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Second edition
2005-02

Passive filter units for electromagnetic interference suppression –

Part 1: Generic specification

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International Electrotechnical Commission, 3, rue de Varembé, PO Box 131, CH-1211 Geneva 20, Switzerland
Telephone: +41 22 919 02 11 Telefax: +41 22 919 03 00 E-mail: inmail@iec.ch Web: www.iec.ch

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

PASSIVE FILTER UNITS FOR ELECTROMAGNETIC INTERFERENCE SUPPRESSION –

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 60939-1 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. This second edition constitutes a technical revision.

The major changes that have been made between the first and the second edition are:

– Clause 3 has been updated in accordance with the usual practice in IEC TC 40 documents.
– Discharge resistance, current overload, passive flammability, active flammability, solvent resistance of marking and component solvent resistance have been added to Clause 4, test and measurement procedures.

NOTE Corrigendum 1 (2005-11) has been included in this copy. It constitutes a revision of the structure of subclause 4.5, as well as an addition to subclause 4.10.3.

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

FDIS	Report on voting
40/1509/FDIS	40/1536/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 2.

IEC 60939 consists of the following parts, under the general title *Passive filter units for electromagnetic interference suppression*

Part 1: Generic specification

Part 2: Sectional specification: Test methods and general requirements

Part 2-1: Blank detail specification – Passive filter units for electromagnetic interference suppression – Filters for which safety tests are required (Assessment level D/DZ)

Part 2-2: Blank detail specification – Passive filter units for electromagnetic interference suppression – Filters for which safety tests are required (Safety tests only)

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.

PASSIVE FILTER UNITS FOR ELECTROMAGNETIC INTERFERENCE SUPPRESSION –

Part 1: Generic specification

1 General

1.1 Scope

This generic specification relates to passive filter units for electromagnetic interference suppression for use within, or associated with, electronic or electrical equipment and machines.

Both single- and multi-channel filters within one enclosure are included within the scope of this generic specification.

Filters constructed of capacitive elements where the inductance is inherent in the construction of the filter are within the scope of this specification. Similarly, filters constructed of inductive elements where the capacitance is inherent in the construction of the filter are also within the scope of this generic specification. The manufacturer shall state whether a given component is to be designed as a capacitor, an inductor or a filter.

The filter units within the scope of this generic specification are further distinguished as those for which safety tests are appropriate (e.g. those connected to mains supplies) and those for which such tests are not appropriate. A separate sectional specification covers the passive filter units for which safety tests are appropriate.

This generic specification establishes standard terms, inspection procedures and methods of test for use in sectional and detail specifications within the IECQ-CECC system for electronic components.

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.

NOTE Components other than inductors and capacitors in the filter unit should fulfil requirements in the relevant IEC Standard.

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

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

IEC 60062, *Marking codes for resistors and capacitors*

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

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

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

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

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

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

IEC 60068-2-17, *Basic environmental testing procedures – Part 2: Tests – Test Q: Sealing*

IEC 60068-2-20, *Environmental testing – Part 2: Tests – Test T: Soldering*

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

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

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

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

IEC 60068-2-45, *Environmental testing – Part 2: Tests – Test XA and guidance: Immersion in cleaning solvents*

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

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

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

IEC 60384-14: *Fixed capacitors for use in electronic equipment – Part 14: Sectional specification: Fixed capacitors for electromagnetic interference suppression and connection to the supply mains*

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

IEC 60695-2-2, *Fire hazard testing – Part 2: Test methods – Section 2: Needle flame test*

IEC QC 001002-3, *IEC Quality assessment system for electronic components (IECQ) – Rules of procedure – Part 3: Approval procedures*

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

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

2 Technical data

2.1 Units, symbols and terminology

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

– IEC 60027
– IEC 60050
– 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 purpose of the IEC 60939 series, the following terms and definitions apply.

2.2.1
type
group of components having similar design features, the similarity of their manufacturing techniques enabling them to be grouped together either for qualification approval or for quality conformance inspection, and 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.

2.2.2
style
subdivision of a type, generally based on dimensional factors; a style may include several variants, generally of a mechanical order

2.2.3
electromagnetic interference suppression filter unit (filter)
radio interference suppression filter unit
assembly of piece-parts and inductive, capacitive and resistive elements to be used for the reduction of electromagnetic interference caused by electrical or electronic equipment, or other sources

2.2.4
rated voltage
U_R
maximum r.m.s. operating voltage at rated frequency or the maximum d.c. operating voltage which may be applied continuously to the terminations of the filter unit at any temperature between the lower and the upper category temperatures

2.2.5
category voltage
U_C
maximum voltage which may be applied to a filter at its upper category temperature

2.2.6
lower category temperature
minimum ambient temperature for which the filter has been designed to operate continuously

2.2.7
upper category temperature
maximum ambient temperature for which the filter unit has been designed to operate continuously

2.2.8
rated temperature
maximum ambient temperature at which a filter can carry its rated current

2.2.9
rated current
maximum r.m.s. operating current at rated frequency or maximum d.c. rating current which allows continuous operation of the filter at the rated temperature, 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})

2.2.10
rated capacitance
C_R
capacitance value for which a capacitor has been designed and which may be indicated upon it

2.2.11
rated inductance
L_R
inductance value for which the inductor has been designed and which may be indicated upon it

2.2.12
insertion loss
ratio of the voltage before and after the insertion of the filter in the circuit as measured at the terminations either with a symmetrical or an asymmetrical test circuit

NOTE It is normally expressed in decibels, when the insertion loss is 20 times the logarithm to base 10 of this ratio.

2.2.13
asymmetrical test circuit
test circuit in which the filter under test is connected as a 3-terminal network, one terminal of which is connected to earth

NOTE The signal is applied between the input terminal and earth, and the output is measured between the output terminal and earth. There is a common (earth) connection between generator, filter and receiver (see Figure 1).

2.2.14
symmetrical test circuit
test circuit in which the filter under test is connected as a 4-terminal network

NOTE 1 The test signal applied to the two input terminals symmetrically about earth, i.e. equal in magnitude but of opposite phase on the two terminals (see Figure 1). The output is measured between the other two terminals.

NOTE 2 It is usual to perform symmetrical tests using an asymmetrical generator and receiver with suitable balance-to-unbalance transformers connected between them and the filter under test.

2.2.15
visible damage
visible damage which reduces the usability of the filter for its intended purpose

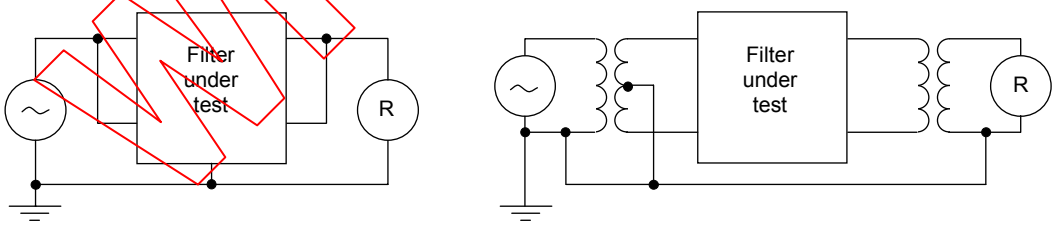

Figure 1 – Asymmetrical and symmetrical test circuit

2.2.16
passive flammability
ability of a filter to burn with a flame as a consequence of the application of an external source of heat

2.2.17
active flammability
ability of a filter to burn with a flame as a consequence of electrical loading