BRITISH STANDARD

BS EN
60939-1:2005

Passive filter units for electromagnetic interference suppression —

Part 1: Generic specification

The European Standard EN 60939-1:2005 has the status of a British Standard

ICS 31.160

BSI
British Standards

National foreword

This British Standard is the official English language version of EN 60939-1:2005. It is identical with IEC 60939-1:2005. It supersedes BS EN 133000:1997 which will be withdrawn on 1 March 2008.

The UK participation in its preparation was entrusted to Technical Committee EPL/40X, Capacitors and resistors for electronic equipment, which has the responsibility to:

— aid enquirers to understand the text;

— present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep UK interests informed;

— monitor related international and European developments and promulgate them in the UK.

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

Cross-references

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English version

Passive filter units for electromagnetic interference suppression
Part 1: Generic specification
(IEC 60939-1:2005)

Filtres passifs d'antiparasitage
Partie 1: Spécification générique
(CEI 60939-1:2005)

Passive Filter für die Unterdrückung
von elektromagnetischen Störungen
Teil 1: Fachgrundspezifikation
(IEC 60939-1:2005)

This European Standard was approved by CENELEC on 2005-03-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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CENELEC
European Committee for Electrotechnical Standardization
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Foreword

The text of document 40/1509/FDIS, future edition 2 of IEC 60939-1, 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 60939-1 on 2005-03-01.

This European Standard supersedes EN 133000:1997.

The following dates were fixed:

– latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2005-12-01
– latest date by which the national standards conflicting with the EN have to be withdrawn	(dow)	2008-03-01

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 60939-1:2005 was approved by CENELEC as a European Standard without any modification.

CONTENTS

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

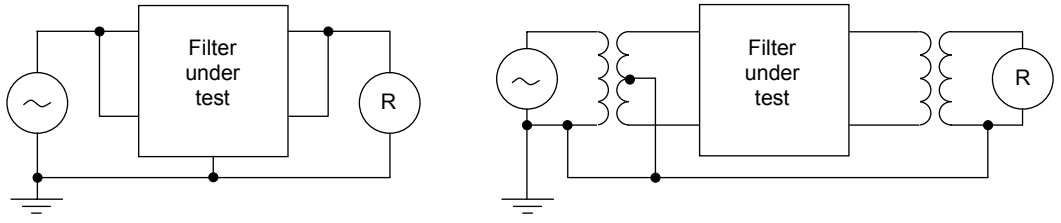


Figure 1 – Asymmetrical and symmetrical test circuit

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

2.3 Preferred values

Each sectional specification shall prescribe the preferred values appropriate to the subfamily 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 filters and the packing.

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

Before filters are qualified according to the procedures of this Clause, the manufacturer shall obtain approval of his organisation following the provisions of IEC QC 001002-3.

Two methods are available for the approval of filters of assessed quality. These are qualification approval and capability approval, both according to the provisions of IEC QC 001002-3. For a given subfamily of filters, separate sectional specifications for qualification approval and capability approval are necessary, and capability approval is therefore available only when a relevant sectional specification has been published.

3.1.1 Applicability of qualification approval

Qualification approval is appropriate for a range of filters manufactured to similar design and production processes and conforming to a published detail specification.

The programme of tests defined in the detail specification for the appropriate assessment and performance levels applies directly to the filter range to be qualified, as prescribed in 3.5 and the relevant sectional specification.

3.1.2 Applicability of capability approval

Capability approval is appropriate when filters based on common design rules are fabricated by a group of common processes. It is particularly appropriate when filters are manufactured to a user's specific requirements.

Under capability approval, detail specifications fall into the following three categories for:

3.1.2.1 Capability Qualifying Components (CQCs), including process validation test vehicles

A detail specification shall be prepared for each CQC as agreed with the ONS. It shall identify the purpose of the CQC and include all relevant test severities and limits.

3.1.2.2 Components for listing in the register of approvals (standard catalogue items)

When the manufacturer wants a filter covered by the capability approval procedure to be listed in the IECQ Register of Approvals, a capability approval detail specification complying with the blank detail specification shall be written. Such specifications shall be registered by the IECQ and the component may be listed in IEC QC 001005: Register of Firms, Products and Services Approved under the IECQ-CECC System.

3.1.2.3 Customer specified filters

The content of the detail specification (often known as a Customer Detail Specification CDS) shall be by agreement between the manufacturer and customer in accordance with IEC QC 001002-3.

Further information on these detail specifications is given in the relevant blank detail specification.

Approval is given to a manufacturing facility on the basis of validated design rules, processes and quality control procedures and the results of tests on capability qualifying components, including any process validation test vehicles. See 3.6 and the relevant sectional specification for further information.

3.2 Primary stage of manufacture

The primary stage of manufacture depends on the construction of the filter:

a) for filters constructed of capacitive elements where the inductance is inherent in the capacitive elements or the construction of the filter, the primary stage of manufacture is the same as for capacitor(s) of the same technology, as defined in the relevant fixed capacitor sectional specification;

b) for filters constructed of inductive elements where the capacitance is inherent in the inductive elements or the construction of the filter, the primary stage of manufacture is the winding of the inductive element(s);

c) for filters which are assembled from capacitive and inductive elements, whether these elements are bought-in or manufactured in-house, the primary stage of manufacture is the manufacturer's evaluation of the capacitive, inductive or resistive elements. Evaluation of capacitive, inductive or resistive elements may be further defined in the sectional specification.

3.3 Subcontracting

The manufacturer shall not sub-contract the primary stage of manufacture or any subsequent stage, except as follows:

– for a) in 3.2, the manufacturer may use capacitors released under the IECQ-CECC system;

– for b) in 3.2, the manufacturer may use inductors released under the IECQ-CECC system;

– for a), b) and c) in 3.2, painting and plating may be subcontracted.

3.4 Structurally similar filters

The grouping of structurally similar filters for qualification approval testing or for quality conformance testing under qualification approval or capability approval shall be prescribed in the relevant sectional specification.

3.5 Qualification approval procedures

3.5.1 Eligibility for qualification approval

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

3.5.2 Application for qualification approval

The manufacturer shall comply with 3.1.3 of IEC QC 001002-3.

3.5.3 Test procedure for qualification approval

One of the two following procedures shall be followed:

1) The manufacturer shall produce test evidence of conformance to the specification requirements on three inspection lots for lot-by-lot inspection taken in as short a time as possible and one lot for periodic inspection. No major changes in the manufacturing process shall be made in the period during which the inspection lots are taken.

   Samples shall be taken from the lots in accordance with IEC 60410. Normal inspection shall be used, but when the sample size would give acceptance on zero defectives, additional specimens shall be taken to meet the sample size requirements to give acceptance on one defective.

2) The manufacturer shall produce test evidence to show conformance to the specification requirements on the fixed sample size test schedule given in the sectional specification.

   The specimens taken to form the sample shall be selected at random from current production or as agreed with the National Supervising Inspectorate.

For the two procedures, the sample sizes and the number of permissible defectives shall be of comparable order. The test conditions and requirements shall be the same.

3.5.4 Granting of qualification approval

Qualification approval shall be granted when the procedures in accordance with Clause 3 of IEC QC 001002-3 have been completed satisfactorily.

3.5.5 Maintenance of qualification approval

Qualification approval shall be maintained by regular demonstration of compliance with the requirements for quality conformance (see 3.5.6).

3.5.6 Quality conformance inspection

Blank detail specification(s) associated with the sectional specification shall prescribe the test schedule for quality conformance inspection. This schedule shall also specify the grouping, sampling and periodicity for the lot-by-lot and periodic inspection.

3.6 Capability approval procedures

3.6.1 Eligibility for capability approval

The manufacturer shall comply with 4.2.1 of IEC QC 001002-3.

3.6.2 Application for capability approval

The manufacturer shall comply with 4.2.4 of IEC QC 001002-3.

3.6.3 Description of capability

The description of the capability shall be made in a capability manual in accordance with Clause 4 of IEC QC 001002-3 and the requirements of the relevant sectional specification.

The ONS shall treat the capability manual as a confidential document. The manufacturer may, if he so wishes, disclose part or all of it to a third party.

3.6.4 Demonstration and verification of capability

The manufacturer shall demonstrate and verify the capability in accordance with Clause 4 of IEC QC 001002-3 and the requirements of the relevant sectional specification.

3.6.5 Granting of capability approval

Capability approval shall be granted when the procedures in accordance with Clause 4 of IEC QC 001002-3 have been completed satisfactorily.

3.6.6 Maintenance of capability approval

Capability approval shall be maintained by complying with the requirements in Clause 4 of IEC QC 001002-3 and the requirements declared in the capability manual, following the schedule of maintenance given in the relevant sectional specification.

3.6.7 Quality conformance inspection

The quality conformance test requirements are given in the detail specification and shall be carried out in accordance with Clause 4 of IEC QC 001002-3.

The specimens taken to form the sample shall be selected at random from current production or as agreed with the national supervising inspectorate.

3.7 Rework and repair work

3.7.1 Rework

Rework is the rectification of processing errors prior to the release of a filter.

It shall not be carried out if prohibited by the relevant sectional specification. The relevant sectional specification shall state if there is a restriction on the number of occasions that rework may take place on a specific component.

All rework shall be carried out prior to the formation of the inspection lot offered for inspection to the requirements of the detail specification.

Such rework procedures shall be fully described in the relevant documentation produced by the manufacturer and shall be carried out under the direct control of the chief inspector. Subcontracting of rework is not permitted.

3.7.2 Repair

Repair is an activity to restore the good condition of an approved filter which has been damaged or become defective after release.

Filters which have been repaired shall not be released under the IECQ-CECC system.

3.8 Release for delivery

3.8.1 General

Filters shall be released for delivery according to IEC QC 001002-3 after the quality conformance inspection prescribed in the detail specification has been carried out.

3.8.2 Release for delivery under qualification approval before the completion of Group B tests

When the conditions of IEC 60410 for changing to reduced inspection have been satisfied for all Group B tests, the manufacturer is permitted to release components before the completion of such tests.

3.9 Certified test records

When certified test records are prescribed in the relevant specification and are requested by a purchaser, the following information shall be given as a minimum:

a) attributes information (that is number of components tested and number of defective components) for tests in the subgroups covered by periodic inspection without reference to the parameter for which rejection was made;

b) variables information for the change in insertion loss and insulation resistance after the endurance test, as required in the sectional specification.

NOTE For capability approval, the certified test records will refer only to tests carried out on capability qualifying components.

3.10 Delayed delivery

Filters held for a period exceeding three years (unless otherwise specified in the sectional specification), following the release of the lot shall, before delivery, be re-examined as specified in the sectional specification.

The re-examination procedure adopted by the manufacturer's chief inspector shall be approved by the ONS.

Once a lot has been satisfactorily re-inspected, its quality is re-assured for the specified period.

3.11 Alternative test methods

The test and measurement methods given in the relevant specification are not necessarily the only methods which can be used. However, the manufacturer shall satisfy the ONS that any alternative methods which he may use will give results equivalent to those obtained by the methods specified. In case of dispute, for referee and reference purposes, the specified methods only shall be used.

3.12 Unchecked parameters

Only those parameters of a component which have been specified in a detail specification and which are subject to testing can be assumed to be within the specified limits. It should not be assumed that any parameter not specified will remain unchanged from one component to another. Should for any reason it be necessary for one or more further parameters to be controlled, then a new, more extensive specification should be used. The additional test methods shall be fully described and appropriate limits, AQLs and inspection levels specified.

4 Test and measurement procedures

4.1 General

The sectional and/or blank detail specification shall contain tables showing the tests to be made, which measurements are to be made before and after each test or subgroup of tests, and the sequence in which they shall be carried out. The stages of each test shall be carried out in the order written. The measuring conditions shall be the same for initial and final measurements.

If national specifications within any Quality Assessment System include methods other than those specified in the above documents, they shall be fully described.

4.2 Standard atmospheric conditions

4.2.1 Standard atmospheric conditions for testing

Unless otherwise specified, all tests and measurements shall be made under standard atmospheric conditions for testing as given in 5.3 of IEC 60068-1.

– temperature: 15 °C to 35 °C;
– relative humidity: 45 % to 75 %;
– air pressure: 86 kPa to 106 kPa.

Before the measurements are made, the filter shall be stored at the measuring temperature for a time sufficient to allow the entire filter to reach this temperature. The period prescribed for recovery at the end of a test is normally sufficient for this purpose.

When measurements are made at a temperature other than the specified temperature, the results shall, where necessary, be corrected to the specified temperature. The ambient temperature during the measurements shall be stated in the test report. In the event of a dispute, the measurements shall be repeated, using one of the referee temperatures (as given in 4.2.3) and such other conditions as are prescribed in this Generic specification.

When tests are conducted in a sequence, the final measurements of one test may be taken as the initial measurements for the succeeding test.

During measurements, the filter shall not be exposed to draughts, direct sunrays or other influences likely to cause error.

4.2.2 Recovery conditions

Unless otherwise specified, recovery shall take place under the standard atmospheric conditions for testing (see 4.2.1).

If recovery has to be made under closely controlled conditions, the controlled recovery conditions of 5.4.1 of IEC 60068-1 shall be used.

Unless otherwise specified in the relevant sectional or detail specification, a duration of 1 h to 2 h shall be used.

4.2.3 Referee conditions

For referee purposes, one of the standard atmospheric conditions for referee tests taken from 5.2 of IEC 60068-1, as given in Table 1, shall be chosen.

Table 1 – Standard atmospheric conditions

Temperature °C	Relative humidity %	Air pressure kPa
20 ± 1	63 to 67	86 to 106
23 ± 1	48 to 52	86 to 106
25 ± 1	48 to 52	86 to 106
27 ± 1	63 to 67	86 to 106

4.2.4 Reference conditions

For reference purposes, the standard atmospheric conditions for reference given in 5.1 of IEC 60068-1 apply:

– temperature: 20 °C;

– air pressure: 101,3 kPa.

4.3 Drying

Unless otherwise specified in the relevant specification, the filter shall be conditioned for (96 ± 4) h by heating in a circulating air oven at a temperature of (55 ± 2) °C and a relative humidity not exceeding 20 %.

The filter shall then be allowed to cool in a desiccator using a suitable desiccant, such as activated alumina or silica gel, and shall be kept therein from the time of removal from the oven to the beginning of the specified tests.

4.4 Visual examination and check of dimensions

4.4.1 Visual examination

The condition, workmanship and finish shall be satisfactory, as checked by visual examination (see 2.2.15).

Marking shall be legible, as checked by visual examination. It shall conform to the requirements of the detail specification.

4.4.2 Dimensions (gauging)

The dimensions indicated in the detail specification as being suitable for gauging shall be checked, and shall comply with the values prescribed in the detail specification.

When applicable, measurements shall be made in accordance with IEC 60294.

4.4.3 Dimensions (detail)

All dimensions prescribed in the detail specification shall be checked and shall comply with the values prescribed.

4.4.4 Creepage distances and clearances

For those filters for which safety tests are appropriate, creepage distances and clearances on the outside of the filter between live parts of different polarity or between live parts and a metal case shall be not less than the appropriate values prescribed in the relevant specification.

4.5 Voltage tests

4.5.1 Application of test voltage

The insulation resistance shall be measured between the measuring points defined in Table 2, specified in the relevant specification.

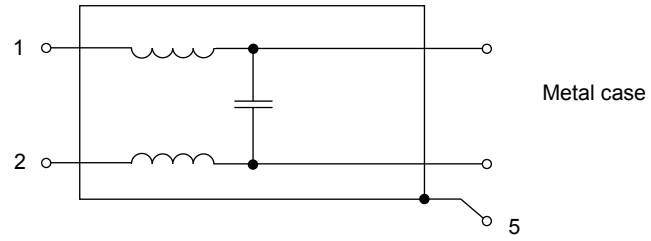
Test A, between terminations, applies to all filters, whether insulated or not. See Test A of Table 2.

Test B, internal insulation, applies to insulated filters in uninsulated metal cases. This test is not applicable to coaxial filters. See Test B of Table 2.

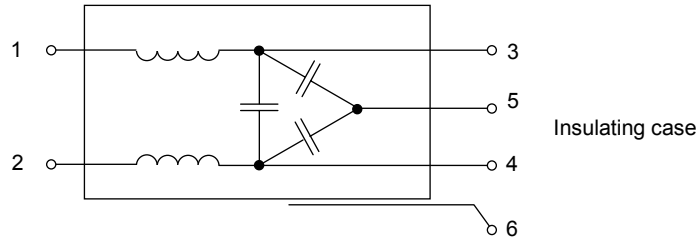
Test C, external insulation, applies to insulated filters in non-metallic cases or in insulated metal cases. For this test, the measuring voltage shall be applied using one of the three following methods as specified in the relevant specification. This test is not applicable to coaxial filters; it is applicable only to insulated filters in a non-metallic case or in an insulated metal case. See Test C of Table 2.

Table 2 – Measuring points

Tests	Description
A Between terminations	Between pairs of lines carrying the load current through the suppression components e.g. line-line or line-neutral.
B Internal insulation	Between the load current terminations connected together and the case (except where the case is one termination) (metal cased types only) or between the load current termination and the earth termination.
C External insulation	Between the load current terminations connected together and the metal plate or foil or V-block (insulated cases not employing metal) or between case and metal plate or foil or V-block (insulated metal cased types only).
NOTE See Figure 2 for examples of the application of this table.	



Test A between 1 and 2 or 3 and 4
Test B between 1, 2, 3, 4 together and 5



Test A between 1 and 2 or 3 and 4
Test B between 1, 2, 3, 4 together and 5
Test C 1, 2, 3, 4, 5 together and the metal foil 6 wrapped around the case

IEC 257/05

Figure 2 – Examples of the application of Table 2

4.5.2 Test methods

4.5.2.1 Foil method

A metal foil shall be closely wrapped around the body of the filter.

For filters with axial terminations, this foil shall extend beyond each end by not less than 5 mm, provided that a minimum distance of 1 mm can be maintained between the foil and the terminations. If this minimum distance cannot be maintained, the extension of the foil shall be reduced by as much as is necessary to establish the distance of 1 mm.

For filters with unidirectional terminations, a minimum distance of 1 mm shall be maintained between the edge of the foil and each termination.

4.5.2.2 Method for filters with mounting devices

The filter shall be mounted in its normal manner on a metal plate, which extends at least 12,7 mm in all directions beyond the mounting face of the filter.

4.5.2.3 V-block method

The filter shall be clamped in the trough of a 90° metallic V-block of such size that the filter body does not extend beyond the extremities of the block.

The clamping force shall be such as to guarantee adequate physical contact between the filter and the block. The clamping force is to be chosen in such a way that no destruction or damage of the filter occurs.

The filter shall be positioned in accordance with the following:

a) for cylindrical filters: the filter shall be positioned in the block so that the termination furthest from the axis of the filter is nearest to one of the faces of the block;
b) for rectangular filters: the filter shall be positioned in the block so that the termination nearest the edge of the filter is nearest to one of the faces of the block.

For cylindrical and rectangular filters having axial terminations, any out-of-centre positioning of the termination at its emergence from the filter body shall be ignored.

4.5.3 Insulation resistance test

4.5.3.1 Discharge resistor

For filters fitted with a discharge resistor, this measurement can only be made with the discharge resistor disconnected. If the discharge resistor cannot be disconnected without the filter being destroyed, the test shall be omitted for lot-by-lot tests; for qualification approval and periodic tests, where the discharge resistor cannot be disconnected without the filter being destroyed, the sample shall consist of filters specially made without discharge resistors.

4.5.3.2 Test voltage

Before the measurement is made, the filters shall be fully discharged.

Unless otherwise specified in the relevant specification, the insulation resistance shall be measured, at the d.c. voltage specified in Table 3.

Table 3 – DC voltage for insulation resistance

Voltage rating of the filter	Measuring voltage
U_R or U_C < 10 V	U_C or U_R ± 10 %
10 V ≤ U_R or U_C < 100 V	(10 ± 1) V [a)]
100 V ≤ U_R or U_C < 500 V	(100 ± 15) V
500 V ≤ U_R or U_C	(500 ± 50) V

[a)] When it can be demonstrated that the voltage has no influence on the measuring result, or that a known relationship exists, measurement can be performed at voltages up to the rated or category voltage (10 V shall be used in case of dispute).

U_R is the rated voltage for use in defining the measuring voltage to be used under standard atmospheric conditions for testing.

U_C is the category voltage for use in defining the measuring voltage to be used at the upper category temperature.

4.5.3.3 The insulation resistance shall be measured after the voltage has been applied for 60 s ± 5 s unless otherwise prescribed in the detail specification.

4.5.3.4 When prescribed by the detail specification, the temperature at which the measurement is made shall be noted. If this temperature differs from 20 °C, a correction shall be made to the measured value by multiplying the value by the appropriate correction factor prescribed in the sectional specification.

4.5.3.5 The relevant specification shall prescribe:

a) the tests and the measuring voltage corresponding to each of these tests (see Table 2);
b) the method of applying the voltage (one of the methods described in 4.5.2.1, 4.5.2.2 or 4.5.2.3);
c) time of electrification if other than 1 min;
d) any special precautions to be taken during measurements;
e) any correction factors required for measurement over the range of temperatures covered by the standard atmospheric conditions for testing;
f) the temperature of measurement if other than the standard atmospheric conditions for testing;
g) the minimum value of insulation resistance for the various tests.

4.5.4 Voltage proof tests

4.5.4.1 Test circuits

4.5.4.1.1 General

The test prescribed in the relevant sectional or detail specification may be either a d.c. test or an a.c. test.

4.5.4.1.2 Test circuit and procedure for a d.c. test

For Test A, where the test voltage will normally be applied across a capacitor, the test circuit shall be such that the conditions relating to the charging and discharging currents and the time constant for charging, prescribed in the relevant specification, are complied with.

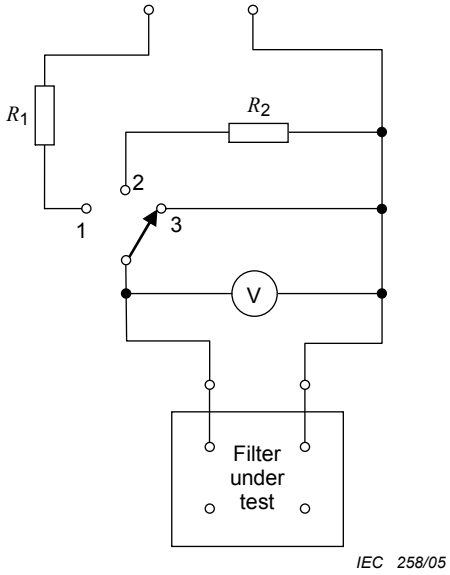


Figure 3 – Test circuit for d.c. test

The resistance of the voltmeter shall be not less than 10 000 Ω/V.

The resistor R_1 includes the internal resistance of the d.c. supply.

The resistors R_1 and R_2 shall have a resistance of sufficient value to limit the charging and discharging current to the value prescribed in the relevant specification.

Procedure

With the switch in position 2, the two terminals at the top of Figure 3 are connected to a variable d.c. supply of sufficient power, which is then adjusted to the required test voltage.

The filter to be tested is connected to the test circuit as indicated in Figure 3.

The switch is then moved to position 1 to charge the filter capacitance. Where necessary, e.g. when the filter is fitted with a discharge resistor, the voltage measured on the voltmeter shall be re-adjusted to the required test voltage.

The switch shall remain in this position for the time specified after the test voltage has been reached.

The filter capacitance shall be discharged through R_2 by moving the switch to position 2. As soon as the voltmeter reading has fallen to a voltage lower than 24 V or a voltage specified by the filter manufacturer, the filter is short-circuited by moving the switch to position 3. The filter shall then be disconnected.

4.5.4.1.3 Test circuit and procedure for an a.c. test

When an a.c. voltage is applied for qualification approval and periodic tests, the voltage may be supplied from a transformer fed from a variable auto-transformer, and the voltage shall be raised from near zero to the test voltage at a rate not exceeding 150 V/s. The test time shall be counted from the time the test voltage is reached. At the end of the test time, the test voltage shall be reduced to near zero and the filter capacitance discharged through a suitable resistor.

For lot-by-lot and 100 % testing, the voltage may be applied directly at the full test voltage, but care should be taken to avoid overvoltage peaks.

4.5.4.2 Tests

Depending on the construction of the filter, the test comprises one or more parts in accordance with Table 2 and the requirements of the relevant specification. When a d.c. test is specified by the relevant sectional or detail specification the circuit and procedure of 4.5.4.1.2 shall be used. When an a.c. test is specified by the relevant specification, the circuit and procedure of 4.5.4.1.3 shall be used.

4.5.4.3 Requirements

For each of the specified tests, there shall be no sign of flashover or permanent breakdown during the test period. Self-healing breakdowns are permitted.

Attention is drawn to the fact that repeated application of the voltage proof test may cause permanent damage to the filter. If repetition of the voltage proof test is made by the user, the applied voltage should not be greater than 66 % of the test voltage specified in the detail specification.

4.5.4.4 The relevant specification shall prescribe:

a) the tests (see Table 2) and the test voltage corresponding to each of the tests;
b) for the external insulation test (Test C), the method of applying the test voltage (one of the methods described in 4.5.2);
c) the time for which the voltage is applied;
d) the maximum charge and discharge currents (when the circuit and procedure of 4.5.4.1.2 or 4.5.4.1.3 is used); these may be specified by prescribing values for R_1 and R_2 in Figure 3.

4.6 Insertion loss

The measurement method shall preferably be selected from those described in CISPR 17 or those described in the sectional specification. If none of these is suitable, then the measurement method shall be described in the detail specification.

4.7 Discharge resistance

The resistance shall be measured as follows, unless otherwise prescribed in the relevant specification.

Compliance is checked by test, carried out on a sample of 10 specimens. The resistor samples shall be separately submitted by the filter manufacturer.

The resistance value shall correspond with the rated resistance taking into account the tolerance.

A voltage of 4,3 U_R d.c. shall be applied for a period of 1 min between the terminations of the resistor.

After this test, the value of resistance shall not differ more than 20 % from the value measured before the voltage proof test.

Before the measurements are made, the resistor shall be stored at the measuring temperature for a time sufficient to allow the resistor to reach this temperature.

No failure is allowed.

4.8 Robustness of terminations

4.8.1 General

The filters shall be subjected to tests Ua1, Ub, Uc and Ud of IEC 60068-2-21. The relevant specification shall prescribe which tests are applicable.

4.8.2 Test Ua1 – Tensile

The force applied shall be:

– for terminations other than wire terminations: 20 N;
– for wire terminations see Table 4.

Table 4 – Force for wire terminations

Nominal cross sectional area mm^2	Corresponding diameter of circular section wires mm	Force N
$S \leq 0{,}05$	$d \leq 0{,}25$	1
$0{,}05 < S \leq 0{,}07$	$0{,}25 < d \leq 0{,}3$	2,5
$0{,}07 < S \leq 0{,}2$	$0{,}3 < d \leq 0{,}5$	5
$0{,}2 < S \leq 0{,}5$	$0{,}5 < d \leq 0{,}8$	10
$0{,}5 < S \leq 1{,}2$	$0{,}8 < d \leq 1{,}25$	20
$1{,}2 < S$	$1{,}25 < d$	40

4.8.3 Test Ub – Bending

This test is not applicable if, in the detail specification, the terminations are described as rigid. Otherwise, it shall be applied to half of the terminations of the sample.

Method 1 shall be used with two consecutive bends in each direction.

4.8.4 Test Uc – Torsion

This test is not applicable if, in the detail specification, the terminations are described as rigid, or if the filter has unidirectional terminations designed for printed circuit applications. Otherwise, it shall be applied to the other half of the terminations of the sample.

Method A, severity 2 (two successive rotations of 180°) shall be used.

4.8.5 Test Ud – Torque

This test is intended only for terminations with threaded studs or screws, and for threaded integral mounting devices.

Table 5 – Torque

Nominal thread diameter mm		2,6	3	3,5	4	5	6	8	10	12
Torque Nm	Severity 1	0,4	0,5	0,8	1,2	2,0	2,5	5	7	12
	Severity 2	0,2	0,25	0,4	0,6	1,0	1,25	2,5	3,5	6

The detail specification shall prescribe which of the two severities, as given in Table 5, is applicable to solid studs and screws. For tubular studs or screws the detail specification shall prescribe the torque to be used.

4.8.6 Visual examination

After each of these tests the filters shall be visually examined. There shall be no visible damage.

4.9 Resistance to soldering heat

4.9.1 Applicability of the test

This test is not applicable to filters with terminations (such as snap-on contacts) which are not intended for soldering, as prescribed in the detail specification.

4.9.2 The measurements prescribed in the relevant specification shall be made.

4.9.3 The filters shall undergo Test Tb of IEC 60068-2-20 with the following requirements:

a) for filters designed for use on printed boards, as indicated in the detail specification, Method 1A shall be used with a duration of 5 s or 10 s as specified in the detail specification. The depth of immersion from the seating plane shall be $2^{0}_{-0,5}$ mm, using a thermal insulating screen of 1,5 mm ± 0,5 mm thickness;

b) for filters not designed for use on printed boards as indicated in the detail specification, and with leads longer than 4 mm, Method 1B shall be used, with depth of immersion from the component body being $3{,}5^{0}_{-0,5}$ mm;

c) for other filters Method 2 shall be used. The relevant specification shall specify which soldering iron bit size shall be used.

The period of recovery shall be not less than 1 h nor more than 2 h, unless otherwise specified by the detail specification.

4.9.4 When the test has been carried out, the filters shall be visually examined.

There shall be no visible damage and the marking shall be legible.

The filters shall then be measured as prescribed in the relevant specification.

4.10 Solderability

4.10.1 Applicability of the test

This test is applicable only to terminations intended for soldering, as prescribed in the detail specification.

4.10.2 Filters shall be subjected to Test Ta of IEC 60068-2-20 using one of the three test methods prescribed.

4.10.3 When the solder bath method (Method 1) is specified, the following requirements apply:

Bath temperature: 235 °C ± 5 °C

Immersion time: 2,0 s ± 0,5 s

Depth of immersion (from seating plane or component body):

a) all filters except those of b) below: $2^{0}_{-0,5}$ mm, using a thermal insulating screen of 1,5 mm ± 0,5 mm thickness.
b) filters indicated by the detail specification as being not suitable for use on printed circuit boards: $3,5^{0}_{-0,5}$ mm.

The terminations shall be examined for good tinning as evidenced by free flowing of the solder with wetting of the terminations.

4.10.4 When the soldering iron method (Method 2) is used, the relevant specification shall prescribe which soldering iron bit size shall be used.

4.10.5 When the solder globule method (Method 3) is used, the requirement shall include the soldering time.

4.11 Rapid change of temperature

4.11.1 The measurement prescribed in the relevant specification shall be made.

4.11.2 The filters shall be subjected to Test Na of IEC 60068-2-14 using the degree of severity as prescribed in the relevant specification.

4.11.3 After recovery, the filters shall be visually examined. There shall be no visible damage.

The measurements prescribed in the relevant specification shall then be made.

4.12 Vibration

4.12.1 The measurements prescribed in the relevant specification shall be made.

4.12.2 The filters shall be subjected to Test Fc of IEC 60068-2-6 using the mounting method and degree of severity prescribed in the relevant specification.

4.12.3 When specified in the detail specification, during the last 30 min of the vibration test in each direction of movement, an electrical measurement shall be made to check intermittent contacts or open or short circuit. The duration of the measurement shall be the time needed for one sweep of the frequency range from one frequency extreme to the other. The method of measurement shall be prescribed in the detail specification.

4.12.4 After the test, the filters shall be visually examined. There shall be no visible damage. When filters are tested as specified in 4.12.3, the requirements shall be stated in the detail specification in terms of the method prescribed.

The measurements prescribed in the relevant specification shall then be made.

4.13 Bump

4.13.1 The measurements prescribed in the relevant specification shall be made.

4.13.2 The filters shall be subjected to Test Eb of IEC 60068-2-29 using the mounting method and severity prescribed in the relevant specification.

4.13.3 After the test, the filters shall be visually examined. There shall be no visible damage.

The measurements prescribed in the relevant specification shall then be made.

4.14 Shock

4.14.1 The measurements prescribed in the relevant specification shall be made.

4.14.2 The filters shall be subjected to Test Ea of IEC 60068-2-27 using the mounting method and the severity prescribed in the relevant specification.

4.14.3 After the test, the filters shall be visually examined. There shall be no visible damage.

The measurements prescribed in the relevant specification shall then be made.

4.15 Container sealing

The filters shall be subjected to the procedure of the appropriate methods of Test Q of IEC 60068-2-17 as prescribed in the relevant specification.

4.16 Climatic sequence

In the climatic sequence, an interval of maximum 3 days is permitted between any of the tests, except that the cold test shall be applied immediately after the recovery period for the first cycle of the damp heat, cyclic, Test Db.

4.16.1 Initial measurements

The measurements prescribed in the relevant specification shall be made.

4.16.2 Dry heat

The filters shall be subjected to Test Ba of IEC 60068-2-2 for 16 h, using the degree of severity of the upper category temperature, as prescribed in the detail specification.

While still at the specified high temperature and at the end of the period of high temperature, the measurements prescribed in the relevant specification shall be made.

After conditioning, the filters shall be removed from the chamber and exposed to standard atmospheric conditions for testing for not less than 4 h.

4.16.3 Damp heat, cyclic, first cycle

The filters shall be subjected to the test described in Clause 4, severity b) of IEC 60068-2-30 for one cycle of 24 h. Unless variant 1 is prescribed in the relevant specification, variant 2 shall be used.

After recovery the filters shall be subjected immediately to the cold test.

4.16.4 Cold

The filters shall be subjected to Test Aa of IEC 60068-2-1 for 2 h, using the degree of severity of the lower category temperature as prescribed in the relevant specification.

While still at the specified low temperature and at the end of the period of low temperature, the measurements prescribed in the relevant specification shall be made.

After conditioning, the filters shall be removed from the chamber and exposed to standard atmospheric conditions for testing for not less than 4 h.

4.16.5 Low air pressure

The filters shall be subjected to Test M of IEC 60068-2-13 using the appropriate degree of severity prescribed in the relevant specification. The duration of the test shall be 10 min, unless otherwise prescribed in the relevant specification.

The relevant specification shall prescribe the:

a) duration of test, if other than 10 min;

b) temperature;

c) degree of severity.

While at the specified low pressure, the rated voltage shall be applied to terminations as prescribed in the relevant specification for the last 1 min of the test period, unless otherwise prescribed in the relevant specification.

During and after the test there shall be no evidence of permanent breakdown, flashover, harmful deformation of the case or seepage of impregnate.

4.16.6 Damp heat, cyclic, remaining cycles

The filters shall be subjected to the test described in Clause 4, severity b) of IEC 60068-2-30 for the number of cycles of 24 h as indicated in Table 6, under the same conditions as for the first cycle. See 4.16.3.

Table 6 – Number of cycles

Categories	Number of cycles
-/-/56	5
-/-/21	1
-/-/10	1
-/-/04	None

4.16.7 Final measurements

After the prescribed recovery, the measurements prescribed in the relevant specification shall be made.

4.17 Damp heat, steady state

4.17.1 The measurements prescribed in the relevant specification shall be made.

4.17.2 The filters shall be subjected to the procedure of Test Cab of IEC 60068-2-78 using the degree of severity corresponding to the climatic category of the filter as indicated in the detail specification. When specified in the sectional specification, the detail specification may specify the application of a polarizing voltage during the whole period of damp heat conditioning.

4.17.3 After recovery, the filters shall be visually examined. There shall be no visible damage.

The measurements prescribed in the relevant specification shall then be made.

4.18 Temperature rise

4.18.1 The filters shall be placed in the test chamber in such a manner that due to close spacing no extra heating of the filters occurs. In cases of doubt, a 25 mm spacing shall be used.

The filters shall be mounted in the manner specified by the manufacturer. When the manufacturer specifies a rated current for both free air and heat sink conditions, the test shall be carried out in the free air condition.

The specimens shall be introduced into a test chamber stabilised at a temperature equal to the rated temperature of the filter, and the rated current shall be applied. There shall be no air circulation other than that produced by natural convection caused by the heated filter. The duration of the test shall be sufficient for the specimen to reach temperature stability.

After thermal equilibrium has been reached, the internal temperature of the filter and the temperature of the case at its hottest point shall be measured, as prescribed in the relevant specification.

The internal temperature of the filter shall not exceed the requirements of IEC 60085. The case temperature shall not exceed the maximum temperature specified in the detail specification.

4.18.2 After recovery, the filters shall be visually examined. There shall be no visible damage.

4.19 Current overload

4.19.1 The measurements prescribed in the relevant specification shall be made.

4.19.2 The filter shall be mounted in the manner specified in the relevant specification in free air at an ambient temperature between 15 °C and 35 °C.

A voltage shall then be applied to the terminals of the filter. The value of the voltage shall be such as to produce a current in the filter of 2,5 times the rated current for a period of 5 s, unless otherwise specified in the relevant specification.

4.19.3 After recovery for 1 h to 2 h, the filters shall be visually examined. There shall be no visible damage and the marking shall be legible.

4.19.4 The measurements prescribed in the relevant specification shall then be made.

4.20 Endurance

4.20.1 The measurements prescribed in the relevant specification shall be made.

4.20.2 The filters shall be mounted in a test chamber in the manner specified by the manufacturer. When the manufacturer specifies a rated current for both free air and heat sink conditions, the test shall be carried out in the free air condition.

The duration of the test, the value(s) of the applied voltage, current, and the chamber temperature(s) at which it shall be conducted, shall be prescribed in the relevant specification.

The filters shall be placed in the test chamber in such a manner that no extra heating of the filters occurs, with a minimum distance of 25 mm between them.

The filters shall not be heated by direct radiation and the circulation of the air in the chamber shall be adequate to prevent the temperature from departing by more than 3 °C from the specified temperature at any point where components may be placed.

After the specified period, the filters shall be allowed to recover under standard atmospheric conditions for testing.

4.20.3 The measurements prescribed in the relevant specification shall then be made.

4.21 Charge and discharge test

4.21.1 For this test, the filter is connected as a capacitor.

4.21.2 The measurements specified in the relevant specification shall be made.

4.21.3 Suitable test circuits are shown in Figure 4 and Figure 5.

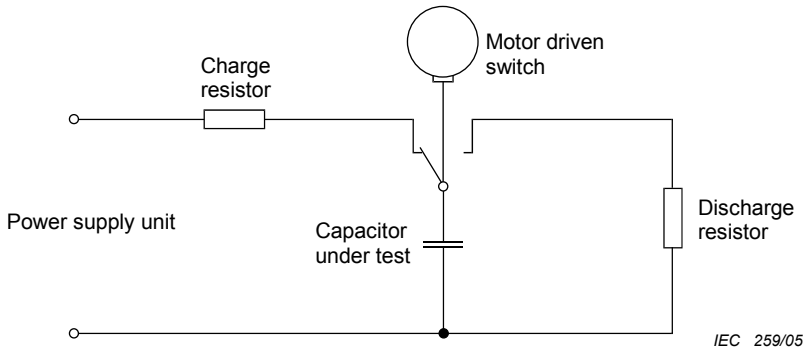


Figure 4 – Relay circuit

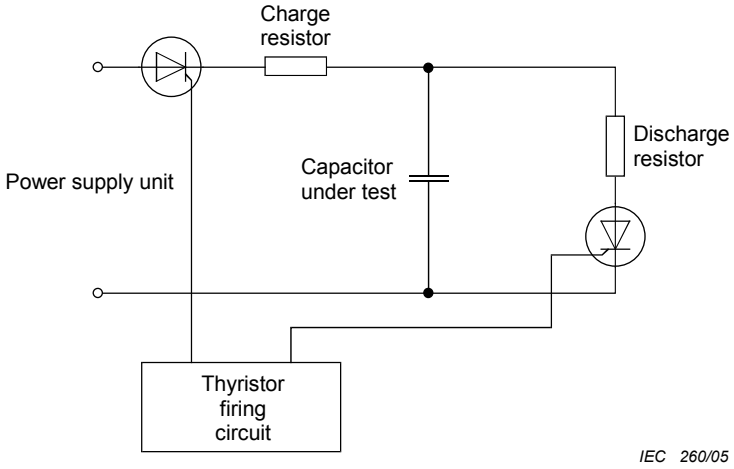


Figure 5 – Thyristor circuit

The voltage and current waveforms across and through the filter under test are approximately as in Figure 6.

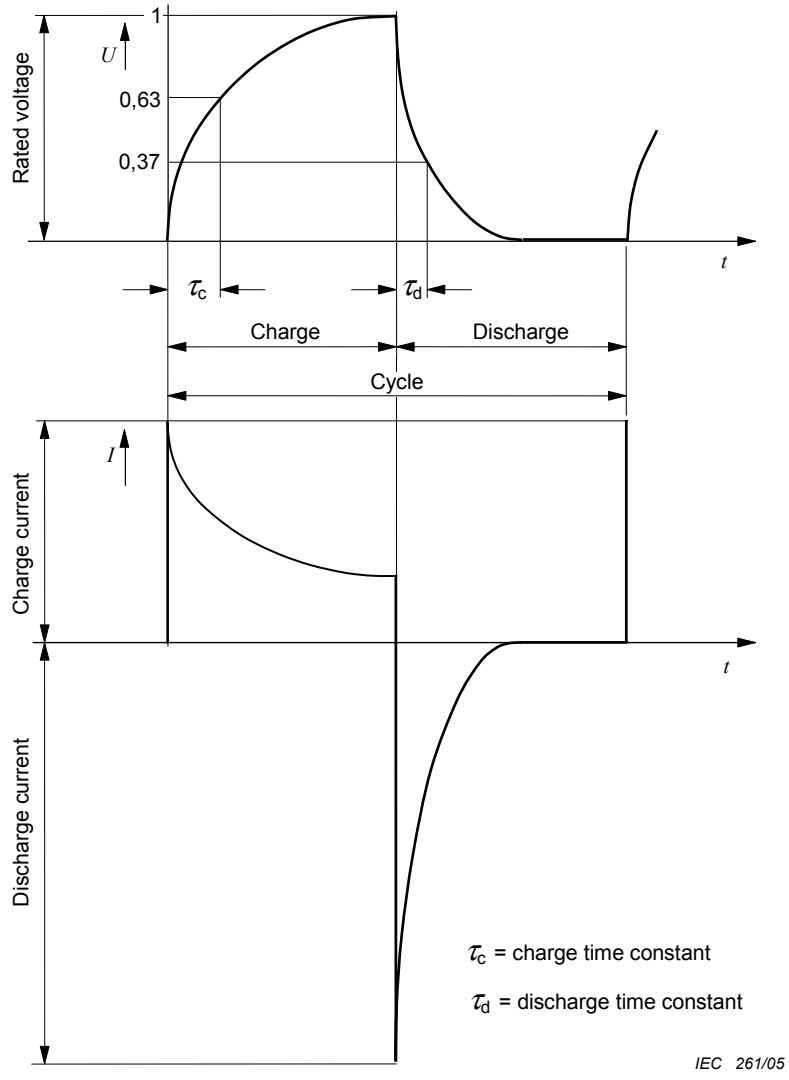


Figure 6 – Voltage and current waveforms

4.21.4 The following information shall be given in the relevant specification:

a) the charge time constant arising from the internal resistance of the power supply, the resistance of the charge circuit and the capacitance of the filter under test;

b) the discharge time constant arising from the resistance of the discharge circuit and the capacitance of the filter under test;

c) the voltage to be applied during the charge period if different from the rated voltage;

d) the number of cycles of the test;

e) the duration of the charge period;

f) the duration of the discharge period;

g) the repetition rate (cycles per second);

h) test temperature, if different from standard atmospheric conditions for testing.

The measurements specified in the relevant specification shall be made.

4.22 Passive flammability

The filters shall undergo the needle flame test of IEC 60695-2-2, with the following requirements:

4.22.1 Three specimens of each case size contained in the test sample shall be tested.

4.22.2 The specimen under test shall be held in the flame in the position where it is most likely to burn. It may be necessary to establish this position by a preliminary experiment. Each specimen shall be exposed only once to the flame. For the time of exposure, see Table 7.

4.22.3 The burning time shall not be exceeded as given in Table 6 for the specimen volume and the category of flammability as prescribed in the relevant specification. The tissue paper under the specimen shall not ignite.

Table 7 – Categories of flammability

Category of flammability	Flame exposure time, in seconds, for specimen volume ranges mm³				Max. burning time s	Additional requirements
	volume ≤ 250	250 < volume ≤ 500	500 < volume ≤ 1 750	Volume > 1 750		
A	15	30	60	120	3	Burning droplets or glowing parts falling down shall not ignite the tissue paper
B	10	20	30	60	10	
C	5	10	20	30	30	

4.23 Active flammability

This test is not applicable to filters that do not incorporate capacitors.

This test is not required for filters that incorporate capacitors certified as according to 4.18 of IEC 60384-14.

If the filter is within a metal case, this test is not required regardless of the capacitors used.

If capacitors which do not follow 4.18 of IEC 60384-14 are used in a filter without metal case, the test according to 4.18 of IEC 60384-14 shall be conducted on the individual capacitors in turn after they have been removed from the filter.

4.24 Solvent resistance of marking

4.24.1 The filters shall be subjected to test XA of IEC 60068-2-45 with the following details:

a) solvent to be used: see 3.1.2 of IEC 60068-2-45;

b) solvent temperature: 23 °C ± 5 °C;

c) conditioning: method 1 (with rubbing);

d) rubbing material: cotton wool;

e) recovery time: not applicable unless otherwise stated in the detail specification.

4.24.2 After the test, the marking shall be legible.

4.25 Component solvent resistance

4.25.1 Initial measurements

The measurements prescribed in the relevant detail specification shall be made.

4.25.2 The filters shall be subjected to test XA of IEC 60068-2-45 with the following details:

a) solvent to be used: see 3.1.2 of IEC 60068-2-45;

b) solvent temperature: 23 °C ± 5 °C;

c) conditioning: method 2 (without rubbing);

d) rubbing material: not applicable;

e) recovery time: 48 h unless otherwise stated in the detail specification.

4.25.3 The measurements prescribed in the relevant specification shall then be made and the specified requirements shall be met.

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Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

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 Where an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

Publication	Year	Title	EN/HD	Year
IEC 60027	Series	Letter symbols to be used in electrical technology	HD 60027 HD 245 S1	Series 1997
IEC 60050	Series	International Electrotechnical Vocabulary	-	-
IEC 60062	- [1)]	Marking codes for resistors and capacitors	EN 60062	2005 [2)]
IEC 60068-1	- [1)]	Environmental testing Part 1: General and guidance	EN 60068-1	1994 [2)]
IEC 60068-2-1	- [1)]	Part 2: Tests - Tests A: Cold	EN 60068-2-1	1993 [2)]
IEC 60068-2-2	- [1)]	Part 2: Tests - Tests B: Dry heat	EN 60068-2-2	1993 [2)]
IEC 60068-2-6	- [1)]	Part 2: Tests - Test Fc: Vibration (sinusoidal)	EN 60068-2-6	1995 [2)]
IEC 60068-2-13	- [1)]	Part 2: Tests - Test M: Low air pressure	EN 60068-2-13	1999 [2)]
IEC 60068-2-14	- [1)]	Part 2: Tests - Test N: Change of temperature	EN 60068-2-14	1999 [2)]
IEC 60068-2-17	- [1)]	Part 2: Tests - Test Q: Sealing	EN 60068-2-17	1994 [2)]
IEC 60068-2-20	- [1)]	Part 2: Tests - Test T: Soldering	HD 323.2.20 S3	1988 [2)]
IEC 60068-2-21	- [1)]	Part 2-21: Tests - Test U: Robustness of terminations and integral mounting devices	EN 60068-2-21	1999 [2)]
IEC 60068-2-27	- [1)]	Part 2: Tests - Test Ea and guidance: Shock	EN 60068-2-27	1993 [2)]
IEC 60068-2-29	- [1)]	Part 2: Tests - Test Eb and guidance: Bump	EN 60068-2-29	1993 [2)]

1) Undated reference.

2) Valid edition at date of issue.

Publication	Year	Title	EN/HD	Year
IEC 60068-2-30	- [1)]	Part 2: Tests - Test Db and guidance: Damp heat, cyclic (12 + 12-hour cycle)	EN 60068-2-30	1999 [2)]
IEC 60068-2-45	- [1)]	Part 2: Tests - Test Xa and guidance: Immersion in cleaning solvents	EN 60068-2-45	1992 [2)]
IEC 60068-2-78	- [1)]	Part 2-78: Tests - Test Cab: Damp heat, steady state	EN 60068-2-78	2001 [2)]
IEC 60085	- [1)]	Electrical insulation - Thermal classification	EN 60085	2004 [2)]
IEC 60294	- [1)]	Measurement of the dimensions of a cylindrical component having two axial terminations	-	-
IEC 60384-14	1993	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	- [1)]	Sampling plans and procedures for inspection by attributes	-	-
IEC 60695-2-2	- [1)]	Fire hazard testing Part 2: Test methods -- Section 2: Needle-flame test	EN 60695-2-2	1994 [2)]
IEC QC 001002-3	- [1)]	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	-	-

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