IEC 60115-4-10

Edition 1.0 2023-12

INTERNATIONAL STANDARD

Fixed resistors for use in electronic equipment – Part 4-10: Blank detail specification: Power resistors with axial leads for through-hole assembly on circuit boards (THT), for general electronic equipment, classification level G

IEC 60115-4-10:2023-12(en)

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FIXED RESISTORS FOR USE IN ELECTRONIC EQUIPMENT –

Part 4-10: Blank detail specification: Power resistors with axial leads for through-hole assembly on circuit boards (THT), for general electronic equipment, classification level G

FOREWORD

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IEC 60115-4-10 has been prepared by IEC technical committee 40: Capacitors and resistors for electronic equipment. It is an International Standard.

This first edition cancels and replaces IEC 60115-4-1:1983. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) it employs the product classification based on application requirements as defined in the generic specification IEC 60115-1:2020;

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b) it permits the specification additional dimensional requirements concerning the eccentricity of termination wires and the coating extending onto wires;

c) it provides for a tabulated presentation of resistance ranges in relationship to the temperature coefficient and the tolerance;

d) it supports solderability testing for both, traditional lead-bearing soldering and up-to-date lead-free soldering, as required;

e) it introduces a test for the specimens' robustness to electrostatic discharge if required;

f) it introduces a test for the specimens' resistance to solvents if required;

g) it introduces a test for the flammability of the specimens if required;

h) it employs consistent stability requirements grouped in stability classes;

i) it supports the provision of detailed visual acceptance criteria

j) it includes the requirement for a visual inspection of the primary and proximity packaging;

k) it provides the correlated test schedules for a qualification approval and for subsequent quality conformance inspections side by side;

l) it employs quality assessment procedures which meet the requirements of a zero-defect approach, which evades the use of historic AQL levels and the permission of non-conforming specimens in test groups;

m) it provides for the inclusion of specific visual acceptance criteria, to be applied in addition to those given in Annex B of the sectional specification IEC 60115-4:2022;

n) furthermore, it employs a new document structure, for which a transition guidance is provided in Annex X.

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

Draft	Report on voting
40/3039/CDV	40/3078/RVC

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

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

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

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

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

- reconfirmed,
- withdrawn, or
- revised.

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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 fixed power resistors with leads, classified to level G, which is defined in IEC 60115-1:2020, 3.4 for general electronic equipment.

Another part of IEC 60115-4 provides separate blank detail specifications for the drafting of detail specifications for fixed power resistors with leads, classified to level P and/or to level R.

Yet other parts of IEC 60115-4 may be issued to provide blank detail specifications for the drafting of detail specifications for vertical or radial fixed power resistors 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 to 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 specified 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.

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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 positions.

[1] The name of the standardization organization 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 standardization organization, together with the date of issue and issue number, as applicable. Further reference details required by the responsible standardization organization 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 8.3). This entry may duplicate information given in the textual scope in Clause 1.

[7] The classification level 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.

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Specification available from: [1]	**IEC 60115-4-10XX: 20YY** [2]
Electronic components of assessed quality in accordance with: Generic Specification: IEC 60115-1:2020 Sectional Specification: IEC 60115-4:2022 Blanc Detail Specification: IEC 60115-4-10:2023 [3]	
FIXED RESISTORS FOR USE IN ELECTRONIC EQUIPMENT – **Part 4-10XX: Detail specification:** **Power resistors with axial leads for through-hole assembly on circuit boards (THT), for general electronic equipment – classification level G** [4]	
Outline drawing [5]	Technology info Insulated / non-insulated [6]
	Product classification level G Assessment level EZ [7] Stability classes …
[8]	

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

Information about components qualified to this detail specification is available ….. [9]

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FIXED RESISTORS FOR USE IN ELECTRONIC EQUIPMENT –

Part 4-10: Blank detail specification: Power resistors with axial leads for through-hole assembly on circuit boards (THT), for general electronic equipment, classification level G

1 Scope

COMMENT 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 fixed power resistors with axial leads for through hole assembly (THT) on circuit boards ...

...

The resistors covered herein are classified to level G, as defined in IEC 60115-1:2020, 3.4 for general electronic equipment, typically operated under benign or moderate environmental conditions, where the major requirement is function. Examples for level G include consumer products and telecommunication user terminals.

This detail specification is based upon the blank detail specification IEC 60115-4-10:2023.

This detail specification establishes test schedules and performance requirements permitting the quality assessment of the resistors covered herein according to the quality assessment procedures specified 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 60115-4:2022, *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 60115-4-10:2023, *Fixed resistors for use in electronic equipment – Part 4-10: Blank detail specification: Power resistors with axial leads for through-hole assembly on circuit boards (THT), for general electronic equipment, classification level G*

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

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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, indicated by the space marked with "…", which however does not preclude from sorting in proper numerical order.

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 specified 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 terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at https://www.electropedia.org/
- ISO Online browsing platform: available at https://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.

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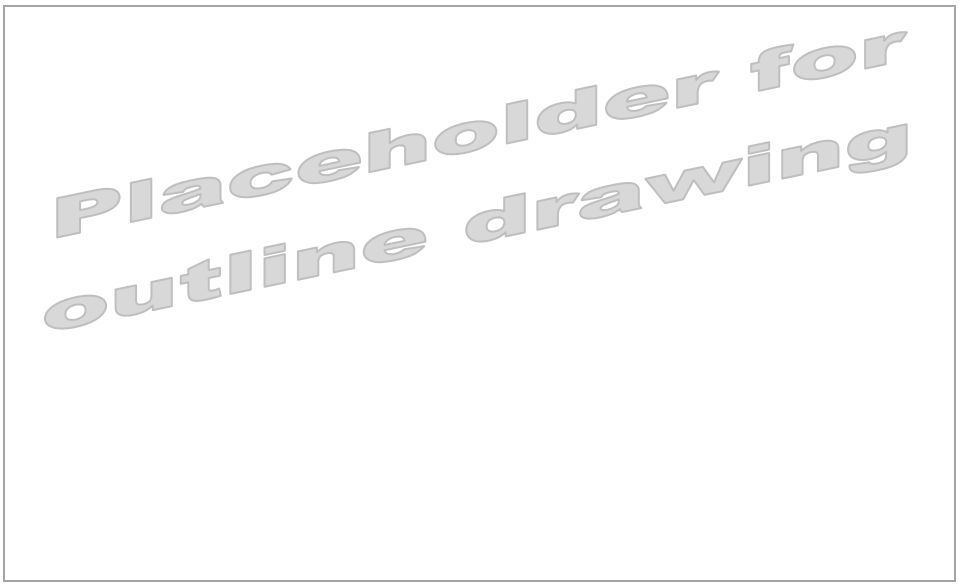

Figure 1 – Outline and dimensions

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 specified in Table 1.

Table 1 – Styles and dimensions

Style		Dimensions[g]					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 specified 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.

[g] For products which have their origin in the imperial system of units, the inch dimensions can be given additionally for information, presented in square brackets.

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, 4.2.1.1. 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 lead

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to correspond to the dimensions identified in Figure 1. The choice of specified 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 specified minimum lead length should consider the variety of inside tape spacing specified 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, 4.2.1.4 with IEC 60115-4:2022, Figure 9. The real eccentricity e, as shown in 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.

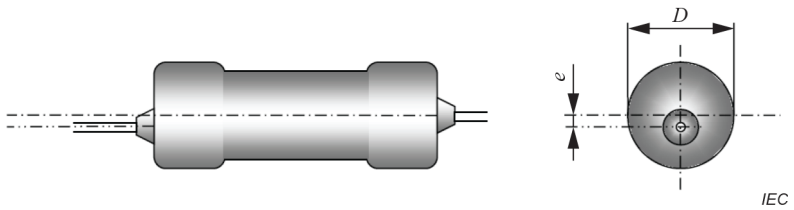

Figure 2 – Lead eccentricity of the wire terminations

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 and Figure 7. The length of excessive coating c, as shown in Figure 3, shall not exceed the limit given in Table 1.

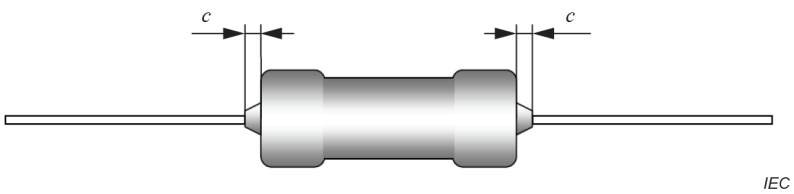

Figure 3 – Length of excessive coating on the wire terminations

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.

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Table 2 – Climatic categories

Climatic category LCT / UCT / duration
… / … / …
… / … / …

COMMENT 1 See IEC 60115-4:2022, 8.2.3. and 4.3.

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

The upper category temperature (UCT), which is used for test procedures, should be lower than the maximum element temperature (MET).

Table 3 – Ratings

Style	Rated dissipation P_{70} W	X	Limiting element voltage DC or AC RMS 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 time insulation properties can be affected by the influence of moisture, organic material and electrical field across the insulating layer(s). For non-insulated resistors, this is the max voltage against ambient.				

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_{ins} = 1,42 × 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.

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