INTERNATIONAL STANDARD

IEC 60939-2-1

First edition
2004-11

Complete filter units for radio interference suppression –

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

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

COMPLETE FILTER UNITS FOR RADIO INTERFERENCE SUPPRESSION –

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

FOREWORD

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International Standard IEC 60939-2-1 has been prepared by IEC technical committee 40: Capacitors and resistors for electronic equipment.

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

FDIS	Report on voting
40/1466/FDIS	40/1487/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 *Complete filter units for radio interference suppression:*

Part 1: Generic specification

Part 2: Sectional specification

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- withdrawn;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 standard may be issued at a later date.

INTRODUCTION

Blank detail specification

A blank detail specification is a supplementary document to the sectional specification and contains requirements for style and layout and minimum content of detail specifications. In the preparation of detail specifications, the content of 1.4 of the sectional specification shall be taken into account.

The use of IEC 60939-2-2 may be more appropriate for components where approval and requalification tests contribute considerably to the cost of the product, whereas the employment of this specification may be necessary for components manufactured in mass production. This specification offers the assessment levels D and DZ (Zero defect).

Identification of the detail specification and of the component

The first page of the detail specification should have the layout recommended on the next page of this blank detail specification. The numbers between square brackets correspond to the following information which shall be inserted at the position indicated:

[1] The name of the National Standards Organization under whose authority the detail specification is published and, if applicable, the organization from which the detail specification is available.

[2] The IECQ symbol and the number allotted to the detail specification by the IECQ General Secretariat.

[3] The number and issue number of the IECQ generic or sectional specification as relevant; also national reference if different.

[4] If different from the IECQ number, the national number of the detail specification, date of issue and any further information required by the national system, together with any amendment numbers.

[5] A brief description of the component or range of components.

[6] Information on typical construction (when applicable).

For [5] and [6] the text to be given in the detail specification should be suitable for an entry in the IECQ Register of Approvals.

[7] Outline drawing with main dimensions which are of importance for interchangeability and/or reference to the appropriate national or international documents for outlines. Alternatively the drawing may be given in an annex to the detail specification, but [7] should always contain an illustration of the general outer appearance of the component.

[8] The level(s) of quality assessment covered by the detail specification, as appropriate.

[9] Reference data giving information on the most important properties of the component which allow comparison between the various component types intended for the same or similar applications.

[1]	IEC 60939-2-1-XXX [2] QC XXXXXXXXX
ELECTRONIC COMPONENTS OF ASSESSED QUALITY IN ACCORDANCE WITH: IEC 60939-1 IEC 60939-2 [3]	[4]
Outline and dimensions: (... angle projection) [7] (Other shapes are permitted within the dimensions given, see Table 1)	PASSIVE FILTER UNITS FOR ELECTROMAGNETIC INTERFERENCE SUPPRESSION AND FOR CONNECTION TO THE SUPPLY MAINS – FILTERS FOR WHICH SAFETY TESTS ARE REQUIRED [5] TYPICAL CONSTRUCTION: cylindrical/rectangular non-metallic/metallic case insulated/non-insulated axial/radial/screwed terminations contains capacitors of subclasses X and Y [6] Assessment level D / DZ [8]
NOTE For [1] to [9], see preceding page.	
REFERENCE DATA: Rated voltages, current range, climatic category, frequency range, insertion loss range, functional circuit diagram. [9]	

Information on the availability of components qualified to this detail specification is given in the IEC QC 001005.

COMPLETE FILTER UNITS FOR RADIO INTERFERENCE SUPPRESSION –

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

1 General data

1.1 Method of mounting for vibration, bump and shock tests

See 1.3.2 of IEC 60939-2.

1.2 Dimensions

Table 1 – Dimensions related to case size

Case size reference	Dimensions mm							
	L	*W*	*H*	...	...	...	...	...

When there is no case size reference, Table 1 may be omitted and the dimensions shall be given in Table 2, which then becomes Table 1.

The dimensions shall be given as maximum dimensions or as nominal dimensions with a tolerance.

1.3 Ratings and characteristics

Rated voltages (see Table 2a)

Category voltage (if applicable) (see Table 2a)

Rated current (see Table 2b)

DC line resistance or d.c. voltage drop at rated current

Maximum current at upper category temperature and derating curve (if applicable)

Maximum internal and external temperatures for temperature rise test (if applicable)

Climatic category

Rated temperature

Insertion loss, no load/room temperature (see Table 2a)

Insertion loss, load/temperature (see Table 2b)

Insulation resistance

Discharge resistance (if applicable)

Category of passive flammability (if applicable)

Table 2a – Insertion loss at no load

Case size or type designation	Rated voltage	Category voltage	Minimum insertion loss dB						
			kHz	kHz	MHz	MHz	MHz	GHz	GHz

Table 2b – Insertion loss at specified current and temperature

Case size or type designation	Rated current	Test current	Test temp. °C	Minimum insertion loss dB						
				kHz	kHz	MHz	MHz	MHz	GHz	GHz

1.4 Normative references

IEC 60384-1, *Fixed capacitors for use in electronic equipment – Part 1: Generic specification*

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

IEC 60939-1, *Complete filter units for radio interference suppression – Part 1: Generic specification* [1]

IEC 60939-2, *Complete filter units for radio interference suppression – Part 2: Sectional specification* [2]

1.5 Marking

The marking of the filter, if any, and the packing shall be in accordance with 1.5 of IEC 60939-2.

The details of the marking of the filter and the packing shall be given in full in the detail specification.

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[1] To be published.

1.6 Ordering information

Orders for filters covered by this specification shall contain, in clear or in coded form, the following information:

(a) type designation;

(b) rated voltage;

(c) number and issue reference of this detail specification.

1.7 Certified test records

Required/not required.

1.8 **Additional information** (not for inspection purposes)

1.9 Additional or increased severities or requirements to those specified in the generic and/or sectional specification

NOTE Additional or increased requirements should be specified only when essential.

Table 3 – Other characteristics

This table is to be used for defining characteristics which are additional to or more severe than those given in the sectional specification

2 Inspection requirements

2.1 Procedures

2.1.1 For Qualification Approval the procedures shall be in accordance with 3.4.2 of IEC 60939-2.

2.1.2 For Quality Conformance inspection the test schedule (Table 4) includes sampling, periodicity, severities and requirements. The formation of inspection lots is covered by 3.5.1 of IEC 60939-2.

Table 4a – Test schedule for lot-by-lot tests (Group A and Group B inspection) – Assessment level D / DZ

Assessment level D				
Clause number and test [1]		**Conditions of test** [1]	***IL*** [2]	***AQL***	**Performance requirements** [1]
Group A1		**Non-destructive**	S-4	2,5 %	
4.2	Visual examination				As in 4.2
4.2	Marking				Any marking on the filter shall be legible and correct
4.2	Dimensions (gauging)				See Table 1 of this specification
Group A2		**Non-destructive**	II	1,0 %	
4.5	DC line resistance or voltage drop				See 1.3 of this specification
4.6	Insertion loss	See Annex A of this specification			See Table 2 of this specification
4.3	Voltage proof (Test A only)	Method: ... [6]			No breakdown or flashover
4.4	Insulation resistance (Test A only)	Method: ... [6]			See 4.4.2
4.7	Discharge resistance [4]				See Table 2a of this specification
Group B1		**Non destructive** [5]	S-3	2,5 %	
4.10	Solderability [4]	Method: ... [6] Specify ageing if none or other than 4 h 155 °C dry heat: ... [6]			
4.10.2	Requirements	Visual examination			Methods 1 and 2: good tinning
		Wetting time			Method 3: < 3 s

Assessment level DZ					
Clause number and test [1]		**Conditions of test** [1]	***IL*** [2]	***AN*** [6]	**Performance requirements** [1]
Group A1		**Non-destructive**	S-3	0	
4.2	Visual examination				As in 4.2
4.2	Marking				Any marking on the filter shall be legible and correct
4.2	Dimensions (gauging)				See Table 1 of this specification
Group A2		**Non-destructive**	S-4	0	
4.5	DC line resistance or voltage drop				See 1.3 of this specification
4.6	Insertion loss	See Annex A of this specification			See Table 2 of this specification
4.3	Voltage proof (Test A only)	Method: ... [4]			No breakdown or flashover
4.4	Insulation resistance (Test A only)	Method: ... [4]			See 4.4.2
4.7	Discharge resistance [3]				See Table 2a of this specification
Group B1		**Non destructive** [5]	S-3	0	
4.10	Solderability [3]	Method: ... [4] Specify ageing if none or other than 4 h 155 °C dry heat: ... [4]			
4.10.2	Requirements	Visual examination			Methods 1 and 2: good tinning
		Wetting time			Method 3: < 3 s

[1] Clause numbers of tests and performance requirements refer to Clause 4 of IEC 60939-2.

[2] Inspection Levels (IL) and Acceptance Quality Levels (AQL) are selected from IEC 60410.

[3] If applicable.

[4] To be required in the detail specification.

[5] Filters which have been submitted to the tests of Group B1 may be released provided they have not been submitted to ageing and are resubmitted to the tests of Group A and pass those tests. It is permitted to submit electrically defective filters or detached terminations instead of completed filters to this test provided they have been subjected to the same process treatments as a completed filter.

[6] Acceptance number.

Table 4b – Test schedule for periodic tests (Group C inspection) – Assessment level D / DZ

Clause number and test [1]		Conditions of test [1]	p	n	c [2]		Performance requirements [1]
					D	DZ	
Group C1A		**Destructive**	6	2 1 1	0 0 0	0 0 0	
4.2	Dimensions (detail)						See Table 1 of this specification
4.2.1	Creepage distances and clearances						See Table 6
4.8	Robustness of terminations	Severity: ... [6]					
		Visual examination					No visible damage
4.9	Resistance to soldering heat [4]	No pre-drying Method 1A or 1B: ... [6]					
4.24	Solvent resistance of marking [3]						Marking legible
4.9.2	Intermediate measurements	Visual examination					No visible damage
		DC line resistance or voltage drop					See 1.3 of this specification
Group C1B		**Destructive**	6	4 1 1	0 0 0	0 0 0	
4.25	Component solvent resistance [3]						
4.11	Rapid change of temperature	T_A = Lower category temperature T_B = Upper category temperature					
		Five cycles Duration t = ... [6]					
4.11.1	Intermediate inspection	Visual examination					No visible damage
4.12	Vibration	Mounting as 1.1 of this specification Severity: ... [6]					
4.12.2	Intermediate inspection	Visual examination					No visible damage
4.13 or 4.14	Bump Shock	Mounting as 1.1. of this specification Severity: ... [6]					
4.13.2 or 4.14.2	Intermediate inspection	Visual examination					No visible damage
		DC line resistance or voltage drop					See 1.3 of this specification

Table 4b *(continued)*

Clause number and test [1]		Condition of test [1]	p [2]	n [2]	c [2]		Performance requirements [1]
					D	DZ	
Group C1		**Destructive**	6	6 2 2	1 1 0	0 0 0	
4.15	Container sealing [3]	Test Qc or Test Qd as required					No evidence of leakage
4.16	Climatic sequence						
4.16.1	Initial measurements	Measurements made in 4.9.2, 4.13.2 or 4.14.2 as appropriate					
4.16.2	Dry heat	No measurements					
4.16.3	Damp heat, cyclic, first cycle						
4.16.4	Cold	No measurements					
4.16.5	Low air pressure [3]	Severity: ... [6] if non-standard: see 4.16.5 for applied voltage					No permanent breakdown or flashover or harmful deformation of the case
4.16.6	Damp heat, cyclic, remaining cycles						
		Recovery 18 h to 26 h					
4.16.7	Final inspection	Visual examination					No visible damage Any marking shall be legible
		Voltage proof at 66 % of value in Table 7					No permanent breakdown or flashover
		Insulation resistance					> 50 % of limit given in Table 8
		DC line resistance or voltage drop					See 1.3 of this specification
		Insertion loss (no load)					See 4.6 and Table 2a of this specification

Table 4b *(continued)*

Clause number and test [1]	Conditions of test [1]	p [2]	n [2]	c [2] D	c [2] DZ	Performance requirements [1]
Group C2	**Destructive**	12	4 2 1	0 0 0	0 0 0	
4.17 Damp heat, steady state						
4.17.1 Test conditions	Specify if applied voltage is required [6] If so for half the sample U_R applied, for other half no voltage applied					
	Recovery: 18 h to 26 h					
4.17.2 Final inspection	Visual examination					No visible damage Any marking shall be legible
	Voltage proof at 66 % of value in Table 7					No permanent breakdown or flashover
	Insulation resistance or voltage drop					≥ 3,5 MΩ
	DC line resistance or voltage drop					See 1.3 of this specification
	Insertion loss (no load)					See 4.6 and Table 2a of this specification
Group C3A	**Destructive**	3	2 2 1	0 0 0	0 0 0	
4.18 Temperature rise [7]						
4.18.2 Final measurements	Internal temperature					See 4.18.2
	Temperature of case					Requirement: … [6]
4.20.1 Endurance current [8] [9]	Duration: 1 000 h Current and temperature: see 4.20.1					See 4.20.5
Group C3B	**Destructive**	3	2 2 1	0 0 0	0 0 0	
4.19 Impulse voltage	3 impulses, full wave Crest voltage: see Tables 1a and 1b					See 4.19.3
4.20.2 Endurance voltage, line terminations to case [4]	Duration: 1 000 h Voltage and temperature: see 4.20.2					See 4.20.5

Table 4b *(continued)*

Clause number and test [1]	Conditions of test [1]	p	n	c		Performance requirements [1]
				D	DZ	
Group C3C	**Destructive**	3	4 2 1	0 0 0	0 0 0	
4.19 Impulse voltage	3 impulses, full wave Crest voltage: see Tables 1a and 1b					See 4.19.3
4.20.3 Endurance voltage, between line terminations [9]	Duration: 1 000 h Voltage and temperature: see 4.20.3					See 4.20.5
4.20.4 Endurance combined voltage current [3] [9]	Duration: 1 000 h Voltage and temperature: see 4.20.4					See 4.20.5
Group C3						
	Recovery 1 h to 26 h					
4.20.5 Final inspection and measurements for all endurance tests	Visual examination					No visible damage Any marking shall be legible
	Voltage proof at 66 % of value in Table 7					No permanent breakdown or flashover
	Insulation resistance					> 50 % of limit in Table 8
	DC line resistance or voltage drop					See 1.3 of this specification
	Insertion loss (no load)					See 4.6 and Table 2a of this specification
Group C4	**Destructive**	12	2 2 1	0 0 0	0 0 0	
4.21 Charge and discharge [4]	10 000 cycles of charge and discharge					
4.21.1 Initial measurements	Capacitance at 1 kHz					Recorded for reference
	Tan δ at: 10 kHz for $C_R \leq 1$ µF 1 kHz for $C_R > 1$ µF					Recorded for reference
4.21.3 Finale measurements	Capacitance					See Table 10
	Tan δ at same frequency as initial measurement					See Table 10
	Insulation resistance					See Table 10