SLOVENSKI STANDARD

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Sectional Specification: Fixed low power film resistors

Rahmenspezifikation: Schicht-Festwiderstände niedriger Belastbarkeit

Spécification intermédiaire: Résistances couche fixes à faible dissipation

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CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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Foreword

This European Standard was prepared by the Technical Committee CENELEC TC 40XB, Resistors.

The text of the draft was submitted to the Unique Acceptance Procedure and was approved by CENELEC as EN 140100 on 2007-10-01.

This European Standard supersedes EN 140100:1996 + A1:2001.

Compared to the superseded standard, the following changes have been implemented:

– modification of the title;

– introduction of a test on the resistance to electrostatic discharge;

– introduction of description and test methods for lead-free soldering;

– introduction of the code letters for temperature coefficient as given in EN 60062;

– adoption of the IECQ rules of procedure, QC 001002-3;

– editorial revision.

The preceding document on the subject covered by this specification has been CECC 40 100:1980.

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) 2008-10-01

– latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 2010-10-01

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1 General

1.1 Scope

This sectional specification prescribes the preferred values for characteristics and ratings and also the inspection requirements for fixed film resistors of assessed quality. These resistors generally have wire terminations and are primarily intended to be mounted directly on to printed boards. It selects from the generic specification, EN 60115-1, the appropriate methods of test to be used in detail specifications derived from this specification.

Associated with this specification are one or more blank detail specifications each referenced by an EN number. A blank detail specification which has been completed as specified in 1.2 of this specification forms a detail specification. Such detail specifications may be used for the grant of Qualification approval and for the performance of Quality conformance inspection in accordance with an established quality assessment system (e.g. the IECQ-CECC system).

1.2 Information to be specified in the detail specification

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

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

The following information shall be specified in each detail specification and the values quoted shall preferably be selected from those given in the appropriate clause of this document.

a) Outline drawing	There shall be an illustration of the resistor as an aid to easy recognition and for comparison of the resistor with others. Dimensions and their associated tolerances, which affect interchangeability and mounting, shall be given in the detail specification.
b) Style and dimensions	See 2.1.1. The dimensions shall be given for the length and diameter of the body, using the provisions of IEC 60294, and for the diameter of the terminations. Where the configuration is other than cylindrical with axial terminations, the detail specification shall specify such dimensional information as will adequately describe the resistor. The free termination length should be given for appropriate tape packing. The mass of the products may be given for information.
c) Climatic category	See 2.1.2.
d) Limits of resistance change after testing	See 2.1.4.
e) Resistance range	See 2.2.1. NOTE 1 When products approved to the detail specification may have different ranges, the following statement should be added: “The range of values available in each style is given in the register of approvals, available e.g. on the website www.iecq.org.“
f) Tolerances on rated resistance	See 2.2.2. NOTE 2 When products approved to the detail specification may have different ranges, the following statement should be added: “The range of values available in each style is given in the register of approvals, available e.g. on the website www.iecq.org.“
g) Temperature coefficient of resistance	See 2.1.3. For preferred combinations of temperature coefficient and tolerance on rated resistance see 2.2.7.

h)	Rated dissipation at 70 °C	See 2.2.3. The mounting conditions are as described in 2.4.2. or 2.4.3 The detail specification shall state the maximum dissipation at temperatures other than 70 °C, e.g. the derating, either in a diagram or in the form of a statement. The category dissipation shall be zero. All break points shall be verified by tests.
i)	Limiting element voltage	See 2.2.4 and EN 60115-1, 2.2.16.
j)	Insulation voltage (insulated styles only)	See 2.2.6 and EN 60115-1, 2.2.17.
k)	Insulation resistance (insulated styles only)	See 2.2.5.
l)	Marking	The resistor shall be marked with the rated resistance according to EN 60062, Clause 3, and as many of the remaining items listed in EN 60115-1, 2.4.1. All the required information shall be marked on the package.
m)	Ordering information	The detail specification shall specify that the following information is required as a minimum when ordering resistors: – the number of the detail specification and style reference; – the rated resistance according to EN 60062; – the tolerance on rated resistance according to EN 60062; – the temperature coefficient of resistance according to EN 60062.

The detail specification may include additional information (which is not normally required to be verified by the inspection procedure), such as circuit diagrams, curves, drawings and notes needed for the clarification of the detail specification.

2 Preferred characteristics, ratings and severities for environmental and overload tests

2.1 Preferred characteristics

The values given in detail specifications shall preferably be selected from the following:

2.1.1 Style and dimensions

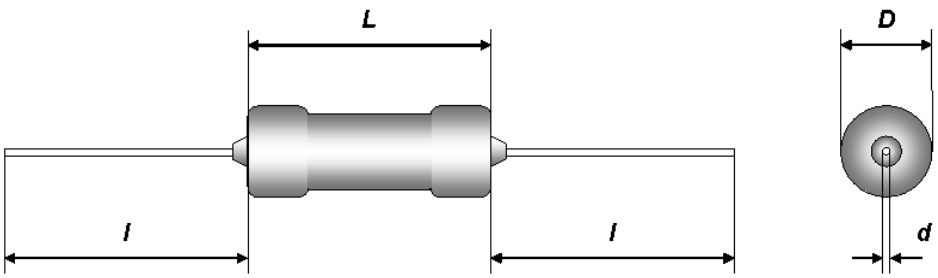

Figure 1 – Outline and dimensions

The preferred styles and dimensions are given in Table 1.

Table 1 – Preferred styles for film resistors

Style		Dimensions					
Code	Size [a]	Length *L* mm		Diameter *D* mm		*d* [b] mm	*l* [c] mm
		min.	max.	min.	max.		min.
A	0204	3,0	4,0	1,3	1,9	0,4 / 0,5	21
B	0207	5,0	6,5	2,0	2,5	0,6	21
C	0411	7,5	10,7	3,0	4,0	0,6 / 0,7	21
D	0414	10,0	12,0	3,6	4,1	0,8	21
E	0617	13,0	16,5	4,7	6,1	0,8	21

[a] For information only.
[b] Nominal diameter, permissible tolerance according to IEC 60301.
[c] Minimum length applies to the free lead length in tape packing according to EN 60286-1 only.

When protective coating is permitted to extend on the terminations, the permissible excess length shall be given in the detail specification.

2.1.2 Preferred climatic categories

The resistors covered by the document are classified into climatic categories according to the general rules given in EN 60068-1, Annex A.

The lower and upper category temperature shall be chosen from EN 60068-2-1 and EN 60068-2-2 respectively and should preferrably be selected from the lists below. The duration of the damp heat, steady state test shall be selected from the list below.

– Lower Category Temperature (LCT): -55 °C; -40 °C and -10 °C,

– Upper Category Temperature (UCT): +85 °C; +125 °C; +155 °C; +175 °C and +200 °C,

– duration of damp heat, steady state test: 10 days; 21 days; 56 days.

The severities for the climatic tests are ruled by the lower and upper category temperatures.

2.1.3 Temperature coefficients of resistance

The limits of resistance change due to variation of temperature within the range of defined category temperatures are given in Table 2.

Table 2 – Temperature coefficients and permitted change of resistance

Temperature coefficient			Limit of resistance change Δ*R*/*R* %							
ppm/K	Code		LCT / Reference temperature °C			Reference temperature / UCT °C				
	a	b	-55 / 20	-40 / 20	-10 / 20	20 / 85	20 / 125	20 / 155	20 / 175	20 / 200
± 1 000	W	A	± 7,5	± 6,0	± 3,0	± 6,5	± 10,5	± 13,5	± 15,5	± 18,0
± 500	V		± 3,75	± 3,0	± 1,5	± 3,25	± 5,25	± 6,75	± 7,75	± 9,0
± 250	U	A, V	± 1,875	± 1,5	± 0,75	± 1,625	± 2,625	± 3,375	± 3,875	± 4,5
± 100	S	B, K	± 0,750	± 0,6	± 0,30	± 0,650	± 1,050	± 1,350	± 1,550	± 1,8
± 50	R	C	± 0,375	± 0,3	± 0,15	± 0,325	± 0,525	± 0,675	± 0,775	± 0,9
± 25	Q	D, E	± 0,188	± 0,15	± 0,075	± 0,163	± 0,263	± 0,338	± 0,388	± 0,45
± 15	P	E, T	± 0,113	± 0,09	± 0,045	± 0,098	± 0,158	± 0,203	± 0,233	± 0,27
± 10	N		± 0,075	± 0,060	± 0,030	± 0,065	± 0,105	± 0,135	± 0,155	± 0,18
± 5	M		± 0,038	± 0,030	± 0,015	± 0,033	± 0,053	± 0,068	± 0,078	± 0,09
± 2	L		± 0,015	± 0,012	± 0,006	± 0,013	± 0,021	± 0,027	± 0,031	± 0,036
± 1	K		± 0,008	± 0,006	± 0,003	± 0,007	± 0,011	± 0,014	± 0,016	± 0,018

[a] Code letters according to EN 60062.

[b] Historical code letters used in CECC 40 101-xxx detail specifications, for information only.

If measurements are required at additional temperatures, these shall be specified in the detail specification.

If asymmetric temperature coefficients are required, the respective limits of resistance change shall be specified in the detail specification, with the code letter for the larger temperature coefficient value applied.

2.1.4 Limits of change of resistance

Tables 3a and 3b list preferred limits for resistance change for all tests listed in the heading. To classify the performance of resistors, they will be assigned to stability classes as listed below.

Table 3a – Limits for change of resistance at tests

Stability class	Limit of resistance change ΔR			
	EN 60115-1, 4.23 Climatic sequence 4.24 Damp heat, steady state 4.25.3 Endurance at upper category temperature	EN 60115-1, 4.25.1 Endurance at 70 °C		EN 60115-1, 4.13 Overload 4.16 Robustness of terminations 4.18 Resistance to soldering heat 4.19 Rapid change of temperature, 5 cycles 4.22 Vibration
		1 000 h	Extended, 8 000 h	
10	± (10 % R + 0,5 Ω)	± (10 % R + 0,5 Ω)	± (20 % R + 0,5 Ω)	± (2 % R + 0,1 Ω)
5	± (5 % R + 0,1 Ω)	± (5 % R + 0,1 Ω)	± (10 % R + 0,1 Ω)	± (1 % R + 0,05 Ω)
2	± (2 % R + 0,1 Ω)	± (2 % R + 0,1 Ω)	± (5 % R + 0,1 Ω)	± (0,5 % R + 0,05 Ω)
1	± (1 % R + 0,05 Ω)	± (1 % R + 0,05 Ω)	± (2 % R + 0,05 Ω)	± (0,25 % R + 0,05 Ω)
0,5	± (0,5 % R + 0,05 Ω)	± (0,5 % R + 0,05 Ω)	± (1 % R + 0,05 Ω)	± (0,1 % R + 0,01 Ω)
0,25	± (0,25 % R + 0,05 Ω)	± (0,25 % R + 0,05 Ω)	± (0,5 % R + 0,05 Ω)	± (0,05 % R + 0,01 Ω)
0,1	± (0,1 % R + 0,02 Ω)	± (0,1 % R + 0,02 Ω)	± (0,25 % R + 0,02 Ω)	± (0,05 % R + 0,01 Ω)
0,05	± (0,05 % R + 0,01 Ω)	± (0,05 % R + 0,01 Ω)	± (0,1 % R + 0,01 Ω)	± (0,025 % R + 0,01 Ω)

Table 3b - Limits for change of resistance at tests

Stability class	Limit of resistance change ΔR			
	EN 60115-1, 4.19 Rapid change of temperature, ≥ 100 cycles	EN 60115-1, 4.27 Single pulse high voltage overload test	EN 60115-1, 4.19 Periodic electric overload	EN 60115-1, 4.40 Electrostatic discharge [a]
10	± (1 % R + 0,05 Ω)	± (1 % R + 0,05 Ω)	± (2 % R + 0,05 Ω)	± (1 % R + 0,05 Ω)
5				
2				
1	± (0,5 % R + 0,05 Ω)	± (0,5 % R + 0,05 Ω)	± (1 % R + 0,05 Ω)	± (0,5 % R + 0,05 Ω)
0,5				
0,25	± (0,25 % R + 0,05 Ω)			
0,1				
0,05				

[a] Human Body Model (HBM) according to EN 61340-3-1, 3 positive + 3 negative discharges.

2.2 Preferred values of ratings

The following values are preferred values to be used in the detail specification.

2.2.1 Rated resistance

See EN 60115-1, 2.3.2. and 0 Ω (Jumper).

2.2.2 Tolerances on rated resistance

The preferred tolerances on rated resistance are:

± 10 %; ± 5 %; ± 2 %; ± 1 %; ± 0,5 %; ± 0,25 %; ± 0,1 %; ± 0,05 %; ± 0,02 % and ± 0,01 %.

For for 0 Ω resistors the preferred values for the maximum residual resistance are:

50 mΩ; 20 mΩ and 10 mΩ.

2.2.3 Rated dissipation (in the mounted state)

The preferred values of rated dissipation are:

0,063 W; 0,125 W; 0,25 W; 0,5 W; 1 W; 2 W and 3 W.

2.2.4 Limiting element voltage

The preferred values of limiting element voltage U_{max} d.c. or a.c. (r.m.s.) are:

50 V; 100 V; 200 V; 300 V; 500 V; 750 V and 1 000 V.

2.2.5 Insulation resistance (insulated styles only)

The insulation resistance shall be not less than 1 GΩ after dry heat tests and not less than 100 MΩ after climatic tests.

2.2.6 Insulation voltage (insulated styles only)

Unless otherwise specified in the detail specification the insulation voltage shall never be less than the peak voltage that can be applied continuously to the element; it shall therefore be not less than √2 times the limiting element voltage.

The preferred values of insulation voltage U_{ins} d.c. or a.c. (peak) are:

75 V; 150 V; 300 V; 500 V; 750 V; 1 100 V and 1 500 V.

2.2.7 Combinations of tolerance on rated resistance and temperature coefficient

The preferred combinations of tolerance on rated resistance and temperature coefficient are:

TC 250 / 5 %; TC 100 / 1 %; TC 50 / 1 %; TC 25 / 0,5 %; TC 25 / 0,1 %; TC 15 / 0,1 %.

NOTE TC 250 = ± 250 ppm/K.