



DPC: 25 / 30509708 DC

BSI Group Headquarters

389 Chiswick High Road London W4 4AL

Tel: +44 (0)20 8996 9000

Fax: +44 (0)20 8996 7400

www.bsigroup.com

Date: 07 February 2025

Origin: International

Latest date for receipt of comments: 26 February 2025

Project No. 2025/00380

Responsible committee: W/- Miscellaneous Standards

Interested committees:

Title: Draft BS EN 60115-4-20 ED1 Fixed resistors for use in electronic equipment

Part 4-20: Blank detail specification Power resistors with axial leads for through-hole assembly on circuit boards (THT), for high performance electronic equipment, classification level P, and/or for high-performance high-reliable electronic equipment,

Please notify the secretary if you are aware of any keywords that might assist in classifying or identifying the standard or if the content of this standard

- i) has any issues related to 3rd party IPR, patent or copyright
- ii) affects other national standard(s)
- iii) requires additional national guidance or information

**WARNING: THIS IS A DRAFT AND MUST NOT BE REGARDED OR USED AS A BRITISH STANDARD.
THIS DRAFT IS NOT CURRENT BEYOND 26 February 2025**

This draft is issued to allow comments from interested parties; all comments will be given consideration prior to publication. No acknowledgement will normally be sent. **See overleaf for information on the submission of comments.**

No copying is allowed, in any form, without prior written permission from BSI except as permitted under the Copyright, Designs and Patent Act 1988 or for circulation within a nominating organization for briefing purposes. Electronic circulation is limited to dissemination by e-mail within such an organization by committee members.

Further copies of this draft may be purchased from BSI Shop <http://shop.bsigroup.com> or from BSI Customer Services, Tel: +44(0) 20 8996 9001 or email cservices@bsigroup.com. British, International and foreign standards are also available from BSI Customer Services.

Information on the co-operating organizations represented on the committees referenced above may be obtained from <http://standardsdevelopment.bsigroup.com>

Introduction

This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

For national standards, comments will be reviewed by the relevant UK national committee and the resulting standards published as a British Standard.

UK Vote

Please indicate whether you consider the UK should submit a negative (with supporting technical reasons) or positive vote on this draft. Please indicate if you are aware of any reason why this draft standard should not be published as a British Standard.

Submission of Comments

- **Annotated drafts are not acceptable and will be rejected.**
- All comments should be submitted online at <https://standardsdevelopment.bsigroup.com/>. You will need to register in order to comment.

Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
------------------	------------------------

1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/Figure/ Table/Note	Type of comment	Commend (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	



40/3207/CD

COMMITTEE DRAFT (CD)

PROJECT NUMBER:
IEC 60115-4-20 ED1

DATE OF CIRCULATION:
2025-01-31

CLOSING DATE FOR COMMENTS:
2025-03-28

SUPERSEDES DOCUMENTS:
40/3136/NP, 40/3165A/RVN

IEC TC 40 : CAPACITORS AND RESISTORS FOR ELECTRONIC EQUIPMENT	
SECRETARIAT: Netherlands	SECRETARY: Mr Ronald Drenthen
OF INTEREST TO THE FOLLOWING COMMITTEES:	HORIZONTAL FUNCTION(S):
ASPECTS CONCERNED:	

This document is still under study and subject to change. It should not be used for reference purposes.

Recipients of this document are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

Recipients of this document are invited to submit, with their comments, notification of any local regulations or technical reasons that may exist and should be considered should this proposal proceed, recognizing that failure to address such requirements could result in the need for new or existing "In Some Countries" clauses. (SEE [AC/22/2007](#) OR [NEW GUIDANCE DOC](#)).

TITLE:

Fixed resistors for use in electronic equipment - Part 4-20: Blank detail specification: Power resistors with axial leads for through-hole assembly on circuit boards (THT), for high performance electronic equipment, classification level P, and/or for high-performance high-reliable electronic equipment, classification level R

NOTE FROM TC/SC OFFICERS:

Copyright © 2025 International Electrotechnical Commission, IEC. All rights reserved. It is permitted to download this electronic file, to make a copy and to print out the content for the sole purpose of preparing National Committee positions. You may not copy or "mirror" the file or printed version of the document, or any part of it, for any other purpose without permission in writing from IEC.

CONTENTS

1		
2		
3	FOREWORD	5
4	1 Scope	10
5	2 Normative references	11
6	3 Terms and definitions	12
7	4 Characteristics and ratings	12
8	4.1 General	12
9	4.2 Dimensions	12
10	4.3 Ratings	14
11	4.4 Resistance range and tolerance on resistance	16
12	5 Tests and test severities	17
13	5.1 General	17
14	5.2 Resistance	17
15	5.3 Temperature coefficient of resistance	17
16	5.4 Temperature rise	18
17	5.5 Endurance	18
18	5.6 Endurance at a maximum temperature: UCT	18
19	5.7 Short-term overload	18
20	5.8 Single-pulse high-voltage overload test	19
21	5.9 Periodic-pulse high-voltage overload test	19
22	5.10 Electrostatic discharge (ESD) test	20
23	5.11 Visual examination	20
24	5.12 Gauging of dimensions	20
25	5.13 Detail dimensions	20
26	5.14 Robustness of terminations	21
27	5.15 Vibration	21
28	5.16 Rapid change of temperature	21
29	5.17 Rapid change of temperature, ≥ 100 cycles	21
30	5.18 Climatic sequence	21
31	5.19 Damp heat, steady state	22
32	5.20 Solderability, with lead-free solder	22
33	5.21 Solderability, with SnPb solder	23
34	5.22 Resistance to soldering heat	23
35	5.23 Solvent resistance	23
36	5.24 Insulation resistance	23
37	5.25 Voltage proof	23
38	5.26 Flammability	23
39	6 Performance requirements	24
40	6.1 General	24
41	6.2 Limits for change of resistance at tests	24
42	6.3 Temperature coefficient of resistance	26
43	6.4 Temperature rise	26
44	6.5 Visual examination	26
45	6.6 Solderability	27
46	6.7 Insulation resistance	27
47	6.8 Flammability	28

48	6.9	Non-linearity	28
49	7	Marking, packaging and ordering information	28
50	7.1	Marking of the component	28
51	7.2	Packaging	29
52	7.3	Marking of the packaging	29
53	7.4	Ordering information	29
54	8	Additional information	29
55	8.1	General	29
56	8.2	Storage and Transportation	30
57	8.3	Substrate for assembly	30
58	8.4	Soldering process	30
59	8.5	Use of cleaning agents or solvents	30
60	8.6	Coating or potting after assembly	31
61	9	Quality assessment procedures	31
62	9.1	General	31
63	9.2	Qualification approval	32
64	9.3	Maintenance of a qualification approval	32
65	9.4	Sample size for assessment of a failure rate level	33
66	Annex A (normative)	Symbols and abbreviated terms	47
67	A.1	Symbols	47
68	A.2	Abbreviated terms	49
69	Annex B (normative)	Reference for visual examination	50
70	Annex C (informative)	Application note on	51
71		Bibliography	52
72			
73	Figure 1	– Outline and dimensions	12
74	Figure 2	– Lead eccentricity of the wire terminations	14
75	Figure 3	– Length of excessive coating on the wire terminations	14
76	Figure 4	– Derating curve for power resistors	15
77	Figure 5	– 3 rd harmonic ratio requirement $A_{3 \text{ min}}$	28
78			
79	Table 1	– Styles and dimensions	13
80	Table 2	– Climatic categories	14
81	Table 3	– Ratings	15
82	Table 4	– Temperature coefficients, tolerances and resistance ranges of products classified to level P, for climatic category ... / ... /	16
83	Table 5	– Temperature coefficients, tolerances and resistance ranges of products classified to level R, for climatic category ... / ... /	17
84	Table 6	– Short-term overload duration	19
85	Table 7	– Pulse voltage factors for the single-pulse high-voltage overload test	19
86	Table 8	– Pulse voltage factors for the periodic-pulse high-voltage overload test	20
87	Table 9	– ESD test voltages	20
88	Table 10	– Number of temperature cycles of the rapid change of temperature test	21
89	Table 11	– Additional cycles of the damp heat, cyclic test	22
90	Table 12	– Damp heat, steady state test duration	22
91	Table 13	– Limits for change of resistance at tests	23
92			
93			

94	Table 14 – Permitted change of resistance due to the variation of temperature	26
95	Table 15 – Required sample size for qualification of a failure rate level	34
96	Table 16 – Sample size for maintenance of a failure rate level based on a 60 %	
97	statistical confidence level	35
98	Table 17 – Sample size for maintenance of a failure rate level based on a 10 %	
99	statistical confidence level	35
100	Table 18 – Test schedule for the qualification approval of power resistors (1 of 5)	36
101	Table 19 – Test schedule for quality conformance inspection of power resistors (1 of 5)	41
102		
103		

INTERNATIONAL ELECTROTECHNICAL COMMISSION

FIXED RESISTORS FOR USE IN ELECTRONIC EQUIPMENT –**Part 4-20: Blank detail specification:
Power resistors with axial leads
for through-hole assembly on circuit boards (THT),
for high-performance electronic equipment, classification level P,
and/or for high-performance high-reliable electronic equipment,
classification level R**

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

IEC 60115-4-20 has been prepared by IEC technical committee 40: Capacitors and resistors for electronic equipment. It is an International Standard

The text of this International Standard is based on the following documents:

FDIS	Report on voting
40/XXXX/CDV	40/XXXX/RVD

154 Full information on the voting for the approval of this International Standard can be found in the
155 report on voting indicated in the above table.

156 The language used for the development of this International Standard is English

157 A list of all parts in the IEC 60115 series, published under the general title *Fixed resistors for*
158 *use in electronic equipment*, can be found on the IEC website.

159 This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in
160 accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available
161 at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are
162 described in greater detail at www.iec.ch/publications

163 The committee has decided that the contents of this document will remain unchanged until the
164 stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to
165 the specific document. At this date, the document will be

- 166 • reconfirmed,
- 167 • withdrawn,
- 168 • replaced by a revised edition, or
- 169 • amended.

170

0 Introduction to the template provided by this blank detail specification

COMMENT This introduction is not intended to be copied into the drafted detail specification. Therefore, it is positioned in front of the conventional document structure and clause numbering range. It nevertheless contains normative requirements to the drafted detail specification.

0.1 Scope of this blank detail specification

This part of IEC 60115-4 is applicable to the drafting of detail specifications for power resistors with leads, classified to level P or to levels P and R, based on the definitions of the product classification levels in IEC 60115-1:2020, 3.4.

Another part of IEC 60115-4 provides a separate blank detail specification for the drafting of detail specifications for power resistors with axial leads, classified to level G.

Yet other parts of IEC 60115-4 may be issued to provide blank detail specifications for the drafting of detail specifications for power resistors with axial leads, of other technologies or of other classification levels.

0.2 Function of this blank detail specification

A blank detail specification is a supplementary document to the sectional specification and contains requirements for style, layout and minimum contents of detail specifications. Detail specifications not complying with these requirements shall not be accepted as being in accordance with IEC specifications nor shall they be described as such.

Detail specifications complying with the requirements of this blank detail specification are a legitimate basis for the quality assessment of leaded fixed power resistors under an adequate quality assessment system, e.g. the IEC Quality Assessment System for Electronic Components (IECQ System), whereas the plain blank detail specification is not a suitable basis.

The detail specification should contain a table of contents prior the first page of the actual specification.

In the preparation of the detail specification, the content of IEC 60115-4:2022, 8.2 shall be taken into account. The detail specification should be written by using the preferred values given in IEC 60115-4.

Units, graphical symbols and letter symbols shall, whenever possible, be taken from those prescribed by the following standards:

- IEC 60027-1, *Letter symbols to be used in electrical technology – Part 1: General*
- IEC 60617, *Graphical symbols for diagrams*
- IEC 80000 (all parts), *Quantities and units*
- ISO 80000 (all parts), *Quantities and units*

This blank detail specification uses for its purpose 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 shall be copied as NOTE into the drafted detail specification. As outlined in the ISO/IEC directives, these notes shall not contain any requirement, instruction, recommendation or permission.
- COMMENT For editorial notes which are intended to aid and direct the specification writer and therefore shall not be copied into the drafted detail specification. In order to accomplish their function, editorial notes require the use of instructions, recommendations and permissions addressed to the writer of the detail specification.

0.3 Identification of the detail specification and the resistor

The first page of the detail specification should have a layout starting with a title block as recommended on the following page.

The numbers in square brackets are editorial references, which are not intended to be copied into the drafted detail specification, and which correspond to the following information on the contents which shall be inserted in the indicated fields.

- [1] The name of the standardisation organisation under whose authority the detail specification is published and, if applicable, the organization from whom the detail specification is available.
- [2] The number allocated to the detail specification by the IEC or by the responsible standardisation organisation, together with the date of issue and issue number, as applicable. Further reference details required by the responsible standardisation organisation or quality assessment system may be given here, including an established mark of conformity, as applicable.
- [3] The number and issue date and number, as applicable, of the relevant generic specification, sectional specification and blank detail specification, where the referenced issues shall be the most recent issues of the respective specifications.
- [4] The title of the detail specification, providing a short description of the type of resistors. This entry should support the discrimination between similar specifications and should be suitable for an entry in a register of approvals or in a catalogue of standards. It may duplicate information given in fields [6] and [7] and in the textual scope in Clause 1.
- [5] An outline drawing or illustration of the products. This entry should aid the easy recognition of the specified resistors and, if possible, support the discrimination between similar specifications. It may duplicate information given in Figure 1.
- [6] Information on the typical construction of the resistors (where applicable), information of the specified resistors being insulated or non-insulated (see IEC 60115-1:2020, 3.1.7), and information on compatibility with a specific soldering process (if applicable, see 8.4). This entry may duplicate information given in the textual scope in Clause 1.
- [7] The classification level(s) of the resistors covered by this detail specification, the level of quality assessment (Assessment level EZ), and the general level of stability requirements at performance tests (Stability class). This information may duplicate information given in the textual scope in Clause 1.
- [8] Optional field for table notes.
- [9] Statement(s) about the availability of information on components qualified to this detail specification, if applied within a full quality assessment system.

Example for the use within the IECQ system:

Information about components qualified to this detail specification is available in the approvals section of the website <http://www.iecq.org>.

[10]

Specification available from: [1]	IEC 60115-4-20xx: 20yy [2]
Electronic components of assessed quality in accordance with: Generic specification: IEC 60115-1:2020 [3] Sectional specification: IEC 60115-4:2022 Blank detail specification: IEC 60115-4-20:202X	
FIXED RESISTORS FOR USE IN ELECTRONIC EQUIPMENT – Part 4-20xx: Detail specification: Power resistors with axial leads for through-hole assembly on circuit boards (THT), ..., for high-performance electronic equipment, — classification level P, and/or for high-performance high-reliable electronic equipment — classification level R [4]	
[5]	Technology ... [6] Insulated / Non-insulated Termination plating ...
	Product classification level P; and/or Product classification level R with assessed failure rate level Assessment level EZ [7] Stability classes ...
[8]	

256 COMMENT 1 The title of the drafted detail specification, given in field [4] and in some other places, may be modified
 257 in order to reflect the actually applied product classification level(s).

258 COMMENT 2 The designation of product classification levels in field [7] may be modified in order to reflect the
 259 actually applied product classification level(s).

260 COMMENT 3 The remainder of this page is intentionally left empty in order to start Clause 1 on top of the next
 261 page..

262

263 Information about components qualified to this detail specification is available

264 [9]

265

266

FIXED RESISTORS FOR USE IN ELECTRONIC EQUIPMENT –

Part 4-20: Detail specification:

Power resistors with axial leads

for through-hole assembly on circuit boards (THT),

...,

for high-performance electronic equipment, classification level P, and/or for high-performance high-reliable electronic equipment, classification level R

COMMENT The above title without the introductory word “blank” is to become the title of the intended detail specification, which is drafted on the basis of this blank detail specification. Also, the actual title of the intended detail specification should hold some wording descriptive for the particular kind of components covered therein, where indicated by “...”, in order to support the differentiation between parallel detail specification on the same level. An example for such descriptive wording would be: rectangular shape, stability classes 0,1; 0,25. The statement on the applied classification level(s) should be modified as required by the intended detail specification.

1 Scope

COMMENT 1 The text of this clause may repeat information already given in some fields of the above title block. Essential information on the special type of components covered by the drafted detail specification may be added, preferably at the place marked with “...”.

This detail specification specifies the characteristics and ratings of power resistors with leads for use in electronic equipment, which are typically assembled in through-hole technology (THT) on circuit boards.

...

The resistors covered herein are classified to level P or to levels P and R.

Classification level P is defined in IEC 60115-1:2020, 3.4 for high-performance electronic equipment, typically operated under harsh environmental conditions, typically built for an extended lifetime, where uninterrupted performance is desired or mandatory. Examples for level P include professional equipment, telecommunication transmission systems, industrial control and measurement systems and most automotive applications operated outside the passenger compartment.

Classification level R is defined in IEC 60115-1:2020, 3.4 for high-performance and high-reliable electronic equipment, with the same operating conditions and requirements as given for level P, with the additional requirement for established reliability and a formally assessed failure rate level. Examples for Level R include military and defense equipment, avionics and aerospace applications.

This detail specification is based upon the blank detail specification IEC 60115-4-20:202X.

This detail specification establishes test schedules and performance requirements permitting the quality assessment of the resistors covered herein according to the quality assessment procedures prescribed by IEC 60115-1:2020, Annex Q.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

IEC 60062, *Marking codes for resistors and capacitors*

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

IEC 60115-1:2020, *Fixed resistors for use in electronic equipment – Part 1: Generic specification*

IEC 60115-2:2023, *Fixed resistors for use in electronic equipment – Part 2: Sectional specification – Low-power film resistors with leads for through-hole assembly on circuit boards (THT)*

IEC 60115-4:2022, *Fixed resistors for use in electronic equipment – Part 4: Sectional specification – Power resistors for through-hole assembly on circuit boards (THT) or for assembly on chassis*

IEC 60115-4-20:202X, *Fixed resistors for use in electronic equipment – Part 4-20: Blank detail specification – Power resistors with axial leads for through-hole assembly on circuit boards (THT), for high-performance and high-reliable electronic equipment, classification levels P and R*

IEC 60286-1, *Packaging of components for automatic handling – Part 1: Tape packaging of components with axial leads on continuous tapes*

IEC 60286-2, *Packaging of components for automatic handling – Part 2: Tape packaging of components with unidirectional leads on continuous tapes*

IEC 60294, *Measurement of the dimensions of a cylindrical component with axial terminations*

IEC 60301, *Preferred diameters of wire terminations of capacitors and resistors*

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

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

...

COMMENT 1 The above list of normative references provides an example and needs to be adapted to the actual requirements of the drafted detail specification.

COMMENT 2 According to the ISO/IEC directives, dated references are required when reference is made to a specific part of the referenced standard and generally should be applied only in such cases.

COMMENT 3 It is recommended to update any dated references to the most recent revision of the referenced standard when drafting a detail specification. This involves updating of the dated normative references within the text of the drafted detail specification.

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60115-1 and in IEC 60115-4, as well as the following, apply.

COMMENT Any terms and their respective definitions specifically required for the scope of the drafted detail specification may be inserted in the space marked with "...", using the prescribed numbering and format. Otherwise, the above statement should be reduced to "For the purposes of this document, the terms and definitions given in IEC 60115-1 and in IEC 60115-4 apply." if no further terms or definitions are required in the drafted detail specification.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

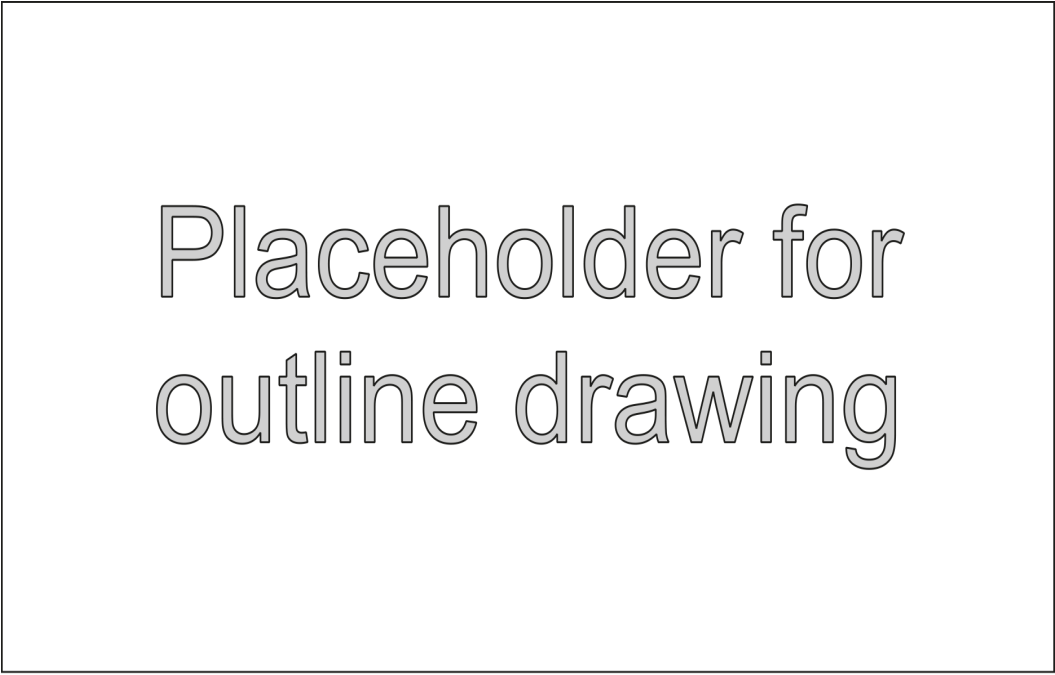
4 Characteristics and ratings

4.1 General

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

4.2 Dimensions

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.

A large rectangular box with a thin black border. Inside the box, the text "Placeholder for outline drawing" is centered in a large, light gray, sans-serif font. The text is arranged in two lines: "Placeholder for" on the top line and "outline drawing" on the bottom line.

Placeholder for
outline drawing

IEC

Figure 1 – Outline and dimensions

COMMENT 1 See IEC 60115-4:2022, 8.2.1.

COMMENT 2 The details shown in Figure 1 may repeat information already given in some fields of the title block above. Figure 1 in particular needs to define all dimensions intended to be verified by measurements, which generally includes those dimensions to be prescribed in Table 1.

Table 1 – Styles and dimensions

Style		Dimensions					Mass ^f
Metric	X ^a	D^b mm	L^c mm	d^d mm	Y	$l_{\min}^e$ mm	m mg

^a Historical style code, for information only.
^b The body diameter of the resistor D shall be gauged as prescribed in IEC 60294, see IEC 60115-4:2022, 5.3.11.
^c The body length of the resistor L shall be gauged and measured according to IEC 60294, see IEC 60115-4:2022, 5.3.11 and 5.3.12, respectively.
^d Nominal diameter of the lead wires d , with permissible tolerances according to IEC 60301.
^e The minimum lead length $l_{\min}$ for products in tape packaging according to IEC 60286-1 applies to the length of the free sections of lead wire between the resistor body and each tape. For untapped resistors it applies to the length of each lead wire.
^f For information only.

COMMENT 3 See IEC 60115-4:2022, 8.2.2.

COMMENT 4 The metric style designation is the normative designation used in all other places throughout this detail specification, see IEC 60115-4:2022, 4.2.1. Column X is an optional column for additional style information, e.g. for traditional alphabetic designations, which generally need to be marked with a respective footnote, e.g. as "Historical style code, for information only".

COMMENT 5 The dimensions for body diameter D , body length L , lead wire diameter d and minimum free lead length $l_{\min}$ are given as example based on the requirements for axial leaded resistors with cylindrical body and need to correspond to the dimensions identified in Figure 1. The choice of prescribed dimensions needs to be adapted to the actual requirements of the drafted detail specification and the shape of products covered therein. The dimensions may be given in the format of nominal values plus tolerance, or by stating permissible minimum and maximum values. Columns for additional dimensions may be inserted as required.

COMMENT 6 Column Y represents one or more optional column(s) for the prescription of an additional dimension, e.g. the permissible lead eccentricity and/or the permissible length of excessive coating on the leads, as required.

COMMENT 7 The prescribed minimum lead length should take account of the variety of inside tape spacing prescribed as dimension B by IEC 60286-1, plus the permissible window for the lateral resistor body location, given there as dimension K .

COMMENT 8 The component mass is not intended to be verified by an inspection procedure. It should be given as the maximum mass of a single component and should be marked with a respective footnote as "For information only".

The wire terminations of the resistor shall emerge concentrically from the end faces of the resistor body, see IEC 60115-4:2022, 4.2.1 with Figure 6. The real eccentricity e , as shown in below Figure 2, shall not exceed the limit given in Table 1. For gauging of the lead eccentricity, the effective eccentricity e' should be used, see IEC 60115-4:2022, 4.2.1.4.

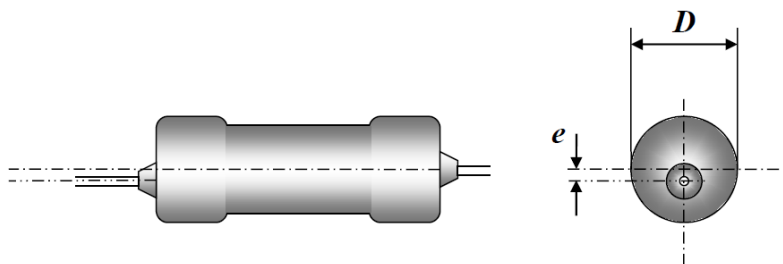


Figure 2 – Lead eccentricity of the wire terminations

COMMENT 9 The above paragraph and figure are optional and given as an example for the specification of a permissible lead eccentricity. If this specification is used in the drafted detail specification, a suitable method for gauging and/or measuring of the lead eccentricity needs to be described, e.g. in the respective subclauses of Clause 5. Alternatively, the deletion of this paragraph and figure will result in the need to update the numbering of subsequent figures accordingly.

The resistor shall be properly coated in order to provide a suitable protection against mechanical, electrical and climatic influences, e.g. by means of a conformal lacquer coating. It is typical for such coating to also cover the end faces of the resistor body, which can lead for some amount of excessive coating to spread onto the leads, see IEC 60115-4:2022, 4.2.1.2 with Figure 7. The length of excessive coating c , as shown in below Figure 3, shall not exceed the limit given in Table 1.

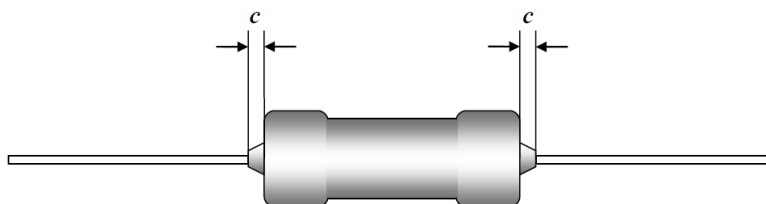


Figure 3 – Length of excessive coating on the wire terminations

COMMENT 10 The above paragraph and figure are optional and given as an example for the specification of a permissible length of excessive coating on the wire terminations. If this specification is used in the drafted detail specification, a suitable method for gauging and/or measuring of the length of excessive coating needs to be described, e.g. in the respective subclauses of Clause 5. Alternatively, the deletion of this paragraph and figure will result in the need to update the numbering of subsequent figures accordingly.

4.3 Ratings

The climatic categories applied in this detail specification are given in Table 2.

Table 2 – Climatic categories

Climatic category
LCT / UCT / duration
... / ... / ...
... / ... / ...

COMMENT 1 See IEC 60115-4:2022, 8.2.3.

COMMENT 2 Table 2 may be amended with a column showing the key parameter to which different climatic categories are allocated for the purpose of discrimination, e.g. the applied stability classes.

The upper category temperature (UCT), which is used for test procedures, should be limited to 200 °C, based on the maximum element temperature (MET), see IEC 60115-4:2022, 1 Scope.

Table 3 – Ratings

Style	Rated dissipation P_{70} W	X	Limiting element voltage DC or AC r.m.s. $U_{\max}$ V	Insulation voltage DC or AC peak U_{ins} V

NOTE For insulated resistors, the insulation voltage U_{ins} is verified with a test duration of one minute. However, long-term insulation properties can be affected by the influence of moisture, organic material and electrical field across the insulating layer(s).

COMMENT 3 See IEC 60115-4:2022, 8.2.6, 8.2.7 and 8.2.8.

COMMENT 4 Column X is an optional column for additional information, e.g. an additional rated dissipation at another ambient temperature than the rated temperature 70 °C. Such information should however only be presented, if it is a traditionally well-established information.

COMMENT 5 The insulation voltage shall not be specified lower than the peak value of the AC voltage that can be applied continuously to the resistors and therefore shall not be rated less than $U_{\text{ins}} = 1,42 \times U_{\max}$. The insulation voltage is not an applicable rating for non-insulated resistors, therefore the entry in this column shall be "n/a" and the note of Table 3 shall be omitted in detail specifications drafted for non-insulated resistors.

COMMENT 6 Different sets of ratings may be assigned to variations of another parameter, e.g. climatic categories or stability classes. Then such different sets of ratings should be given in separate tables which need to be clearly assigned to the relevant parameter(s). According to the ISO/IEC directives, such duplicate tables need to be titled with subsequent numbers as required, which will result in the need to update the numbering of subsequent tables accordingly.

The permissible dissipation of resistors covered by this detail specification is the rated dissipation as given in Table 3, which is derated for an ambient temperature above the rated temperature 70 °C according to the diagram in Figure 4.

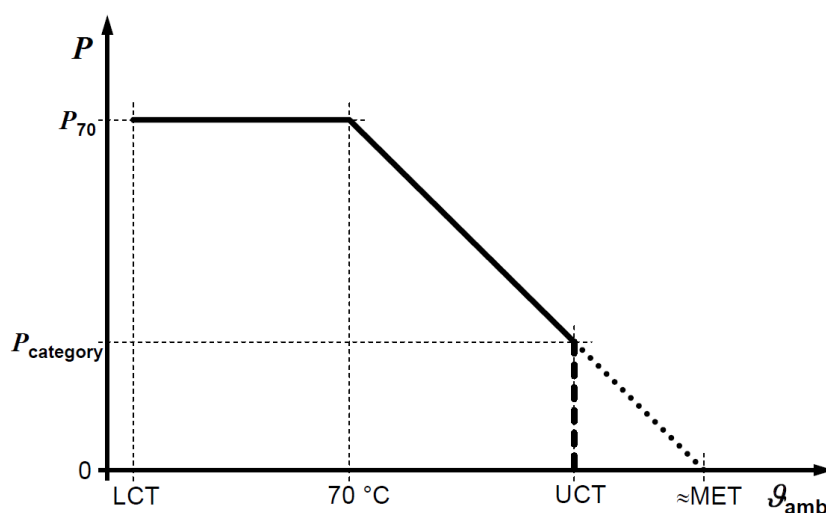


Figure 4 – Derating curve for power resistors

COMMENT 7 See IEC 60115-4:2022, 8.2.6.

COMMENT 8 The scale of derated dissipation may be given as absolute value in Watt or relative in percent as a fraction of the rated dissipation P_{70} .

COMMENT 9 A larger area of operation or permissible temperature rise may be given by the detail specification, provided it includes all the area given in Figure 4.