



# SLOVENSKI STANDARD

## SIST EN 60115-2:2015

01-september-2015

Nadomešča:  
SIST EN 140100:2008

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**Fiksni upori za elektronsko opremo - 2. del: Področna specifikacija: nežični upori z majhno močjo**

Fixed resistors for use in electronic equipment - Part 2: Sectional specification : Fixed low-power non-wirewound resistors

Festwiderstände zur Verwendung in Geräten der Elektronik - Teil 2: Rahmenspezifikation - Verbleite niedrig belastbare Schichtwiderstände

Résistances fixes utilisées dans les équipements électroniques - Partie 2: Spécification intermédiaire: Résistances fixes à broche à couches, à faible dissipation

**Ta slovenski standard je istoveten z: EN 60115-2:2015**

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**ICS:**

31.040.10      Fiksni upor      Fixed resistors

**SIST EN 60115-2:2015**      en

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EUROPEAN STANDARD  
NORME EUROPÉENNE  
EUROPÄISCHE NORM

**EN 60115-2**

January 2015

ICS 31.040.10

Supersedes EN 140100:2008

English Version

**Fixed resistors for use in electronic equipment - Part 2:  
Sectional specification: Leaded fixed low power film resistors  
(IEC 60115-2:2014 , modified)**

Résistances fixes utilisées dans les équipements  
électroniques - Partie 2: Spécification intermédiaire:  
Résistances fixes à broches à couches, à faible dissipation  
(IEC 60115-2:2014 , modifiée)

Festwiderstände zur Verwendung in Geräten der Elektronik  
- Teil 2: Rahmenspezifikation - Verbleite niedrig belastbare  
Schichtwiderstände  
(IEC 60115-2:2014 , modifiziert)

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Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

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

**CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels**

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## Foreword

This document (EN 60115-2:2015) 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 140100:2008.

Clauses, subclauses, notes, tables, figures and annexes which are additional to those in IEC 60115-2:2014 are prefixed “Z”.

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## 1 Modification to Clause 2

After the 1<sup>st</sup> paragraph, **add** the following note:

NOTE The readers of this European Standard are advised of the corresponding European documents listed in the normative Annex ZA, which take precedence over the International Standards listed in this clause. The precedence also applies to all normative references made within this document.

## 2 Modification to 3.1

At the end, **add** the following:

### 3.1.Z1

#### nominal resistance

$R_n$

resistance value for which the resistor has been designed, and which is generally used for denomination of the resistor

Note 1 to entry: The definition of nominal resistance,  $R_n$ , is identical to the definition of rated resistance,  $R_r$ , in EN 60115-1:2011. Therefore nominal resistance,  $R_n$ , may be applied wherever rated resistance,  $R_r$ , is required, e.g. in a quality assessment scheme.

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## 3 Modifications to 3.3

At the beginning of the 2<sup>nd</sup> paragraph, **replace** “Two general end product levels” by “Three general end product levels”.

[SIST EN 60115-2:2015](https://standards.iteh.ai/catalog/standards/sist/7e338596-b303-449d-a8e9-81e1f4c/sist-7e338596-b303-449d-a8e9-81e1f4c)

<https://standards.iteh.ai/catalog/standards/sist/7e338596-b303-449d-a8e9-81e1f4c/sist-7e338596-b303-449d-a8e9-81e1f4c>

After the 5<sup>th</sup> paragraph (Examples for Level P (4.)), **add** the following:

NOTE Z1 Product classification level P adopts and succeeds the former Version A.

**Replace** the 6<sup>th</sup> paragraph (Level P is the suitable basis ...) by

**Level R** – High-performance and high-reliability electronic equipment, where the requirement for established reliability and for an approved failure rate level applies in addition to the criteria of Level P.

Examples for Level R include military & defence equipment, avionics and aerospace applications.

NOTE Z2 Product classification level R adopts and succeeds the former Version E.

**Replace** the 7<sup>th</sup> paragraph (Each level shall be used ...) by

Each level shall be used in individual detail specifications, except for Level P and Level R, which may be used in combined detail specifications.

## 4 Modification to 4.6

**Replace** the 4<sup>th</sup> paragraph by

The upper category temperature (UCT), which is used for test procedures, shall be the same as the maximum element temperature (MET).

## 5 Modification to 5.2.10

**Replace** the last paragraph by

This test is mandatory only for resistors categorized as Level P or as Level R.

## 6 Modification to 5.2.12.5

**Replace** the 2<sup>nd</sup> entry for air pressure (1 kPa ... ) by

$$p_{\text{amb}} = 1 \text{ kPa, for resistors categorized as Level P or as Level R.}$$

## 7 Modification to 5.2.14

**Replace** the last paragraph by

The extended endurance of this test is mandatory only for resistors categorized as Level P or as Level R.

## 8 Modification to 5.2.17

**Replace** the last paragraph by

This test is mandatory only for resistors categorized as Level P or as Level R.

## 9 Modification to 5.2.18

**Replace** the entry for the solvent temperature by

$$\vartheta_{\text{bath}} = (50_{-5}^0) \text{ } ^\circ\text{C}$$

## 10 Modification to 5.2.19

**Replace** the entry for solvent temperature by

$$\vartheta_{\text{bath}} = (50_{-5}^0) \text{ } ^\circ\text{C}$$

## 11 Modifications to 5.2.21

**Replace** the 2<sup>nd</sup> list entry for positive discharges ( $n_{\text{pos}} = 3 \dots$ ) by

$$n_{\text{pos}} = 3 \text{ for resistors categorized as Level P or as Level R}$$

**Replace** the 2<sup>nd</sup> list entry for negative discharges ( $n_{\text{neg}} = 3 \dots$ ) by

$$n_{\text{neg}} = 3 \text{ for resistors categorized as Level P or as Level R}$$

## 12 Modification to 5.2.22

**Replace** the last paragraph by

This test is mandatory only for resistors categorized as Level P or as Level R.

## 13 Modification to 6.2

**Replace** Footnote <sup>a</sup> in Table 3 by

<sup>a</sup> Test is mandatory only for resistors categorized as Level P or as Level R.

## 14 Modification to 6.5

**Replace** the explanation for MET by

MET is the maximum element temperature, MET = UCT.

## 15 Modifications to 9.4

**Replace** the 1<sup>st</sup> paragraph by

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### 9.4.Z1 General

The procedures for Qualification Approval testing are given in EN 60115-1:2011, Clause Q.2, with the test procedures described in EN 60115-1:2011, Q.2.4. <https://standards.iteh.ai/catalog/standards/sist/7e338596-b303-449d-a8e9-e8430b13cf4c/sist-en-60115-2-2015>

**Replace** the last paragraph by

<https://standards.iteh.ai/catalog/standards/sist/7e338596-b303-449d-a8e9-e8430b13cf4c/sist-en-60115-2-2015>

### 9.4.Z2 Granting the approval for products classified to Level G or to Level P

The qualification approval for classification level G or P shall be granted after successful completion of 1 000 h of the test endurance at 70 °C and all other tests of Table 5.

### 9.4.Z3 Granting the approval for products classified to Level R

The qualification approval for classification 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 Table 5.

Thereafter, the qualification approval for classification 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 classification level R shall be withdrawn if the 8 000 h test is not completed successfully.

## 16 Modification to 9.5

**Replace** the 1<sup>st</sup> sentence of the 1<sup>st</sup> paragraph by

The schedule for the lot-by-lot and periodic tests for Quality Conformance Inspection of resistors categorized as level G, P or R are given in Table 6.



## 17 Modification to 9.6

**Replace** the 1<sup>st</sup> paragraph by

This sectional specification does not support the capability approval as described in EN 60115-1:2011, Q.3.

## 18 Modification to 9.7

**Replace** the 1<sup>st</sup> paragraph by

The provisions of EN 60115-1:2011, Q.4 shall apply, and the test schedules of Table 5 and Table 6 shall be used.

## 19 Modification to 9.8

**Replace** the 1<sup>st</sup> paragraph by

The provisions of EN 60115-1:2011, Q.1.7 shall apply, except that the inspection level shall be reduced to S-2.

## 20 Modification to 9.9

**Replace** the 1<sup>st</sup> paragraph by

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

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## 21 Modifications to Table 5

In Group 7, Test 4.25.1.8, **replace** the bracketed term of the entry in the 1<sup>st</sup> column by

(applicable only to resistors categorized as Level P or as Level R)

In Group 12, Test 4.39, **replace** the bracketed term of the entry in the 1<sup>st</sup> column by

(applicable only to resistors categorized as Level P or as Level R)

In Group 13, Test 4.19, **replace** the bracketed term of the entry in the 1<sup>st</sup> column by

(applicable only to resistors categorized as Level P or as Level R)

In Group 14, Test 4.27, **replace** the bracketed term of the entry in the 1<sup>st</sup> column by

(applicable only to resistors categorized as Level P or as Level R)

## 22 Modifications to Table 6

In Group C2, Test 4.25.1.8, **replace** the bracketed term of the entry in the 1<sup>st</sup> column by

(applicable only to resistors categorized as Level P or as Level R)

In Group F, Test 4.19, **replace** the bracketed term of the entry in the 1<sup>st</sup> column by

(applicable only to resistors categorized as Level P or as Level R)

In Group G, Test 4.27, **replace** the bracketed term of the entry in the 1<sup>st</sup> column by

(applicable only to resistors categorized as Level P or as Level R)

## 23 Modifications to Clause D.1

In the list of letter symbol explanations, **add** the new entry after the entry for  $R_n$ :

|       |                               |          |
|-------|-------------------------------|----------|
| $R_r$ | Rated resistance, $R_r = R_n$ | $\Omega$ |
|-------|-------------------------------|----------|

In the list of letter symbol explanations, **replace** the respective entries for temperature  $T$  to  $\Delta T_{\max}$  by

|                                |  |                    |
|--------------------------------|--|--------------------|
| $\vartheta$                    | Temperature, e.g. as an atmospheric condition for testing (also written as $T$ )                       | $^{\circ}\text{C}$ |
| $\vartheta_A$                  | Low temperature of a change of temperature test (also written as $T_A$ )                               | $^{\circ}\text{C}$ |
| $\vartheta_B$                  | High temperature of a change of temperature test (also written as $T_B$ )                              | $^{\circ}\text{C}$ |
| $\vartheta_{\text{amb}}$       | Ambient temperature (also written as $T_{\text{amb}}$ )  | $^{\circ}\text{C}$ |
| $\vartheta_{\text{bath}}$      | Bath temperature, e.g. in solvent resistance or solder bath tests (also written as $T_{\text{bath}}$ ) | $^{\circ}\text{C}$ |
| $\vartheta_{\text{max}}$       | Maximum temperature, maximum element temperature (also written as $T_{\text{max}}$ )                   | $^{\circ}\text{C}$ |
| $\vartheta_r$                  | Rated temperature (also written as $T_r$ )   | $^{\circ}\text{C}$ |
| $\vartheta_{\text{sup}}$       | Upper temperature, e.g. in a respective temperature sequence (also written as $T_{\text{sup}}$ )       | $^{\circ}\text{C}$ |
| $\Delta\vartheta$              | Temperature rise (also written as $\Delta T$ )   | K                  |
| $\Delta\vartheta_{\text{max}}$ | Maximum permissible temperature rise (also written as $\Delta T_{\text{max}}$ )                        | K                  |

## 24 Modifications to Annex X

**Delete** Annex X (Cross reference for references to the prior revision of this standard).

## 25 New Annex ZA

**Add** the new normative Annex ZA (see attached Annex ZA) on correspondences for normative references.

## 26 New Annex ZX

**Add** the new informative Annex ZX (see attached Annex ZX) providing cross references for references to the predecessor of this specification.

## 27 Modifications to the Bibliography

**Replace** the Bibliography by the Bibliography providing references to European Standards (see attached Bibliography).

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## Annex ZA (normative)

### Normative references to international publications with their corresponding European publications

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.

NOTE 1 When an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: [www.cenelec.eu](http://www.cenelec.eu).

| <u>Publication</u> | <u>Year</u> | <u>Title</u>   | <u>EN/HD</u>                   | <u>Year</u>  |
|--------------------|-------------|--|--------------------------------|--------------|
| IEC 60062          | 2004        | Marking codes for resistors and capacitors   | EN 60062<br>+ corrigendum Jan. | 2005<br>2007 |
| IEC 60068-1        | 2013        | Environmental testing -<br>Part 1: General and guidance  | EN 60068-1                     | 2014         |
| IEC 60068-2-1      | -           | Environmental testing -<br>Part 2-1: Tests - Test A: Cold  | EN 60068-2-1                   | -            |
| IEC 60068-2-2      | -           | Environmental testing -<br>Part 2-2: Tests - Tests B: Dry heat   | EN 60068-2-2                   | -            |
| IEC 60068-2-6      | 2007        | Environmental testing -<br>Part 2-6: Tests - Test Fc: Vibration (sinusoidal)   | EN 60068-2-6                   | 2008         |
| IEC 60068-2-20     | 2008        | Environmental testing -<br>Part 2-20: Tests – Test T – Test methods for<br>solderability and resistance to soldering heat of<br>leaded devices | EN 60068-2-20                  | 2008         |
| IEC 60115-1 (mod.) | 2008        | Fixed resistors for use in electronic equipment<br>- Part 1: Generic specification   | EN 60115-1                     | 2011         |
| IEC 60286-1        | -           | Packaging of components for automatic<br>handling -<br>Part 1: Tape packaging of components with<br>axial leads on continuous tapes            | EN 60286-1                     | -            |
| IEC 60294          | 2012        | Measurement of the dimensions of a cylindrical<br>component having two axial terminations  | EN 60294                       | 2012         |
| IEC 60301          | -           | Preferred diameters of wire terminations of<br>capacitors and resistors  | EN 60301                       | -            |
| IEC 61193-2        | 2007        | Quality assessment systems –<br>Part 2: Selection and use of sampling plans for<br>inspection of electronic components and<br>packages         | EN 61193-2                     | 2007         |
| IEC 61760-1        | 2006        | Surface mounting technology –<br>Part 1: Standard method for the specification of<br>surface mounting components (SMDs)                        | EN 61760-1                     | 2006         |

## Annex ZX (informative)

### Cross reference for references to the predecessor of this specification

This sectional specification is presented in a new structure compared to the preceding document. The following table provides a cross reference for all references to specific elements of the predecessor of this Sectional Specification.

| EN 140100:2008<br>Clause/Subclause | EN 60115-2:2015<br>Clause/Subclause | Notes   |
|------------------------------------|-------------------------------------|---|
| 1                                  | —                                   | The subject is covered by Clauses 1 and 8.                                  |
| 1.1                                | 1                                   | —   |
| 1.2                                | 8                                   | —   |
| 2                                  | —                                   | The subject is covered by Clauses 4, 5 and 6.                               |
| 2.1                                | —                                   | The subject is covered by Clauses 4 and 6.                                  |
| 2.1.1                              | 4.1                                 | The prior Table 1 is succeeded by Table 1.                                  |
| 2.1.2                              | 4.2                                 | The prior Table 2 is succeeded by Table 4.                                  |
| 2.1.3                              | 6.4                                 | —   |
| 2.1.4                              | 6.2                                 | The prior Tables 3a and 3b are succeeded by Tables 3a and 3b, respectively. |
| 2.2                                | 4                                   | —   |
| 2.2.1                              | 4.4                                 | —   |
| 2.2.2                              | 4.5                                 | —   |
| 2.2.3                              | 4.6                                 | —   |
| 2.2.4                              | 4.7                                 | —   |
| 2.2.5                              | 4.9                                 | —   |
| 2.2.6                              | 4.8                                 | —   |
| 2.2.7                              | —                                   | The subject is left to the ruling of the detail specification.              |
| 2.3                                | 5.2                                 | —   |
| 2.3.1                              | 5.2.13                              | —   |
| 2.3.2                              | 5.2.11                              | —   |
| 2.3.3                              | 5.2.12.5                            | —   |
| 2.3.4                              | 5.2.9<br>5.2.10                     | —   |
| 2.3.5                              | 5.2.7                               | —   |
| 2.3.6                              | 5.2.8                               | —   |
| 2.3.7                              | 5.2.4                               | —   |
| 2.3.8                              | 5.2.17                              | —   |

|              |              |   |
|--------------|--------------|---|
| 2.3.9        | 5.2.22       | —   |
| 2.3.10       | 5.2.21       | —   |
| 2.3.11       | 5.2.20       | —   |
| 2.4          | 5.1          | —   |
| 2.4.1        | 5.1.1        | —   |
| 2.4.2        | 5.1.2        | —   |
| 2.4.3        | 5.1.3        | —   |
| 3            | 9            | —   |
| 3.1          | 9.1          | —   |
| 3.1.1        | 9.2.2        | —   |
| 3.1.2        | 9.3          | —   |
| 3.2          | 9.4          | The information of the prior Table A.1 concerning Qualification Approval is implemented in Table 5.   |
| 3.3          | 9.5          | The information of the prior Table A.1 concerning Quality Conformance Inspection is implemented in Table 6a, for lot-by-lot tests, and in Table 6b, for periodic tests. |
| 3.4          | 9.7          | —   |
| 3.5          | —            | —   |
| 3.6          | 9.8          | —   |
| A            | —            | The subject is covered by 9.4 and 9.5.  |
| B            | D            | —   |
| B.1          | D.1          | —   |
| B.2          | D.2          | —   |
| Bibliography | Bibliography | —   |

## Bibliography

- EN 60027-1, *Letter symbols to be used in electrical technology – Part 1: General* (IEC 60027-1)
- EN 60060-1, *High-voltage test techniques – Part 1: General definitions and test requirements* (IEC 60060-1)
- EN 60068-2-1:1993 <sup>1)</sup>, *Environmental testing – Part 2-1: Tests – Test A: Cold* (IEC 60068-2-1:1990)
- EN 60068-2-2:1993 <sup>2)</sup>, *Basic environmental testing procedures – Part 2-2: Tests – Tests B: Dry heat* (IEC 60068-2-2:1974)
- EN 60068-2-13, *Environmental testing – Part 2-13: Tests – Test M: Low air pressure* (IEC 60068-2-13)
- EN 60068-2-14, *Environmental testing – Part 2-14: Tests – Test N: Change of temperature* (IEC 60068-2-14)
- EN 60068-2-21, *Environmental testing – Part 2-21: Tests – Test U: Robustness of terminations and integral mounting devices* (IEC 60068-2-21)
- EN 60068-2-30, *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 2-45: Tests – Test Xa and guidance: Immersion in cleaning solvents* (IEC 60068-2-45)
- EN 60068-2-78, *Environmental testing – Part 2-78: Tests – Test Cab: Damp heat, steady state* (IEC 60068-2-78)
- EN 60286-2, *Packaging of components for automatic handling – Part 2: Packing of components with unidirectional leads on continuous tapes* (IEC 60286-2)
- EN 60440, *Method of measurement of non-linearity in resistors* (IEC 60440)
- 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 60717, *Method for the determination of the space required by capacitors and resistors with unidirectional terminations* (IEC 60717)
- EN 61192-3, *Workmanship requirements for soldered electronic assemblies – Part 3: Through-hole mount assemblies* (IEC 61192-3)
- 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 80000 (all parts), *Quantities and units* (IEC 80000 (all parts))
- EN ISO 80000 (all parts), *Quantities and units* (ISO 80000 (all parts))
- IEC 60063, *Preferred number series for resistors and capacitors*
- IEC 60195, *Method of measurement of current noise generated in fixed resistors*
- IECQ 03-3, *IEC Quality Assessment System for Electronic Components (IECQ) – Rules of Procedure – Part 3: IECQ Approved Component Products, Related Materials & Assemblies Scheme*
- IECQ 03-3-1, *IEC Quality Assessment System for Electronic Components (IECQ) – Rules of Procedure – Part 3-1: IECQ Approved Component Products, Related Materials & Assemblies Scheme, IECQ Approved Component – Technology Certification (IECQ AC-TC)*

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1) EN 60068-2-1:1993 is replaced by EN 60068-2-1:2007, *Environmental testing – Part 2-1: Tests – Test A: Cold* (IEC 60068-2-1:2007).

2) EN 60068-2-2:1993 is replaced by EN 60068-2-2:2007, *Environmental testing – Part 2-1: Tests – Test B: Dry heat* (IEC 60068-2-2:2007).