INTERNATIONAL STANDARD

IEC 60938-2

QC 280100

Second edition
1999-11

Fixed inductors for electromagnetic interference suppression –

Part 2: Sectional specification

Inductances fixes d'antiparasitage –

Partie 2:
Spécification intermédiaire

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- **IEC web site***
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Terminology, graphical and letter symbols

For general terminology, readers are referred to IEC 60050: *International Electrotechnical Vocabulary* (IEV).

For graphical symbols, and letter symbols and signs approved by the IEC for general use, readers are referred to publications IEC 60027: *Letter symbols to be used in electrical technology*, IEC 60417: *Graphical symbols for use on equipment. Index, survey and compilation of the single sheets* and IEC 60617: *Graphical symbols for diagrams*.

* See web site address on title page.

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

FIXED INDUCTORS FOR ELECTROMAGNETIC INTERFERENCE SUPPRESSION –

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FOREWORD

1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the 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, the IEC publishes International Standards. 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. The IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
2) The formal decisions or agreements of the IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested National Committees.
3) The documents produced have the form of recommendations for international use and are published in the form of standards, technical specifications, technical reports or guides and they are accepted by the National Committees in that sense.
4) In order to promote international unification, IEC National Committees undertake to apply IEC International Standards transparently to the maximum extent possible in their national and regional standards. Any divergence between the IEC Standard and the corresponding national or regional standard shall be clearly indicated in the latter.
5) The IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with one of its standards.
6) Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. The IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 60938-2 has been prepared by IEC technical committee 40: Capacitors and resistors for electronic equipment.

This second edition cancels and replaces the first edition published in 1988.

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

FDIS	Report on voting
40/1111/FDIS	40/1137/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.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 3.

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, C and D form an integral part of this standard.

The committee has decided that this publication remains valid until 2005.

At this date, in accordance with the committee's decision, 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 INDUCTORS FOR ELECTROMAGNETIC INTERFERENCE SUPPRESSION –

Part 2: Sectional specification

1 General

1.1 Scope

This International Standard applies to fixed inductors designed for electromagnetic interference suppression and which fall within the scope of the generic specification, IEC 60938-1. It is restricted to fixed inductors for which safety tests are appropriate. This implies that inductors specified according to this specification will either be connected to mains supplies, when compliance with the mandatory tests of table 1 is necessary, or used in other circuit positions where the equipment specification prescribes that some or all of these safety tests are required.

This standard applies to fixed inductors which will be connected to an a.c. mains or other supply with a nominal voltage not exceeding 1 000 V a.c. (r.m.s.) or d.c. between conductors and with a nominal frequency not exceeding 400 Hz.

1.2 Object

The object of this standard is to prescribe standard requirements for safety tests and standard ratings and characteristics, to select from IEC 60938-1 the appropriate methods of test and to give general performance requirements for suppression inductors. Test severities and performance requirements prescribed in detail specifications referring to this sectional specification shall be of equal or higher performance level. In addition, the minimum requirements for safety tests specified herein always apply.

1.3 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 60060-1:1989, *High-voltage test techniques – Part 1: General definitions and test requirements*

IEC 60063:1963, *Preferred number series for resistors and capacitors*
Amendment 1 (1967)
Amendment 2 (1977)

IEC 60085:1984, *Thermal evaluation and classification of electrical insulation*

IEC 60279:1969, *Measurement of the winding resistance of an a.c. machine during operation at alternative voltage*

IEC 60938-1:1999, *Fixed inductors for electromagnetic interference suppression – Part 1: Generic specification*

ISO 3:1973, *Preferred numbers – Series of preferred numbers*

1.4 Information to be given in a detail specification

1.4.1 General

Detail specifications shall be derived from the relevant blank detail specification.

Detail specifications shall not specify requirements inferior to those of the generic or sectional specification. When more severe requirements are included they shall be listed in 1.8 of the detail specification and indicated in the test schedules, for example by an asterisk.

NOTE – The information given in 1.4.2 may, for convenience, be presented in tabular form.

The information given in 1.4.2 to 1.4.5 shall be given in each detail specification and the values quoted shall preferably be selected from those given in the appropriate clause of this sectional specification.

1.4.2 Outline drawing and dimensions

There shall be an illustration of the inductor as an aid to easy recognition and for comparison of the inductor with others. Dimensions and their associated tolerances, which affect interchangeability and mounting, shall be indicated upon the drawing. All dimensions shall be stated in millimetres.

Normally the numerical values shall be given for the length of the body, the width and height of the body or for cylindrical types, the body diameter, and the length and diameter of the terminations. When necessary, for example when a number of items (inductance values/ voltage ranges) are covered by a detail specification, the dimensions and their associated tolerances shall be placed in a table below the drawing.

When the configuration is other than described above, the detail specification shall state such dimensional information as will adequately describe the inductor. When the inductor is not designed for use on printed boards, this shall be clearly stated in the detail specification.

1.4.3 Mounting

The detail specification shall specify the method of mounting to be recommended for normal use and the method which is mandatory for the application of the vibration, bump and shock tests. The design of the inductor may be such that special mounting fixtures are required in its use. In this case, the detail specification shall describe the mounting fixtures and they shall be used in the application of the bump, shock and vibration tests. The specified heat sink shall be used in the application of the endurance test.

1.4.4 Ratings and characteristics

The ratings and characteristics shall be in accordance with the relevant clauses of this specification.

1.4.4.1 Additional characteristics may be listed, when they are considered necessary to specify adequately the inductor for design and application purposes.

1.4.5 Marking

Deviations from 1.6 of this sectional specification, shall be specifically stated in the detail specification.

1.5 Definitions

For the purpose of this International Standard, the definitions in IEC 60938-1 apply.

1.6 Marking

1.6.1 The information given in the marking is normally selected from the following list; the relative importance of each item is indicated by its position in the list:

a) manufacturer's name (or trade mark);
b) manufacturer's type designation;
c) recognized approval mark;
d) rated inductance and tolerance;
e) rated voltage;
f) rated current;
g) identification of terminations or circuit diagram;
h) rated temperature;
i) climatic category;
j) year and month (or week) of manufacture (this may be in code form);
k) reference to the detail specification.

1.6.2 Marking of the inductor may be omitted when the manufacturer considers that there is insufficient space, and this fact is recorded in the detail specification. When present, the marking shall be sufficient to provide a clear identification of the inductor. Any duplication of information in the marking on the inductor should be avoided.

1.6.3 The packaging containing the inductor(s) shall be clearly marked with all the information listed in 1.6.1, except g).

1.6.4 Any additional marking shall be so applied that no confusion can arise.

2 Preferred ratings and characteristics

2.1 Climatic categories

Electromagnetic interference suppression inductors covered by this specification are classified into climatic categories according to the general rules given in IEC 60068-1. The lower and upper category temperatures and the duration of the damp heat, steady state test shall be selected from the following:

Lower category temperature: –65 °C, –55 °C, –40 °C, –25 °C and –10 °C.

Upper category temperature: +85 °C, +100 °C, +125 °C and +155 °C.

Duration of the damp heat, steady state test: 21 and 56 days.

The severities for the cold and dry heat tests are the lower and upper category temperatures respectively.

2.2 Values of ratings

2.2.1 Rated inductance and tolerance

Preferred values of rated inductance are values chosen from the E 6 series of preferred values given in IEC 60063.

The preferred tolerances on rated inductance are as follows:

±30 %; –30 %/+50 %.

2.2.2 Rated voltage (U_R)

Preferred values for rated voltages are:

AC inductors: 50 V, 125 V, 250 V, 400 V, 440 V, 480 V and 760 V.

DC inductors: 50 V, 160 V, 250 V and 500 V.

NOTE – Electromagnetic interference suppression inductors are normally chosen to have their rated voltage equal to or greater than the nominal voltage of the supply system to which they are to be connected. It should, however, be borne in mind that the voltage of the system may rise up to 10 % above the nominal voltage.

2.2.3 Category voltage (U_C)

The category voltage is equal to the rated voltage, unless otherwise stated in the detail specification.

2.2.4 Rated temperature

The rated temperature shall not be lower than +40 °C.

2.2.5 Rated current

The preferred values of rated current are selected from the R10 series of ISO 3.

2.2.6 Passive flammability

When specified, the minimum category of passive flammability permitted is category C.

3 Quality assessment procedures

3.1 Primary stage of manufacture

See 3.2 of IEC 60938-1.

3.2 Structurally similar inductors

Inductors are structurally similar when for their range of inductance values they have the following common characteristics:

a) essentially the same materials;

b) similar design features and manufacturing techniques;

c) same rated voltage.

3.3 Certified records of released lots

When certified test records are requested by a purchaser, they shall be specified in the detail specification.

3.4 Qualification approval

The procedures for qualification approval testing for structurally similar inductors are given in 3.4 of IEC 60938-1.

3.4.1 Qualification approval on the basis of the fixed sample size procedures

3.4.1.1 Sampling

This standard covers procedures for qualification approval tests only. Two alternative test procedures are given, namely the full test procedure covering both safety tests and performance requirements, and a restricted test procedure covering safety tests.

Table 1 and annex A form the schedule limited to tests for safety tests only approval. Prior to the approval testing for safety tests only it is necessary to submit to the certification body a declaration of design (annex D) registering essential data and basic design details of the inductors for which approval is sought.

Table 2 and annex B form the full schedule for safety tests and performance approval.

Each rated voltage shall be separately qualified. The total number of inductors of each rated voltage to be tested in each group is given in table 1 or 2. For each rated voltage the sample shall contain equal numbers of specimens of the highest and lowest inductance and the highest and lowest rated current in the range to be qualified. Where only one inductance value or rated current value is involved, the total number of inductors as stated in table 1 or 2 shall be tested.

Spare specimens are permitted as follows:

a) one per inductance/rated current combination which may be used to replace the permitted non-conforming items in group 0;
b) one per inductance/rated current combination which may be used as replacements for specimens lost due to incidents not attributable to the manufacturer or the test sequence;
c) the remainder of the spares may be required if it is necessary to repeat any test according to the provisions of note 1 to table 1 or 2;
d) spares may be kept at the premises of the manufacturer instead of being sent to the testing station.

The number of samples given in group 0 assume that all groups are applicable. If this is not so the numbers may be reduced accordingly.

When additional groups are introduced into the qualification approval test schedule, the number of specimens required for group 0 shall be increased by the same number as that required for the additional groups.

3.4.1.2 Tests

The complete series of tests specified in either table 1 or 2 is required for the approval of a series of structurally similar inductors of one rated voltage. The tests of each group shall be carried out in the order given.

The whole sample shall be subjected to the tests of group 0 and then divided for the other groups.

Non-conforming items found during the tests of group 0 shall not be used for the other groups.