BS EN 140402:2015

BSI Standards Publication

Blank Detail Specification: Fixed low power wirewound surface mount (SMD) resistors

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National foreword

This British Standard is the UK implementation of EN 140402:2015. It supersedes BS EN 140402:1998 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee EPL/40X, Capacitors and resistors for electronic equipment.

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

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Blank Detail Specification: Fixed low power wirewound surface mount (SMD) resistors

Spécification particulière cadre: Résistances fixes bobinées à faible dissipation pour montage en surface (CMS)

Vordruck für Bauartspezifikation: Oberflächenmontierbare drahtgewickelte Festwiderstände (SMD) niedriger Belastbarkeit

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Contents

Foreword

This document (EN 140402:2015) has been prepared by CLC/TC 40XB, "Resistors".

The following dates are fixed:

• latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2015-12-15
• latest date by which the national standards conflicting with this document have to be withdrawn	(dow)	2017-12-15

This document supersedes EN 140402:1998.

EN 140402:2015 includes the following significant technical changes with respect to EN 140402:1998:

– introduction of a test on the resistance to electrostatic discharge (ESD) in 1.7 and Annex A;

– introduction of code letters for the temperature coefficient (TCR) as in EN 60062:2005;

– revision of ordering information in 1.10.4;

– adoption of the IECQ rules of procedure according to QC 001002-3:2005;

– revision of the sample quantities and the sequence of tests in Annex A;

– editorial revision.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC [and/or CEN] shall not be held responsible for identifying any or all such patent rights.

This specification supports the building of a series of documents describing fixed low power wire wound surface mount (SMD) resistors as follows:

– EN 60115-1, *Fixed resistors for use in electronic equipment — Part 1: Generic specification (IEC 60115-1, modified)*

– EN 60115-8, *Fixed resistors for use in electronic equipment — Part 8: Sectional specification — Fixed surface mount resistors (IEC 60115-8, modified)*

– EN 140402-8xx, *Detail specification: Fixed low power wirewound surface mount (SMD) resistors — .....*

Any detail specification within this series is written on the basis of this blank detail specification.

———————

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. Detail specifications not complying with these requirements should not be considered as being in accordance with European Standards nor should they be so described.

In the preparation of the detail specification the content of EN 60115-8:2012, 1.4 should be taken into account.

The detail specification should be written by using the preferred values given in EN 60115-8.

The detail specification should contain a table of contents prior the first page of the actual specification. For the use of SI units refer to EN ISO 80000-1, for the use of letter symbols to be used in electrical technology, refer to EN 60027-1.

This Blank Detail Specification uses two different kinds of notes:

– NOTE for notes which give additional information intended to assist the understanding or use of the resulting document and therefore should be copied as NOTE into the drafted Detail Specification.

– NOTE (ed) for editorial notes which are intended to aid and direct the specification writer and therefore should not be copied into the drafted Detail Specification.

Identification of the detail specification and the component

The first page of the detail specification should have the layout recommended on page 6.

The numbers in square brackets correspond to the indications to be completed thereunder:

[1] the name of the Standardisation Organisation under whose authority the detail specification is published and if applicable, the organisation from whom the detail specification is available;

[2] the CECC symbol and the number allocated to the detail specification by the CENELEC General Secretariat;

[3] the number and issue number of the EN generic and sectional specification as relevant; also national reference if different;

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

[5] a brief description of the component or range of components;

[6] information on typical construction (where applicable);

[7] an outline drawing with the main dimensions which are of importance for interchangeability and/or reference to the appropriate national or international document for outlines. Alternatively, this drawing may be given in an annex to the detail specification;

[8] the level of quality assessment covered by the detail specification.

For [5] and [6] the text to be given in the detail specification should be suitable for an entry in a register of approvals and the “CENELEC Catalogue of European Standards”.

Specification available from: **[1]**	**EN 140402- . . .** (Specification number) **[2]**
Electronic components of assessed quality in accordance with: **[3]** EN 60115-1:2011 EN 60115-8:2012 EN 140402:2015	**Issue . . .** **[4]** April 2015
[7]	Fixed low power wire wound resistors **[5]**
	(Description of the component) **[6]**
	Assessment level EZ [a] **[8]** Level P: with 100 %-test Level R: with failure rate level and 100 %-test Stability classes . . .
Other shapes are permitted within the given dimensions. **Figure 1 — Outline and dimensions (see Table 1)**	
[a] See 2.1.1 for an explanation on the assessment level EZ.	

NOTE 1 (ed) Level R is optional.

NOTE 2 (ed) The title block shown above is not part of the specification's foreword or introduction and therefore needs to appear on top of a new page. The remainder of that page is intentionally left empty in order to start Clause 1 on top of the next page.

1 Characteristics and ratings

1.1 General

Various parameters of this component are precisely defined in this specification. Unspecified parameters may vary from one component to another.

1.2 Dimensions and ratings

The shape and dimensions of the resistors covered by this specification are shown in Figure 1, with the specific styles and their respective dimensions given in Table 1. Other shapes are permissible within the given dimensions.

Table 1 — Style and dimensions

Style [a]		**Length** L		**Width** W								**Mass** [a]
		mm		mm		mm		mm		mm		mg
metric	X [a]	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	max.

[a] For information only.

NOTE 1 (ed) Column X is optional for additional information (e.g. size code), which is for information only.

NOTE 2 (ed) See EN 60115-8:2012, 1.4.2.

NOTE 3 Information about manufacturers who have components qualified to this detail specification is available in the approvals section of the website http://www.iecq.org.

Table 2 — Ratings

Style	**Rated dissipation** P_{70} W	**X**	**Limiting element voltage d.c. or a.c. (r.m.s.)** U_{max} V	**Insulation voltage d.c. or a.c. (peak)** U_{ins} V	
				1 min	continuous

NOTE 4 (ed) Column X is an optional column for additional information, e.g. an additional maximum dissipation at another ambient temperature than 70 °C, hence e.g. at 25 °C or at 40 °C.

NOTE 5 (ed) See EN 60115-8:2012, 1.4.8, 1.4.9 and 1.4.10.

Should it be necessary to control further parameters, a more detailed specification should be used. Then the additional test method(s) shall be fully described and appropriate limits and inspection levels (IL) shall be specified.

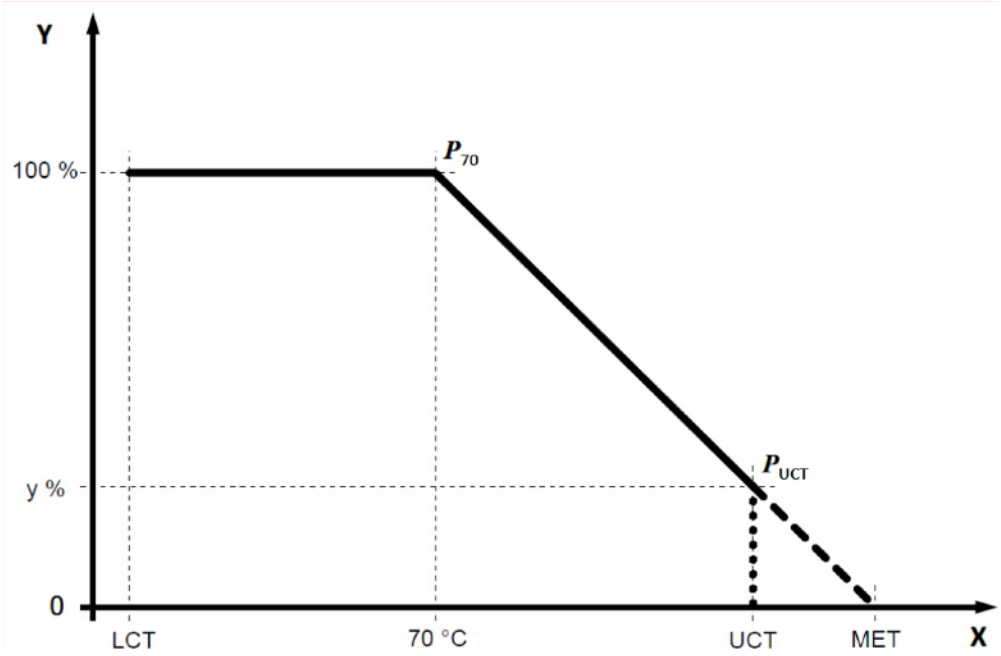
1.3 Derating curve

The permissible dissipation of resistors covered by this detail specification is the rated dissipation as given in Table 2, which is derated for an ambient temperature above the rated temperature 70 °C according to the diagram in Figure 2.

NOTE 1 (ed) See EN 60115-8:2012, 1.4.8.

NOTE 2 (ed) A larger area of operation may be given in the detail specification, provided it includes all the area given above. In such case the following paragraph applies.

The manufacturer of the resistors covered by this detail specification may uprate the products by specification of an increased dissipation up to the maximum dissipation given in Table 2, which is derated for an ambient temperature above the reference temperature of … according to the diagram in Figure 2. The manufacturer shall support such uprating with respective test results.



Key

X ambient temperature ϑ_{amb}

Y fraction of the rated dissipation P_{70}

Figure 2 — Derating curve

NOTE 3 Climatic tests and the assessment of the temperature coefficient of resistance apply the upper category temperature, UCT, as the highest temperature, whereas the loads applied under endurance testing aim to subject the resistive element to the maximum element temperature, MET.

NOTE 4 (ed) The following paragraph applies if the maximum element temperature is specified above 155 °C

The use of the full specified dissipation and temperature range results in a high temperature on the substrate (PCB) and in the solder joints. It may hence be required to select suitable substrate material and suitable solder material in order to maintain the reliability of the assembly.

1.4 Resistance range and tolerance on rated resistance

1.4.1 Level P

NOTE 1 Product classification to Level P adopts and succeeds the former Version A as used in prior revisions of this detail specification.

Table 3 gives the combinations of temperature coefficient, tolerance on resistance and resistance range which may be approved to Level P according to this detail specification. The respective E Series are specified as a recommendation only for Level P.

Products from the extent given in Table 3 shall be used for the initial product qualification approval to Level P according to 2.2.2, and for the quality conformance inspection according to 2.3.

The qualification of resistances below or above the specified resistance ranges is permissible if they fulfil the requirements of the stability class prescribed for the closest resistance within a specified range; e.g. resistors of Style RW0704M, 1 %, > 2,43 kΩ shall fulfil the requirements of stability class 1.

Table 3 — Resistance range and tolerance on rated resistance for Level P

Style	Tolerance on rated resistance		Temperature coefficient		Resistance range	Stability class	E Series [b]
	%	Code [a]	10^{-6}/K	Code [a]			

[a] Code letters according to EN 60062.

[b] E Series according to IEC 60063.

NOTE 2 (ed) Limits of the resistance ranges should only be values from an E Series, which is suitable for the considered tolerance.

NOTE 3 (ed) Information on the temperature coefficient may be given in Table 5, if it is distinctively linked with fixed resistance ranges and does not provide any ordering options.

The range of resistors approved in each style, together with the associated temperature coefficient and tolerance, shall be given in the register of approvals, as available for example on the website http://www.iecq.org.

1.4.2 Level R

NOTE 1 Product classification to Level R adopts and succeeds the former Version E as used in prior revisions of this detail specification.

Table 4 gives the combinations of temperature coefficient, tolerance on resistance, resistance range and mandatory E Series which may be approved to Level R according to this detail specification.

Products from the extent given in Table 4 shall be used for the initial product qualification approval to Level R according to 2.2.3, and for the quality conformance inspection according to 2.3.

Table 4 — Resistance range and tolerance on rated resistance for Level R

Style	Tolerance on rated resistance		Temperature coefficient		Resistance range	Stability class	E Series [b]
	%	Code [a]	10^{-6}/K	Code [a]			

[a] Code letters according to EN 60062.

[b] E Series according to IEC 60063.

NOTE 2 (ed) Subclause 1.4.2 with Table 4 is only required if the drafted Detail Specification includes Level R and should be a subset of Table 3.

NOTE 3 (ed) Information on the temperature coefficient may be given in Table 5, if it is distinctively linked with fixed resistance ranges and does not provide any ordering options.

The range of resistors approved in each style, together with the associated temperature coefficient and tolerance, shall be given in the register of approvals, as available for example on the website http://www.iecq.org.

1.5 Variation of resistance with temperature and temperature rise

The permissible limits for the reversible change of resistance at variation of resistance with temperature tests are given in Table 5 for the category temperatures applied in this detail specification.

Table 5 — Temperature coefficients and permissible change of resistance

Temperature coefficient			X	Limit of resistance change $\Delta R/R$ %	
				Lower TCR	Upper TCR
10^{-6}/K	Code [a]	Code [b]		LCT / Reference temperature	Reference temperature / UCT
				-55 °C / 20 °C	20 °C / 200 °C

[a] Code letters according to EN 60062.

[b] Historical code letters according to …. , for information only.

NOTE 1 (ed) The second code column with historical code references is optional.

NOTE 2 (ed) Column X is an optional column for resistance ranges, if the ranges are distinctively linked with temperature coefficients and this relationship does not provide any ordering options.

NOTE 3 (ed) See EN 60115-8:2012, 1.4.7.

The permissible temperature rise $(\Delta\vartheta)_{max}$ for the temperature rise test according to EN 60115-1:2011, 4.14 is given in Table 6.

Table 6 — Limit of temperature rise

Stability class	Limit of temperature rise at rated dissipation
	$\Delta\vartheta \leq \ldots$
	$\Delta\vartheta \leq \ldots$

The thermal resistance is calculated to $R_{th} = (\Delta\vartheta)_{max} / P_{70}$.

1.6 Climatic categories

The climatic categories applied in this detail specification are given in Table 7.

NOTE 1 (ed) See EN 60115-8:2012, 1.4.3.

Table 7 — Climatic categories

Stability class	Climatic category LCT / UCT / Duration
	… / … / …
	… / … / …

NOTE 2 (ed) The following paragraph applies if UCT is lower than MET.

The upper category temperature (UCT), which is used for a number of test procedures, is lower than the maximum element temperature (MET), which may be observed in application conditions.

1.7 Limits for change of resistance at tests

The permissible limits for the change of resistance at tests are given in Table 8 for the stability classes applied in this detail specification.

NOTE 1 (ed) See EN 60115-8:2012, 1.4.4.

Table 8 — Limits for change of resistance at tests

Stability class	Limit of resistance change ΔR Ω					
	Long term tests			Short term tests	Advanced stress tests	
	EN 60115-1:2011 4.23 Climatic sequence 4.24 Damp heat, steady state 4.25.3 Endurance at a maximum temperature	EN 60115-1:2011 4.25.1 Endurance at the rated temperature 70 °C [a] or 4.25.2 Endurance at room temperature		EN 60115-1:2011 4.13 Short time overload 4.18 Resistance to soldering heat 4.19 Rapid change of temperature, 5 cycles 4.21 Shock 4.22 Vibration 4.33 Substrate bending test	EN 60115-1:2011 4.19 Rapid change of temperature, ≥ 100 cycles 4.27 Single-pulse high-voltage overload test 4.38 Electrostatic discharge [b]	EN 60115-1:2011 4.39 Periodic-pulse overload test
		1 000 h	Extended, 8 000 h			

[a] Testing endurance at the rated temperature 70 °C is mandatory for Level R.

[b] Human body model (HBM) according to EN 61340-3-1, 3 positive + 3 negative discharges.

NOTE 2 (ed) The number of cycles for the rapid change of temperature test, ≥ 100 cycles, should preferably be 1 000.

NOTE 3 (ed) The tests 4.19 (≥ 100 cycles), 4.27, 4.38 and 4.39 may be separated or grouped according to the individual suitable stability requirements..

1.8 Non-linearity

No Provisions.

NOTE Measurement of non-linearity is generally not considered as a meaningful or significant test for wirewound resistors.

1.9 Tests related to soldering

1.9.1 Severities for solderability testing

See EN 60115-8:2012, 2.3.2.

1.9.2 Severities for testing resistance to soldering heat

See EN 60115-8:2012, 2.3.3.

The solder bath method represents the soldering stress of all wave soldering and reflow soldering methods.

1.10 Marking, packaging and ordering designation

NOTE (ed) The marking of components and packaging shall be in accordance with the requirements of EN 60115-1:2011, 2.4 and EN 60115-8:2012, 1.4.12 and 1.4.13.

1.10.1 Marking of the component

SMD wirewound resistors are generally marked on the body. If some marking is applied to the body of resistors classified to Level P, the component shall be marked with the rated resistance using a letter and digit code according to EN 60062:2005, Clause 4, preferably the RKMG code system according to EN 60062:2005, 4.2.1. If possible, the tolerance shall be marked using the letter code of EN 60062:2005, 5.1.

Resistor classified to Level R shall be marked with the rated resistance using the RKMG code system according to EN 60062:2005, 4.2.1, and with the tolerance using the letter code of EN 60062:2005, 5.1.

Marking of the temperature coefficient and of any other item from the list given in EN 60115-1:2011, 2.4.1 shall be the choice of the manufacturer.

1.10.2 Packaging

Components shall be taped according to EN 60286-3, type 2a.

1.10.3 Marking of the packaging

The packaging of the component shall be marked with the ordering information in accordance to 1.10.4 and additionally with:

– CECC or IECQ sign of conformity,
– CECC or IECQ manufacturer code,
– NATO manufacturer code (only Level R),
– date code of manufacture according to EN 60062.

Additional information is permissible.

1.10.4 Ordering information

Orders for resistors covered by this specification shall contain the following information:

– detail specification number;
– assessment level;

– style;
– temperature coefficient;
– rated resistance;
– tolerance on rated resistance;
– failure rate level (only for Level R; “E0” for Level P);
– form of delivery (in addition to the ordering information given in the schematic below).

Schematic of the ordering information for resistors covered by this specification:

Level P:	EN140402–8xxEZRWxxxxMQ4K75FE0
Level R (with failure rate level):	EN140402–8xxEZRWxxxxMQ4K75FE5

NOTE 1 Level P succeeds the former Version A, and Level R succeeds the former Version E.

NOTE 2 (ed) Provisions for the ordering information of Level R are required only if the drafted detail specification includes Level R.

The elements used in this ordering information have the following meaning:

EN140402–8xx	Detail specification number
EZ	Assessment level
RWxxxxM	Style (see Table 1)
Q	Temperature coefficient according to EN 60062 (see Table 5)
4K75	Resistance value, RKMG code system according to EN 60062, 4 characters
F	Tolerance on rated resistance (see Table 3 or Table 4)
E0; E5	Failure rate level according to EN 60115-1:2011, Table ZR.1

NOTE 3 The specific values for style, temperature coefficient, resistance, tolerance and failure rate level applied above have been used to exemplify the schematic and hence need to be replaced by the user’s relevant choices.

The ordering information used for electronic order processing shall not contain any spaces.

1.11 Additional information (not for inspection purpose)

NOTE (ed) The detail specification may include information (which is not required to be verified by the inspection procedure) for the clarification of the detail specification. The information below should be given in the detail specification as a minimum.

1.11.1 Storage

The permitted storage time is 20 years under the conditions of EN 60115-1:2011, 2.7.

Solderability and resistance may be affected by storage. Therefore test of solderability and measurement of resistance are recommended before delivery if the storage time exceeds two years.

1.11.2 Mounting

The resistors are suitable for mounting on alumina substrates, common printed boards and flexible foils.

NOTE (ed) The following paragraph applies if the maximum element temperature is specified above 155 °C.

Temperatures next to the resistor resulting from use of the full specified dissipation and temperature range may exceed the specification limits of the substrate material and thus are likely to affect the reliability of the assembly. It may hence be required to select a suitable substrate material in order to maintain the reliability of the assembly.

1.11.3 Soldering process

The resistors are suitable for all soldering methods according to EN 61760-1.

This includes full compatibility with

– lead free solder, e.g. SnCu, SnCuNi, SnAg or SnAgCu,
– conventional SnPb solder.

The immersion time shall not exceed 10 s when the components are immersed in a solder of 260 °C.

NOTE (ed) The following paragraph applies if the maximum element temperature is specified above 155 °C.

Temperatures in the solder joints resulting from use of the full specified dissipation and temperature range may exceed the specification limits of the above solder materials and thus are likely to affect the reliability of the assembly. It may hence be required to select a suitable solder material, e.g. a PbSn alloy with a higher melting point, in order to maintain the reliability of the assembly. However, solderability with PbSn alloys and resistance to the increased level of soldering heat required for such solder is not subject to any test prescribed within this specification.

It is recommended to only use fluxes which do not require a cleaning process after soldering. Flux residues may be hard to remove, particularly from the space between the resistor and the circuit board or substrate. Flux residues may establish some conductivity in parallel to the assembled resistor and thereby adversely affect the performance of the electronic circuit.

1.11.4 Conductive gluing

NOTE (ed) This clause is optional.

1.11.5 Use of cleaning solvents

For the removal of flux residues the following agents may be used:

– alcohol, such as ethanol, propanol, isopropanol (IPA) or butanol;
– aqueous solutions;
– deionized water.

Reaction time of the solvent shall not exceed 5 min.

Consultation with the resistor manufacturer is recommended if the use of other cleansing agents is intended.

1.11.6 Pulse load capability

NOTE (ed) This clause is optional.

1.11.7 Variation of resistance (drift) for lifetimes up to 200 000 h

NOTE (ed) This clause is optional.

1.11.8 Dissipation notes

NOTE (ed) This clause is optional.

2 Quality assessment procedures

NOTE (ed) See also EN 60115-1:2011, Annex Q and EN 60115-8:2012, Clause 3.

2.1 General

2.1.1 Zero defect approach

This specification fulfils the requirements of the zero defect approach. Assessment level EZ meets the requirements of the zero defect approach and aligns the assessment procedures and levels with the

current industry practices, e.g. by setting the number of permitted non-conformities (acceptance number) to zero.

The sampling plans and inspection levels for assessment level EZ shall be selected from those given in EN 61193-2, except for those elements of the test schedule which are based on fixed sample sizes, irrespective of the size of the lot being inspected.

2.1.2 100 % Test

2.1.2.1 General

All resistors according to this specification are subject to a 100 % test during the manufacturing process. The following tests shall be performed:

2.1.2.2 Resistance and tolerance

Resistance and tolerance on rated resistance shall be measured according to EN 60115-1:2011, 4.5.

This test shall be followed by re-inspection by sampling in order to monitor the outgoing quality level. The sampling level shall be established by the manufacturer, preferably according to EN 61193-2:2007, Annex A. All non-conforming units shall be counted for the assessment of a quality level.

A lot shall not be released if one or more non-conforming units occur in the sample.

2.1.2.3 Reduction of early-failure rate

The following screening method shall be applied in order to reduce the early-failure rate of the resistors covered by this specification:

– overload test according to the manufacturer's specification; where the specification and limits are agreed by the IECQ Certification Body.

NOTE Measurement of non-linearity is generally not considered as a meaningful or significant test for wirewound resistors, hence also does not constitute a suitable means for a screening method.

2.1.3 Certificate of Conformity (CoC)

The conformity is declared by marking the packaging in accordance to the relevant system rules if components are qualified to this specification by a certification body of a quality assessment system (e.g. IECQ, successor of CECC).

An additional Certificate of Conformity is not required for qualified components.

2.1.4 Certified test records

Certified test records according to EN 60115-1:2011, Q.1.5 can be supplied if agreed between the customer and the manufacturer.

2.1.5 Failure rate level

Components qualified according to this detail specification, Level R, shall be delivered with a failure rate level:

Failure rate level = E5 or E6 or E7 or E8.

Components qualified according to this detail specification, Level P, shall be delivered without a failure rate level:

Failure rate level = E0.

The procedure according to EN 60115-1:2011, Annex ZR shall be applied for the determination and qualification of the failure rate level and for the evaluation of the quality factor (π_Q).

2.2 Qualification approval

2.2.1 General

The fixed sample size procedure (see EN 60115-1:2011, Q.2) shall be used for the qualification approval. The qualification is to be performed according to Annex A.

2.2.2 Level P

NOTE Product classification to Level P adopts the former Version A as used in prior revisions of this specification.

The qualification approval for Level P shall be granted after successful completion of 1 000 h of the test Endurance at 70 °C and all other tests of Annex A.

2.2.3 Level R

NOTE Product classification to Level R adopts the former Version E as used in prior revisions of this specification.

The qualification approval for Level R, failure rate level E5 shall be granted after successful completion of 1 000 h of the test Endurance at 70 °C and all other tests of Annex A.

Thereafter, the qualification approval for Level R, failure rate level E6 shall be granted after successful completion of 8 000 h of the test Endurance at 70 °C.

The qualification approval for Level R shall be withdrawn, if the 8 000 h test is not completed successfully.

2.3 Quality conformance inspection

2.3.1 General

The quality of the components according to this detail specification is monitored using one of the following quality evaluation procedures.

The Certificate of Approval shall state which quality evaluation procedures is used by the manufacturer.

2.3.2 Qualification approval according to QC 001002-3:2005, Clause 3

For quality conformance inspection the test schedule shown in Annex A includes provisions for periodicity, sampling and requirements. Inspection lots shall be formed according to EN 60115-8:2012, 3.3.

2.3.3 Technology approval according to QC 001002-3:2005, Clause 6

If the manufacturer is certified according to a published Technology Approval Schedule, the following modifications and amendments apply to the lot-by-lot tests of Annex A:

The tests of groups A and B may be performed during the production process according to the established Technology approval declaration document (TADD) of the manufacturer if equivalence of test results is confirmed by the IECQ Certification Body (IECQ CB).

The manufacturer's TADD shall specify

- type and degree of non-conformity on which the IECQ CB shall be informed by the Designated Management Representative (DMR) and permissible protraction period for this information,
- conditions for the withdrawal of the Technology Approval,

– corrective actions for non-conformities.

As required by the Technology Approval Schedule, test results shall be continuously documented.

NOTE At the date of publication of this specification, there is no published Technology Approval Schedule known to cover the range of wirewound resistors.

2.3.4 Non-conforming items

All tests of a sub-group shall be repeated on a new sample if one non-conforming item is obtained during Quality conformance inspection tests. Then no non-conforming items are permitted. Release of product may continue during repeat testing.

For mounted specimen, any specimen found defective after mounting shall not be taken into account when calculating the permissible non-performing items for the succeeding tests. They shall be replaced by spare parts.

Annex A
(normative)

Fixed sample size Qualification Approval and Quality Conformance Inspection test schedule for fixed low power wire wound SMD resistors

Table A.1 — Test schedule for qualification approval and quality conformance inspection, lot-by-lot tests, assessment level EZ (1 of 3)

ASSESSMENT LEVEL EZ, ACCEPTANCE NUMBER c = 0				**Qualification Approval**		**Quality Conformance Inspection** (Lot-by-lot tests)		
Tests [a]		**Conditions of test**	**D or ND** [b]	n [b]	c [b]	**IL** [b]	c [b]	**Performance requirements** [a]
				Group 1		**Group A1**		
4.5	Resistance		ND	260 / 355 [c]	0	100 % (see 2.1.2)		As in 4.5.2
				Group 2		**Group A2**		
4.4.1	Visual examination [d]	Marking, if applicable	ND	260 / 355 [c]	0	S-4 / II [c]	0	As in 4.4.1
4.4.2	Dimensions (gauging) [d]	A calliper shall be used		(20 of the sample)		S-4	0	As in Table 1
				Group 3		**Group B1**		
4.6	Insulation resistance	See EN 60115-1:2011, 4.6.1.4,	ND	50	0			$R \geq 1$ GΩ
4.7	Voltage proof	See EN 60115-1:2011, 4.6.1.4 Voltage: $U = 1{,}42 \cdot U_{\text{ins}}$ Duration: 1 min				S-3	0	As in 4.7.3

Table A.1 (2 of 3)

Tests [a]	Conditions of test	D or ND [b]	Qualification Approval		Quality Conformance Inspection (Lot-by-lot tests)		Performance requirements [a]
			n [b]	c [b]	IL [b]	c [b]	
			Group 3 *(continued)*		**Group B1** *(continued)*		
4.13 Short time overload	See EN 60115-8:2012, 2.3.1; mounting: see Annex D, or unmounted. Voltage: $U = \sqrt{6{,}25 \cdot P_{70} \cdot R}$ or $U = 2 \cdot U_{max}$, whichever is the less severe **Style** / **Duration**: … / …; … / … Visual examination Resistance	D	(20 of the sample)				As in 4.13.3 As in Table 8
			Group 4		**Group B2**		
		D	40	0		0	
4.17. Solderability with SnPb solder	See EN 60115-8:2012, 2.3.2 Ageing 4 h at 155 °C, dry heat; Method 1: Solder bath Solder: Sn60Pb40; (235 ± 5) °C, (2 ± 0,2) s Visual examination		(half of the sample)		S-3		As in 4.17.3, > 95 % of the surface shall be covered by new solder

Table A.1 (3 of 3)

Tests [a]	Conditions of test	D or ND [b]	Qualification Approval		Quality Conformance Inspection (Lot-by-lot tests)		Performance requirements [a]
			n [b]	*c* [b]	IL [b]	*c* [b]	
			Group 4 *(continued)*		**Group B2** *(continued)*		
4.17. Solderability with lead-free solder [e]	See EN 60115-8:2012, 2.3.2 Ageing 4 h at 155 °C, dry heat Method 1: Solder bath Solder: Sn96,5Ag3Cu0,5; (245 ± 5) °C, (3 ± 0,3) s or Solder: Sn99,3Cu0,7; (250 ± 5) °C, (3 ± 0,3) s Visual examination		(the other half of the sample)		S-3		As in 4.17.3, > 95 % of the surface shall be covered by new solder
			Group 5		**Group B3**		
4.8 Variation of resistance with temperature	Mounting: see Annex D, or unmounted 20 °C / LCT / 20 °C / UCT / 20 °C Resistance	D	20	0			As in Table 5
4.8 Variation of resistance with temperature (applicable only to resistors with a temperature coefficient superior to ± 50 10^{-6}/K)	Mounting: see Annex D, or unmounted 20 °C / LCT / 20 °C / UCT / 20 °C Resistance	D			S-3	0	As in Table 5

[a] Clause numbers in this column refer to EN 60115-1:2011.
[b] Refer to B.1 for a list of letter symbols and to B.2 for a list abbreviations.
[c] First figure is sample size for Level P; second figure is sample size for Level R.
[d] For quality conformance inspection this tests may be replaced by in-production testing if the manufacturer installs SPC on dimensional measurements or other mechanisms to avoid parts exceeding limits.
[e] This test is not applicable if the relevant detail specification explicitly excludes compatibility of the components covered therein with any lead-free soldering process.

Table A.2 – Test schedule for qualification approval and quality conformance inspection, periodic tests, assessment level EZ (1 of 7)

Tests [a]	Conditions of test	D or ND [b]	Qualification Approval		Quality Conformance Inspection			Performance requirements [a]
					Periodic tests			
			n [b]	c [b]	p [b]	n [b]	c [b]	
			Group 6		Group C1			
		D	20	0	3	20	0	
4.33 Substrate bending test	See EN 60115-8:2012, 2.3.10; mounting: see Annex D Depth of bend 2 mm, 3 times Visual examination Resistance		(half of the sample)			(half of the sample)		Electrical continuity. No open circuits when the board is in the bent position of the last bend. As in 4.33.4 As in Table 8
4.19 Rapid change of temperature	Mounting: see Annex D ϑ_A = LCT, ϑ_B = UCT (see Table 7); 5 cycles Visual examination Resistance		(the other half of the sample)			(the other half of the sample)		As in 4.19.3 As in Table 8
4.21 Shock	See EN 60115-8:2012, 2.3.4 Acceleration : 500 m/s^2 Pulse duration : 11 ms Waveform : Half sine, Number of shocks: 3 successive shocks in each direction of the three axes (total 18 shocks) Visual examination Resistance							As in 4.21.5 As in Table 8

Table A.2 (2 of 7)

Tests [a]	Conditions of test	D or ND [b]	Qualification Approval		Quality Conformance Inspection			Performance requirements [a]
					Periodic tests			
			n [b]	c [b]	p [b]	n [b]	c [b]	
			Group 6 (*continued*)		**Group C1** (*continued*)			
4.22 Vibration	See EN 60115-8:2012, 2.3.5; mounting: see Annex D Endurance by sweeping Frequency range: 10 Hz to 2 000 Hz ; Amplitude: 1,5 mm or 200 m/s², whichever is the less severe; 10 sweep cycles in each axis Visual examination Resistance							 As in 4.22.4 As in Table 8
4.23 Climatic sequence - Dry heat - Damp heat, cyclic - Cold - Low air pressure - Damp heat, cyclic - D.C. load - Final measurements	Mounting: see Annex D 16 h at UCT (see Table 7) 1 cycle, raising to (55 ± 2) °C 2 h at LCT (see Table 7) 1 h / 1 kPa at +15 °C to +35 °C … cycles, raising to (55 ± 2) °C Voltage: $U = \sqrt{P_{70} \cdot R}$ or $U = U_{max}$, whichever is the less severe; 1 min Visual examination Resistance Insulation resistance		(all of the sample)			(all of the sample)		 As in 4.23.8 As in Table 8 $R_{ins} \geq 100$ MΩ

Table A.2 (3 of 7)

Tests [a]	Conditions of test	D or ND [b]	Qualification Approval		Quality Conformance Inspection			Performance requirements [a]
					Periodic tests			
			n [b]	c [b]	p [b]	n [b]	c [b]	
			Group 7		Group C2			
4.25.1 Endurance at the rated temperature 70 °C (mandatory for resistors categorized as Level R)	Mounting: see Annex D Voltage: $U = \sqrt{P_{70} \cdot R}$ or $U = U_{max}$ whichever is the less severe; 1,5 h on and 0,5 h off; duration 1 000 h Visual examination Resistance Insulation resistance	D	20 / 115 [c]	0	3	20	0	As in 4.25.1.7 As in Table 8 $R_{ins} \geq 1$ GΩ
4.25.1.8 Extended endurance at the rated temperature 70 °C	Duration extended to 8 000 h once a year Resistance				12	20		As in Table 8
Or 4.25.2 Endurance at room temperature (applicable only to resistors categorized as Level P, if agreed between manufacturer and Certification Body)	Mounting: see Annex D Voltage: $U = \sqrt{P_{Test} \cdot R}$ with P_{Test} calculated according to 4.25.2.4, or $U = U_{max}$, whichever is the less severe; 1,5 h on and 0,5 h off; duration 1 000 h Visual examination Resistance Insulation resistance				3	20	0	As in 4.25.1.7 As in Table 8 $R_{ins} \geq 1$ GΩ
4.25.2.8 Extended endurance at room temperature	Duration extended to 8 000 h once a year Resistance				12	20		As in Table 8

Table A.2 (4 of 7)

Tests [a]	Conditions of test	D or ND [b]	Qualification Approval		Quality Conformance Inspection			Performance requirements [a]
					Periodic tests			
			n [b]	c [b]	p [b]	n [b]	c [b]	
			Group 8		**Group C3**			
4.18 Resistance to soldering heat	See EN 60115-8:2012, 2.3.3 Solder bath method; (260 ± 5) °C, (10 ± 1) s Visual examination Resistance	D	20	0	3	20	0	 As in 4.18.3 As in Table 8
4.35 Flammability	Needle flame test of EN 60695-11-5 Duration of flame application, t_a = 10 s Duration of burning		(5 of the sample)		36	(5 of the sample)		 $t_b \leq 30$ s
					Group D1			
4.8 Variation of resistance with temperature (applicable only for resistors with a temperature coefficient of ± 50 10^{-6}/K or inferior)	Mounting: see Annex D, or unmounted 20 °C / LCT / 20 °C / UCT / 20 °C Resistance	D			12	20	0	 As in Table 5
			Group 9		**Group D2**			
4.24 Damp heat, steady state	Mounting: see Annex D, or unmounted Temperature: (40 ± 2) °C Relative humidity: (93 ± 3) % Duration: 56 d Visual examination Resistance Insulation resistance	D	20	0	12	20	0	 As in 4.24.4 As in Table 8 $R_{ins} \geq 100$ MΩ

Table A.2 (5 of 7)

Tests [a]	Conditions of test	D or ND [b]	Qualification Approval		Quality Conformance Inspection			Performance requirements [a]
					Periodic tests			
			n [b]	c [b]	p [b]	n [b]	c [b]	
			Group 10		**Group D3**			
4.4.3 Dimensions (detail)		D	20	0	36	20	0	As in Table 1
4.25.3 Endurance at a maximum temperature	see Annex D Temperature: UCT = 200 °C Category dissipation: P_{UCT} = …. x P_{70} Duration: 1 000 h Visual examination Resistance Insulation resistance							As in 4.25.3.7 As in Table 8 $R_{ins} \geq 1$ GΩ
4.14 Temperature rise (applicable only to resistors below the critical resistance)	Mounting: see Annex D Temperature rise		(6 of the sample)			(6 of the sample)		As in Table 6
			Group 11		**Group E1**			
4.38 Electrostatic discharge	See EN 60115-8:1012, 2.3.11; mounting: see Annex D, or unmounted. Human body model (HBM) of EN 61340-3-1, 3 pos. and 3 neg. discharges **Style** / **Voltage U_d**: … / …; … / … Visual examination Resistance	D	20	0	12	20	0	As in 4.38.4 As in Table 8

Table A.2 (6 of 7)

Tests [a]	Conditions of test	D or ND [b]	Qualification Approval		Quality Conformance Inspection			Performance requirements [a]
					Periodic tests			
			n [b]	*c* [b]	*p* [b]	*n* [b]	*c* [b]	
			Group 11 *(continued)*			**Group E1** *(continued)*		
4.29 Component solvent resistance	See EN 60115-8:2012, 2.3.7; mounting: see Annex D, or unmounted. Method 2; solvent: IPA; temperature: (50 – 5) °C Visual examination		(half of the sample)			(half of the sample)		As in 4.4.1
4.30 Solvent resistance of marking (applicable only to marked resistor)	See EN 60115-8:2012, 2.3.8; mounting: see Annex D, or unmounted Method 1, rubbing device: tooth brush; solvent: IPA; temperature: (50 – 5) °C Visual examination		(the other half of the sample)			(the other half of the sample)		As in 4.4.1
			Group 12					
4.22 Vibration	See EN 60115-8:2012, 2.3.5; mounting: see Annex D Endurance by sweeping Frequency range: 10 Hz to 2 000 Hz ; Amplitude: 1,5 mm or 200 m/s², whichever is the less severe; 10 sweep cycles in each axis Visual examination Resistance	D	20	0				As in 4.22.4 As in Table 8

Table A.2 (7 of 7)

Tests [a]		Conditions of test	D or ND [b]	Qualification Approval		Quality Conformance Inspection			Performance requirements [a]
						Periodic tests			
				n [b]	c [b]	p [b]	n [b]	c [b]	
				Group 12 *(continued)*					
4.39	Periodic-pulse overload test	See EN 60115-8:2012, 2.3.12; mounting: see Annex D Voltage: $U = \sqrt{15 \cdot P_{70} \cdot R}$ or $U = 2 \cdot U_{max}$, whichever is the less severe; 0,1 s on and 2,5 s off; 1 000 cycles Visual examination Resistance							As in 4.37.4 As in Table 8
				Group 13		**Group F**			
4.19	Rapid change of temperature	Mounting: see Annex D, or unmounted ϑ_A = LCT; ϑ_B = UCT; see Table 7 Style: … Cycles: … Visual examination Resistance	D	20	0	36	20	0	As in 4.19.3 As in Table 8
				Group 14		**Group G**			
4.27	Single-pulse high-voltage overload test (applicable only to resistors of 10 Ω or above)	See EN 60115-8:2012, 2.3.6; mounting: see Annex D, or unmounted Severity No. … (10/700) Visual examination Resistance	D	20	0	12	20	0	As in 4.27.3.7 As in Table 8

[a] Clause numbers in this column refer to EN 60115-1:2011.

[b] Refer to B.1 for a list of letter symbols and to B.2 for a list abbreviations.

[c] The first figure is the sample size for Level P; the second figure is the sample size for Level R.

Annex B
(informative)

Letter symbols and abbreviations

B.1 Letter symbols

c	Permitted number of non-conformances per group, group acceptance criterion	1
n	Sample size	1
p	Periodicity	month^{-1}
P	Actual dissipation	W
P_{70}	Rated dissipation at 70 °C ambient temperature	W
P_{UCT}	Category dissipation at the upper category temperature	W
P_{Test}	Relevant dissipation for the endurance at room temperature test	W
P_{ϑ}	Permissible dissipation at ambient temperature ϑ, derated above 70 °C	W
R	Resistance	Ω
R_{ins}	Insulation resistance	Ω
R_r	Rated resistance	Ω
ΔR	Change of resistance	Ω
$\Delta R/R$	Relative change of resistance (Resistance change related to prior resistance)	%
ϑ_{amb}	Ambient temperature	°C
ϑ_A	Low temperature of a change of temperature test	°C
ϑ_B	High temperature of a change of temperature test	°C
ϑ_s	Surface temperature	°C
t_a	Duration of application of test flame	s
t_b	Duration of burning after removal of test flame	s
$\Delta\vartheta$	Temperature rise	K
U_d	Discharge voltage	V
U_{ins}	Insulation voltage	V
U_{max}	Limiting element voltage, maximum permissible voltage	V
U_r	Rated voltage, $U_r = \sqrt{P_{70} \cdot R}$	V

B.2 Abbreviations

CB	Certification body
CoC	Certificate of Conformity
D	Destructive
DMR	Designated management representative (Quality system manager)
ESD	Electrostatic discharge
HBM	Human body model, representation of the capacitance and resistance of a human body for ESD testing
IECQ CB	IECQ Certification Body
IL	Inspection level
IPA	Isopropyl alcohol, Isopropanol (CAS Registry Number: 67-63-0)
LCT	Lower category temperature
MET	Maximum element temperature
ND	Non-destructive
NSI	National supervising inspectorate
	NOTE 1 IECQ 01, IEC Quality Assessment System for Electronic Components (IECQ Scheme) – Basic Rules, has implemented in its 2007-12 revision a change of the term Supervising Inspectorate to IECQ Certification Body (IECQ CB).
ONS	Organisme National de Surveillance, National supervising inspectorate
	NOTE 2 This term has been used in specifications prior to using the term National Supervising Inspectorate (NSI).
RKMG code system	Coding system for resistance values, where the SI prefix indicating the decimal multiple of the unit Ohm is used to replace the decimal sign.
	NOTE 3 The code characters R, K, M, G are written in upper case, even though the SI prefix for kilo (10^3) is a lower case k.
	NOTE 4 The RKMG code system is not prescribed to provide a code of fixed length. However, trailing zeroes can be used to fill to a fixed length, if required.
RW	Resistor, Wirewound (SMD)
TA	Technology approval
TADD	Technology approval declaration document
TAS	Technology approval schedule
TCR	Temperature coefficient of resistance
UCT	Upper category temperature

Annex C
(normative)

Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 60062:2005 + Corrigendum 2007, *Marking codes for resistors and capacitors (IEC 60062:2004)*

EN 60115-1:2011, *Fixed resistors for use in electronic equipment — Part 1: Generic specification (IEC 60115-1:2008, modified)*

EN 60115-8:2012, *Fixed resistors for use in electronic equipment — Part 8: Sectional specification — Fixed surface mount resistors (IEC 60115-8:2009, modified)*

EN 60286-3, *Packaging of components for automatic handling — Part 3: Packaging of surface mount components on continuous tapes (IEC 60286-3)*

EN 60695-11-5*, Fire hazard testing — Part 11-5: Test flames — Needle-flame test method — Apparatus, confirmatory test arrangement and guidance (IEC 60695-11-5)*

EN 61193-2:2007, *Quality assessment systems — Part 2: Selection and use of sampling plans for inspection of electronic components and packages (IEC 61193-2:2007)*

EN 61340-3-1, *Electrostatics — Part 3-1: Methods for simulation of electrostatic effects — Human body model (HBM) electrostatic discharge test waveforms (IEC 61340-3-1)*

EN 61760-1, *Surface mounting technology — Part 1: Standard method for the specification of surface mounting components (SMDs) (IEC 61760-1)*

IEC 60063*, Preferred number series for resistors and capacitors*

IEC QC 001002-3:2005, *IEC Quality Assessment System for Electronic Components (IECQ) - Rules of Procedure - Part 3: Approval procedures*

Bibliography

EN 60027-1, *Letter symbols to be used in electrical technology — Part 1: General (IEC 60027-1)*

EN 60068-1, *Environmental testing — Part 1: General and guidance (IEC 60068-1)*

EN 60068-2-1, *Environmental testing — Part 2-1: Tests - Test A: Cold (IEC 60068-2-1)*

EN 60068-2-2, *Environmental testing — Part 2-2: Tests - Test B: Dry heat (IEC 60068-2-2)*

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

EN 60068-2-13, *Environmental testing — Part 2: Tests - Test M: Low air pressure (IEC 60068-2-13)*

EN 60068-2-14, *Environmental testing — Part 2: Tests - Test N: Change of temperature (IEC 60068-2-14)*

EN 60068-2-20, *Environmental testing — Part 2-20: Tests - Test T: Test methods for solderability and resistance to soldering heat of devices with leads (IEC 60068-2-20)*

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

EN 60068-2-27, *Environmental testing — Part 2: Tests — Test Ea and guidance: Shock (IEC 60068-2-27)*

EN 60068-2-30, *Environmental testing — Part 2-30: Tests — Test Db: Damp heat, cyclic (12 h + 12 h cycle) (IEC 60068-2-30)*

EN 60068-2-45, *Environmental testing — Part 2: Tests —Test Xa and guidance: Immersion in cleaning solvents (IEC 60068-2-45)*

EN 60068-2-58, *Environmental testing — Part 2-58: Tests — Test Td: Test methods for solderability, resistance to dissolution of metallization and to soldering heat of surface mounting devices (SMD) (IEC 60068-2-58)*

EN 60068-2-78, *Environmental testing — Part 2-78, Test Cab: Damp heat, steady state (IEC 60068-2-78)*

EN 80000 (all parts), *Quantities and units*

EN ISO 80000 (all parts), *Quantities and units*

IECQ 01, *IEC quality assessment system for electronic components (IECQ system) — Basic rules*

http://certificates.iecq.org, internet access to the public area of the IECQ On-Line Certificate System

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