INTERNATIONAL STANDARD

IEC 60938-1

QC 280000

Edition 2.1

2006-11

Edition 2:1999 consolidated with amendment 1:2006

Fixed inductors for electromagnetic interference suppression –

Part 1: Generic specification

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

FIXED INDUCTORS FOR ELECTROMAGNETIC INTERFERENCE SUPPRESSION –

Part 1: Generic specification

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International Standard IEC 60938-1 has been prepared by IEC technical committee 40: Capacitors and resistors for electronic equipment.

This consolidated version of IEC 60938-1 consists of the second edition (1999) [documents 40/1110/FDIS and 40/1136/RVD] and its amendment 1 (2006) [documents 40/1602/CDV and 40/1699A/RVC].

The technical content is therefore identical to the base edition and its amendment and has been prepared for user convenience.

It bears the edition number 2.1.

A vertical line in the margin shows where the base publication has been modified by amendment 1.

The QC number that appears on the front cover of this publication is the specification number in the IEC Quality Assessment System for Electronic Components (IECQ).

Annexes A, B and C form an integral part of this standard.

The committee has decided that the contents of the base publication and its amendments 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,
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- replaced by a revised edition, or
- amended.

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

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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.

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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 60938-1:1999+AMD1:2006 CSV
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61ecaf7e83ef/iec-60938-1-1999amd1-2006-csv

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 integral mounting devices*
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)

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

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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.

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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}).

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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

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2.2.19
earth inductor
an inductor connected in the earth lead of an equipment.

For requirements for earth inductors, see annex C

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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