the national standards conflicting
with the amendment have to be withdrawn (dow) 2010-02-01

Endorsement notice

The text of amendment 1:2006 to the International Standard IEC 60938-1:1999 was approved by CENELEC as an amendment to the European Standard without any modification.

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FIXED INDUCTORS FOR ELECTROMAGNETIC INTERFERENCE SUPPRESSION –

Part 1: Generic specification

1 General

1.1 Scope

This International Standard applies to inductors designed for electromagnetic interference suppression intended for use within, or associated with, electronic or electrical equipment and machines. It is restricted to inductors for which safety tests are appropriate.

The combination of two or more inductors within one enclosure is also included.

Inductors within the scope of this standard may also be used to protect apparatus and machines from electrical noise and voltage or current transients coming from either the supply or from other parts of the apparatus.

This standard does not necessarily apply in its entirety to inductors intended for use on motor vehicles, in aircraft or for marine applications.

1.2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of IEC and ISO maintain registers of currently valid International Standards.

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

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

IEC 60062:1992, *Marking codes for resistors and capacitors*

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 60068-2-3:1969, *Environmental testing – Part 2: Tests – Test Ca: Damp heat, steady state*
Amendment 1 (1984)

IEC 60068-2-6:1995, *Environmental testing – Part 2: Tests – Test Fc: Vibration (sinusoidal)*

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 60068-2-17:1994, *Environmental testing – Part 2: Tests – Test Q: Sealing*

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

IEC 60068-2-21:1983, *Environmental testing – Part 2: Tests – Test U: Robustness of terminations and integrations*
Amendment 2 (1991)
Amendment 3 (1992)

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 60068-2-30:1980, *Environmental testing – Part 2: Tests – Test Db and guidance: Damp heat, cyclic (12 + 12 hour cycle)*
Amendment 1 (1985)

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

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

IEC 60335-1:1991, *Safety of household and similar electrical appliances – Part 1: General requirements*

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

IEC 60617 (all parts), *Graphical symbols for diagrams*

IEC 60695-2-2:1991, *Fire hazard testing – Section 2: Needle-flame test*
Amendment 1 (1994)

CISPR 17:1981, *Methods of measurement of the suppression characteristics of passive radio interference filters and suppression components*

IEC QC 001002-3:1998, *Rules of Procedure of the IEC Quality Assessment System for Electronic Components (IECQ) – 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, letter symbols and terminology shall, 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 documents listed above.

2.2 Definitions

For the purpose of this International Standard, the following definitions apply.

2.2.1

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.

2.2.2

style

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

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

2.2.3

family (of electronic components)

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

2.2.4

sub-family (of electronic components)

a group of components within a family manufactured by similar technological methods

2.2.5

rated voltage (U_R)

rated voltage is either the maximum r.m.s. operating voltage of rated frequency or the maximum d.c. operating voltage which may be applied continuously to the terminations of the inductor at any temperature between the lower category temperature and the rated temperature

NOTE – For inductors with only one winding, the rated voltage should only be applied between one terminal and any conducting surface with which the case is liable to come into contact in normal use. For inductors having more than one winding, the rated voltage may be applied across two individual windings.

2.2.6

category voltage (U_C)

maximum voltage which may be applied continuously to an inductor at its upper category temperature

2.2.7

lower category temperature

minimum external surface temperature for which the inductor has been designed to operate continuously

2.2.8

upper category temperature

maximum external surface temperature for which the inductor has been designed to operate continuously

NOTE – The external surface temperature can be affected by internal heating due to the lead-through current. The terminations are considered to be part of the external surface.

2.2.9

rated temperature

maximum ambient temperature at which an inductor can carry its rated current

2.2.10

rated current

maximum r.m.s. operating current at rated frequency or maximum d.c. operating current which allows continuous operation of the inductor at the rated temperature. It is assigned by the manufacturer for one or both of the following conditions:

- a) free air (I_{RO});
- b) with a specified heat sink (I_{RH}).

2.2.11

rated inductance (L_R)

inductance value for which the inductor has been designed and which is usually indicated upon it

2.2.12

insertion loss

ratio of the voltage before and after the insertion of the suppressor in the circuit as measured at the terminations

NOTE 1 – The insertion loss can be measured either with a symmetrical or an asymmetrical test circuit.

NOTE 2 – When expressed in decibels the insertion loss is 20 times the logarithm of the ratio stated.

2.2.13

asymmetrical test circuit

a test circuit in which the inductor under test is connected with a coaxial cable of which the outer conductor constitutes a return path for high-frequency current

[CISPR 17:1981, 3.5 modified]

2.2.14

symmetrical test circuit

a test circuit in which the inductor under test is connected with screened conductor pairs in which the asymmetrical voltage is small enough to be neglected

[CISPR 17:1981, 3.6 modified]

2.2.15

insulated inductor

an inductor in which all terminations connected to a section may be raised to a potential different (but not less than the rated voltage) from that of any conducting surface with which the case is liable to come into contact in normal use

2.2.16

uninsulated inductor

an inductor in which at least one of the terminations connected to a section cannot be raised to a potential different (but not less than the rated voltage) from that of any conducting surface with which the case is liable to come into contact in normal use

2.2.17

electromagnetic interference suppression inductor

an inductor which at mains frequency has a low impedance, but which at radio frequency has a high inductive impedance

NOTE 1 – It may be used for reducing the interference at frequencies caused by electrical equipment.

NOTE 2 – These inductors are sometimes known as RF chokes.

2.2.18

current-compensated inductor

an inductor having more than one winding on a single core arranged in such a way that the resultant magnetization caused by the current is near zero

2.2.19

earth inductor

an inductor connected in the earth lead of an equipment.

For requirements for earth inductors, see annex C

2.2.20

thyristor inductor

an inductor used in thyristor controlled circuits

2.2.21

mains inductor

an inductor intended for direct electrical connection to the supply mains

NOTE – This inductor may form part of an equipment.

2.2.22

TV choke

an inductor designed to reduce interference mainly in the frequency range 30 MHz to 300 MHz

NOTE – Unencapsulated, non-current compensated TV chokes are not within the scope of this specification, but should be considered as part of the equipment wiring.

2.2.23

visible damage

visible damage which reduces the usability of the inductor unit for intended purpose

2.3 Preferred values

Each sectional specification shall prescribe the preferred values appropriate to the sub-family covered by that sectional specification.

2.4 Marking

2.4.1 General

The sectional specification shall indicate the identification criteria and other information to be shown on the inductors and the packing.

The order of priority for marking small inductors shall be specified.

2.4.2 Coding

When coding is used for tolerance or date of manufacture, the method shall be selected from those given in IEC 60062.

3 Quality assessment procedures

3.1 General

When these standards are used for the purpose of a full quality assessment system such as the IEC Quality Assessment System for Electronic Components (IECQ), compliance to 3.4 or 3.5 is required.

When these standards are used outside quality assessment systems for purposes such as design proving or type testing, the procedures and requirements of 3.4.1 and 3.4.3 may be used, but the tests and parts of tests shall be applied in the order given in the test schedules.

Before inductors can be qualified according to the procedures of this clause the manufacturer shall obtain the approval of his organization in accordance with the provisions of IEC QC 001002-3.

For certification by an independent test laboratory the procedure of 3.4.3 shall be sufficient, except that the test laboratory will produce the evidence of conformance.

3.2 Primary stage of manufacture

The primary stage of manufacture is the winding of the inductive element(s).

3.3 Structurally similar inductors

The grouping of structurally similar inductors for the purpose of qualification approval and quality conformance inspection shall be prescribed in the sectional specification.

3.4 Qualification approval procedures

3.4.1 Eligibility for qualification approval

The manufacturer shall comply with 3.1.1 of IEC QC 001002-3.