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# **Harmonized system of quality assessment for electronic components Generic specification : Fixed resistors**

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**Système harmonisé d'assurance de la qualité des composants électroniques  
Spécification générique : Résistances fixes**

**Harmonisiertes Gütebestätigungssystem für Bauelemente der Elektronik  
Fachgrundspezifikation : Festwiderstände**

**National foreword**

This British Standard has been prepared under the direction of the Electronic Components Standards Committee. It is identical with CENELEC Electronic Components Committee (CECC) 40000 'Harmonized system of quality assessment for electronic components : Generic specification : Fixed resistors' (second edition).

This standard is a harmonized specification within the CECC system.

This standard supersedes BS E9110 which is therefore now withdrawn.

**Terminology and conventions.** The text of the CECC specification has been approved as suitable for publication, without deviation, as a British Standard. Some terminology and certain conventions are not identical with those used in British Standards; attention is especially drawn to the following.

The comma has been used throughout as a decimal marker. In British Standards it is current practice to use a full point on the baseline as the decimal marker.

**Cross-references.** The British Standard harmonized with CECC 00100 is BS E9000 'General requirements for electronic components of assessed quality harmonized with the CENELEC Electronic Components Committee System' Part 1 'Basic rules'.

| International standard | Corresponding British Standard                                                                                                                                             |
|------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ISO 3-1973             | BS 2045 : 1965 Preferred numbers<br>(Technically equivalent)                                                                                                               |
| ISO 1000-1973          | BS 5555 : 1976 SI units and recommendations for the use of their multiples and of certain other units<br>(Identical)                                                       |
| IEC 62 : 1974          | BS 1852 : 1975 Marking codes for resistors and capacitors<br>(Identical)                                                                                                   |
| IEC 63 : 1963          | BS 2488 : 1966 Schedule of preferred numbers for the resistance of resistors and the capacitance of capacitors for telecommunication equipment<br>(Technically equivalent) |
| IEC 195 : 1965         | BS 4119 : 1967 Method of measurement of current noise generated in fixed resistors<br>(Technically equivalent)                                                             |
| IEC 294 : 1969         | BS 5692 : 1979 Method for measurement of the dimensions of a cylindrical component having two axial terminations<br>(Identical)                                            |
| IEC 440 : 1973         | BS 5694 : 1979 Method for measurement of non-linearity in resistors<br>(Identical)                                                                                         |
|                        | BS 2011 Basic environmental testing procedures                                                                                                                             |
| IEC 68-1 : 1978        | BS 2011 : Part 1.1 : 1977 General<br>(Identical)                                                                                                                           |
| IEC 68-2-1 : 1974      | BS 2011 : Part 2.1A : 1977 Test A : Cold<br>(Identical)                                                                                                                    |
| IEC 68-2-2 : 1974      | BS 2011 : Part 2.1B : 1977 Test B : Dry heat<br>(Identical)                                                                                                                |
| IEC 68-2-3 : 1969      | BS 2011 : Part 2.1Ca : 1977 Test Ca : Damp heat, steady state<br>(Identical)                                                                                               |
| IEC 68-2-4 : 1960      | BS 2011 : Part 2.1Da : 1977 Test Da : Accelerated damp heat<br>(Identical)                                                                                                 |
| IEC 68-2-6 : 1970      | BS 2011 : Part 2.1Fc : 1977 Test Fc : Vibration (sinusoidal)<br>(Identical)                                                                                                |
| IEC 68-2-10 : 1968     | BS 2011 : Part 2.1J : 1977 Test J : Mould growth<br>(Identical)                                                                                                            |
| IEC 68-2-11 : 1964     | BS 2011 : Part 2.1Ka : 1977 Test Ka : Salt mist<br>(Identical)                                                                                                             |
| IEC 68-2-13 : 1966     | BS 2011 : Part 2.1M : 1977 Test M : Low air pressure<br>(Identical)                                                                                                        |
| IEC 68-2-14 : 1974     | BS 2011 : Part 2.1N : 1977 Test N : Change of temperature<br>(Identical)                                                                                                   |
| IEC 68-2-20 : 1968     | BS 2011 : Part 2.1Ta : 1977 Test Ta : Solderability<br>(Identical)                                                                                                         |
| IEC 68-2-20A : 1970    | BS 2011 : Part 2.1Tb : 1977 Test Tb : Soldering—resistance to solder heat, Method 1<br>(Identical)                                                                         |
| IEC 68-2-21 : 1975     | BS 2011 : Part 2.1U : 1977 Test U : Robustness of terminations and integral mounting devices<br>(Identical)                                                                |



Amendment No. 1  
published and effective from 30 November 1982  
to BS CECC 40000 : 1980

Harmonized system of quality assessment  
for electronic components  
Generic specification: Fixed resistors

REVISED TEXT

This Amendment is identical with the 1st Amendment published  
in 1982 to CECC 40000: 1979.

A consequent amendment to the national foreword has also been  
made.

AMD 4099  
November 1982

National foreword

On the inside back cover after paragraph 2 ending, 'BS 6001  
'Sampling procedures and tables for inspection by  
attributes', insert the following:

'The Technical Committee has reviewed the provisions of  
IEC 695-2-2 : 1980 to which reference is made in the text and  
has decided that they are acceptable for use in conjunction  
with this standard'.

AMD 4099  
November 1982

The following amendments shall be made:

CONTENTS

Add:

4.25 Flammability

PREFACE

Below CECC(Secretariat)543 add:

CECC(Secretariat)869    October 1979  
CECC(Secretariat)975

2.1 Related documents

Below IEC 440 add:

IEC 695-2-2 (1980) Fire hazard testing. Part 2: Test methods  
- Needle flame test.

SECTION 4

Add:

4.25 Flammability

4.25.1 Needle flame test

The resistors shall be subjected to the needle flame test of  
IEC 695-2-2 using the appropriate severity chosen from 5, 10,  
15, 30, 60 and 120 s duration.





Amendment No. 2  
published and effective from 30 March 1984  
to BS CECC 40000 : 1980

Harmonized system of quality assessment  
for electronic components  
Generic specification : Fixed resistors

REVISED TEXT

This Amendment is identical with the 2nd Amendment published  
in 1983 to CECC 40000: 1979.

A consequent amendment to the national foreword has also been  
made.

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AMD 4495  
March 1984

National Foreword

In paragraph 1, at the end of the second sentence insert  
'including Amendment No.1 (1982) and Amendment No.2 (1983)'.

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AMD 4495  
March 1984

The following amendments shall be made:

CONTENTS

Add:

3.9 Switching rules for reduced inspection in Group C

PREFACE

Below CECC(Secretariat)975 add:

CECC(Secretariat)1032    January 1981

SECTION 3

Add:

3.9 Switching rules for reduced inspection in Group C

For resistors covered by this generic specification the switching  
rules given in RP7 Issue 2 Part 1 Clause 16 apply.

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**Amendment No. 3**  
**published and effective from 28 September 1984**  
**to BS CECC 40000 : 1980**

**Harmonized system of quality assessment**  
**for electronic components**  
**Generic specification : Fixed resistors**

### Revised text

This Amendment is identical with the 3rd Amendment published in 1983 to CECC 40000 : 1979.

A consequent amendment to the national foreword has also been made.

**AMD 4525**  
**September 1984**

### National foreword

In paragraph 1, at the end of the second sentence, delete 'and Amendment No. 2 (1983).' and substitute ', Amendment No. 2 (1983) and Amendment No. 3 (1983).'

**AMD 4525**  
**September 1984**

### Contents

#### Page 1

Add:

2.2.17 Derating curve 10a

2.2.18 Voltage coefficient 10a

#### Page 3

Add:

4.26 Seal test (Hermetically sealed resistors only) 38

APPENDIX 'G' Internal visual examination of fixed resistors 51

### Instructions for the insertion of new and revised pages

**AMD 4525**  
**September 1984**

**Page 4.** Delete this page and insert the revised page 4 attached.  
(Do not remove as page 3 is still valid).

**Page 10a.** Insert the new page 10a attached.

**Pages 37 and 38.** Remove these pages and insert the revised pages 37 and 38 attached.

**Pages 51 to 54.** Insert the new pages 51 to 54 attached.



## FOREWORD

The CENELEC Electronic Components Committee (CECC) is composed of those member countries of the European Committee for Electrotechnical Standardization (CENELEC) who wish to take part in a harmonized System for electronic components of assessed quality.

The object of the System is to facilitate international trade by the harmonization of the specifications and quality assessment procedures for electronic components, and by the grant of an internationally recognized Mark, or Certificate, of Conformity. The components produced under the System are thereby accepted by all member countries without further testing.

This specification has been formally approved by the CECC, and has been prepared for those countries taking part in the System who wish to issue national harmonized specifications for FIXED RESISTORS. It should be read in conjunction with document CECC 00 100: Basic Rules (1974).

At the date of printing of this document the member countries of the CECC are Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, the Netherlands, Norway, Sweden, Switzerland, and the United Kingdom. Copies of it can be obtained from the addresses shown on the inside cover.

## PREFACE

This generic specification was prepared by CECC Working Group 4 : Resistors.

In accordance with the requirements of CECC 00 111 : Specifications (Issue 3) it is based, wherever possible, on the Recommendations of the International Electrotechnical Commission and in particular on IEC 115-1 : Fixed Resistors : Terms and methods of test.

The text of the first issue of this generic specification (1973) was circulated to the CECC for voting in the documents listed below :

| <u>Document</u>      | <u>Date of vote</u> | <u>Report on the voting</u> |
|----------------------|---------------------|-----------------------------|
| CECC(Secretariat)60  | 10 January 1972     | CECC(Secretariat)89         |
| CECC(Secretariat)83  | 30 June 1972        | CECC(Secretariat)118        |
| CECC(Secretariat)99  | 23 October 1972     | CECC(Secretariat)140        |
| CECC(Secretariat)102 | 13 November 1972    | CECC(Secretariat)161        |

This second issue of the generic specification results from amendments or additions to the text of Issue 1 which were circulated to the CECC for voting in the documents listed below and was approved by the CECC Management Committee for publication as a CECC specification:

|                       |                  |                       |
|-----------------------|------------------|-----------------------|
| CECC(Secretariat)156  | 30 July 1973     | CECC(Secretariat)204  |
| CECC(Secretariat)258  | 19 July 1974     | CECC(Secretariat)324  |
| CECC(Secretariat)334  | 27 May 1975      | CECC(Secretariat)396  |
| CECC(Secretariat)538  | 20 October 1976  | CECC(Secretariat)610  |
| CECC(Secretariat)543  | 28 December 1976 | CECC(Secretariat)612  |
| CECC(Secretariat)869  | 23 February 1980 | CECC(Secretariat)975  |
| CECC(Secretariat)1032 | 25 March 1981    | CECC(Secretariat)1099 |
| CECC(Secretariat)1242 | 3 January 1983   | CECC(Secretariat)1312 |
| CECC(Secretariat)1243 | 3 January 1983   | CECC(Secretariat)1311 |
| CECC(Secretariat)1245 | 3 January 1983   | CECC(Secretariat)1309 |

Introduction of the additions to the Issue 2 of the specification covered by Amendment 3 , published in 1983, enables this generic specification to be used for the issue of specifications for FIXED RESISTORS OF ENHANCED ASSESSMENT OF QUALITY in accordance with RP 7 Part II (Issue 1).

The additional tests and requirements have been prepared with the co-operation of the European Space Agency (ESA) in accordance with the provisions of the Memorandum of Understanding between the CECC and the ESA. If the additional requirements of Appendix B to RP 7 Part II are met, then the components concerned can be supplied for use in space applications.

Sectional specifications, each dealing with a particular sub-family of resistors, will select those tests which are considered appropriate to the sub-family. They will also give more detailed information relevant to the sub-family.

## Effective dates

This second issue of CECC 40 000 shall become effective for all new qualification approvals on 1 October 1979. It shall become effective for all other qualification approvals by 1 October 1980.



2.2.17 Derating curve

The derating curve is a curve which shows the maximum allowable dissipation at ambient temperatures between the upper and lower category temperatures.

2.2.18 Voltage co-efficient of resistance

The voltage co-efficient of resistance is defined as the reversible change in resistance caused by the applied voltage. It is expressed as a percentage change in resistance per applied volt.



4.24.3.5 The size of the testing chamber and the number of resistors under test shall be such that, when all resistors are fully loaded, the heat produced by them shall be less than that required to maintain the atmosphere in the chamber at the upper category temperature, so that the temperature can still be controlled by the heating elements.

The sensor of the temperature controlling element and the thermometer shall be suitably spaced from the resistors (at least 10 times the resistor diameter) and shall be shielded, so as not to be directly influenced by the radiation of the resistors. It shall be assumed that in this test that the ambient temperature of the resistors is the same as the upper category temperature.

4.24.3.6 After approximately 48, 168, 500 and 1 000 h the resistors shall be removed from the chamber and allowed to cool under standard atmospheric conditions for testing for not less than 1 h and not more than 2 h.

The removal from the chamber shall take place at the end of the half-hour off period, for those resistors which are dissipating power.

4.24.3.7 The resistors shall be visually examined. There shall be no visible damage.

4.24.3.8 The resistance shall be measured as specified in 4.4 and the change in resistance, with respect to the value measured in 4.24.3.1 in each of the succeeding measurements, shall not exceed the value prescribed in the detail specification.

4.24.3.9 After intermediate measurements, the resistors shall be returned to the test chamber. The interval between the removal of any resistor from the chamber and its return to the conditions of test shall not exceed 12 h.

4.24.3.10 After 1 000 h, the insulation resistance shall be measured as specified in 4.5 and the value shall be not less than that prescribed in the detail specification.

4.24.3.11 When required by the detail specification the duration of the test may be extended. The detail specification shall state the duration of the test, the intervals at which any measurements shall be made and the requirements for any intermediate/final measurements.

#### 4.25 Flammability

##### 4.25.1 Needle flame test

The resistors shall be subjected to the needle flame test of IEC 695-2-2 using the appropriate severity chosen from 5, 10, 15, 30, 60 and 120 s duration.

#### 4.26 Seal test (Hermetically sealed resistors only)

4.26.1 For the purposes of this specification, a hermetically sealed resistor is a resistor whose resistance element is contained within a sealed enclosure of ceramic, glass or metal, or combination thereof, the sealing being accomplished by material fusion; welding, brazing or soldering.

4.26.2 The resistors shall be placed in a pressure chamber with a dye solution. The dye solution shall be of a depth sufficient to completely cover all the test specimens.

4.26.3 The chamber shall be pressurised to 600 to 650 kPa for 3 to  $3\frac{1}{2}$  hours.

4.26.4 The resistors shall then be removed and carefully washed, using a suitable solvent for the dye used, followed by an air jet dry.

4.26.5 The resistors shall then be examined under a magnification of x7 to x20, using an ultra-violet light source of appropriate frequency to determine that all the dye has been removed from the exterior.

4.26.6 Clear glass devices shall then be examined for evidence of dye in the cavity.

4.26.7 Any evidence of dye inclusion shall constitute a failure.

4.26.8 Non-transparent devices shall be placed in a vacuum chamber and evacuated to less than 650 Pa for  $30 \pm 5$  minutes.

4.26.9 After removal from the vacuum chamber, the resistors shall be examined under a magnification of x7 to x20, using an ultra-violet source of appropriate frequency.

4.26.10 Any evidence of dye effusion shall constitute a failure.

### SECTION 5 - BLANK DETAIL SPECIFICATIONS

#### 5.1 General

Sectional specifications, giving the data to be prescribed in detail specifications and preferred values and severities of test for sub-families of resistors, are associated with this generic specification.

Accompanying each sectional specification are one or more blank detail specifications which shall be used in the preparation of detail specifications.

Writers of detail specifications shall, wherever possible, use the values prescribed in the appropriate sectional specification when completing a blank detail specification.

They may specify inspection and test requirements which are more severe than those prescribed in the sectional or blank detail specifications. They are not permitted to delete inspection and test requirements from the blank detail specification unless they are identified for example, as "insulated styles only" when testing a non-insulated resistor, or "where applicable".

## APPENDIX G

### INTERNAL VISUAL EXAMINATION OF FIXED RESISTORS

#### G1 SCOPE

This Appendix describes the requirements for checking the internal aspects of materials, design, construction and workmanship.

Where the configuration or construction of a particular resistor differs from the drawings shown in this Appendix or, where it is intended to use the manufacturer's inspection drawings or standards, such variants together with the amended criteria shall have been detailed in the accepted Process Identification Document (PID). These criteria shall be used by the ONS as the basis for the Internal visual examination for the qualification approval and quality conformance inspection.

#### G2 GENERAL REQUIREMENTS

##### G2.1 General

An inspection lot shall contain only specimens from one production lot.

Evidence that this is not so shall be cause for rejection of the total lot in question.

##### G2.2 Illumination

Resistors undergoing examination with optical equipment shall be illuminated such that a particle blemish which has a size of 0,0125 mm in the major dimension can be detected at a magnification of 20 power (x20).

##### G2.3 Material, construction and dimensions

The material, construction and dimensions, shall be in accordance with the appropriate PID and the appropriate detail specification.

#### G3 DETAILED REQUIREMENTS

##### G3.1 Procedure

The resistors shall be examined prior to the application of any housing, coating or moulding and in such a manner that a minimum of handling and movement of the resistor is involved.

The resistors shall be examined with a stereoscopic microscope with a minimum magnification of 5 power (x5).

Suitable fixtures may be used to assist in the examination provided they do not of themselves cause damage to the resistor.

### G3.2 Reject criteria

A resistor shall be rejected if it exhibits one or more of the defects listed in any of the following clauses. Drawings have been included to provide additional explanatory material, but they shall be considered as typical examples only.

### G3.3 Wirewound resistors

#### G3.3.1 Solder joints

- Surface of the solder not smooth or clean
- Evidence of cracks, voids or holes
- Structure of the soldered part not visible
- Incomplete solder flow or coverage
- Balling, or spherical appearance of the solder
- Evidence of foreign material encapsulated in the solder.

#### G3.3.2 Resistor body

- Holes or cracks in the resistor body.

#### G3.3.3 Resistance wire (See Figure G1)

- Bond or joint in winding
- Deformations, nicks, cracks
- Loose wire
- Broken wire
- Any abrasion not authorized by the appropriate approved design.

#### G3.3.4 Winding

- Loose winding
- Uneven spacing between turns of the winding
- Average winding pitch exceeding five times the wire diameter
- Effective wire coverage such that more than 20% of the overall winding area remains uncovered.

NOTE : The effective wire coverage is the winding length on the body between the points of departure from the normal winding pitch.

G3.3.5 Wire welding

- Length of the welding area (dimension 'B' of Figure G2) less than 1,5 times the wire diameter (ultrasonic bond)
- Termination wire deformed by more than 50% and less than 25% (electrical weld).

G3.3.6 Winding to cap connection (See Figure G2)

- Changes in direction of wire before or within the welding area.

G3.3.7 Caps and terminations (See Figure G3)

- Burrs on the edges of the caps
- Either of the cap edges ('K') deviating by more than 5° from the edge ('B') of the resistor body
- Any damage to the termination reducing its diameter by more than 10%.

G3.4 Film resistors

G3.4.1 Solder joints

As in G3.3.1

G3.4.2 Resistor body

As in G3.3.2

G3.4.3 Caps and terminations

As in G3.3.7

G3.4.4 Films

- Non-uniform deposition of film
- Blisters, thin spots, or other blemishes on film
- Flaking of film
- Non-uniform spiralling of film (when appropriate)
- Spiralling occupying less than 70% of the actual length of the resistor element.

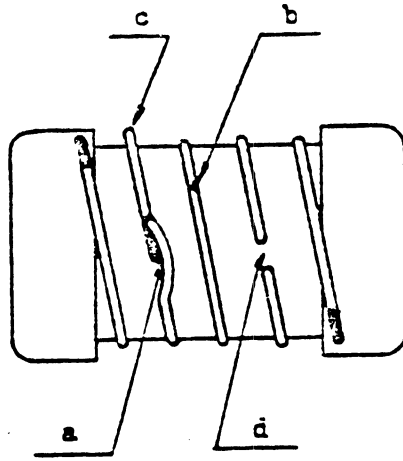


FIG. G1

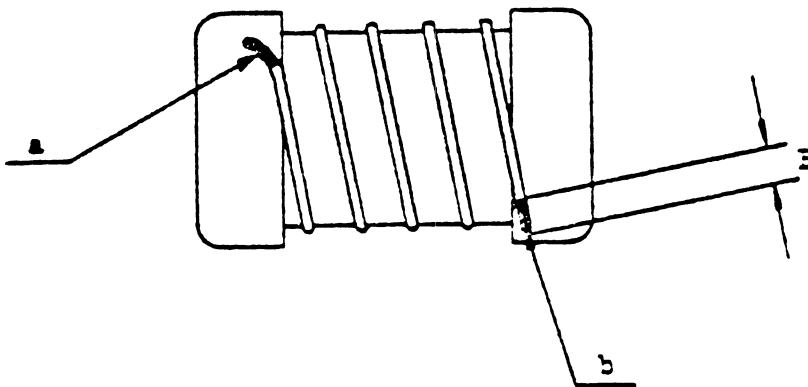


FIG. G2

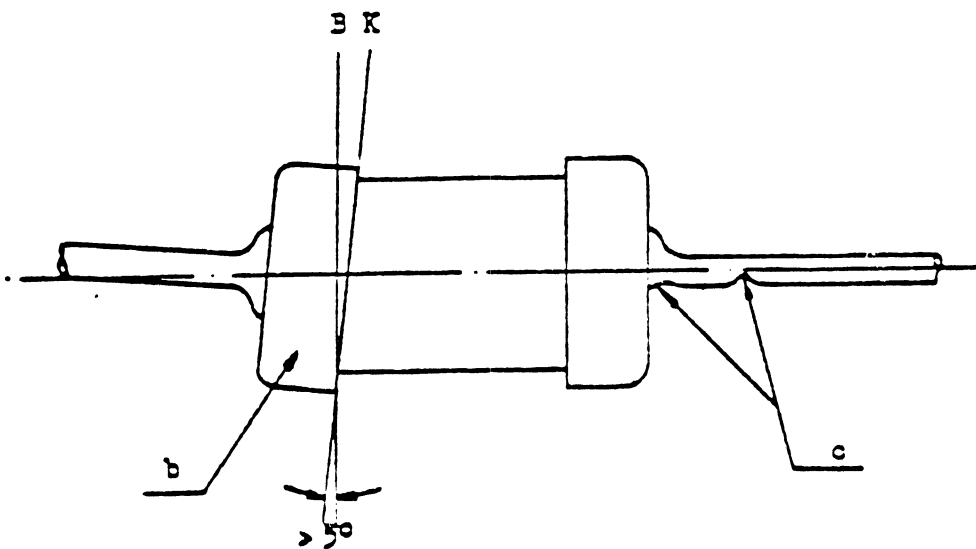


FIG. G3



**Amendment No. 4**  
**published and effective from 30 June 1989**  
**to BS CECC 40000 : 1980**

**Harmonized system of quality assessment**  
**for electronic components**  
**Generic specification: Fixed resistors**

This Amendment is identical with the 4th Amendment published in 1986 to CECC 40000 : 1979.

A consequent amendment to the national foreword has also been made.

## Revised text

**AMD 5513**  
**June 1989**

### National foreword

In paragraph 1, at the end of the second sentence, delete 'and Amendment No. 3 (1983).' and substitute ', Amendment No. 3 (1983) and Amendment No. 4 (1986).'

**AMD 5513**  
**June 1989**

### Contents

#### Page 2

Against '4.15.2 Resistance to heat' delete '25' and substitute '25a'.

**AMD 5513**  
**June 1989**

### Clause 2.1 Related documents

#### Page 5

After the reference to IEC 68, insert the following new line.

'IEC 68-2-20 (1979) Test T: Soldering'

#### Page 6

After the reference to CECC 00 007, insert the following new line.

'CECC 00 012 (1985) Radiographic inspection of electronic components'

**AMD 5513**  
**June 1989**

### Clauses 3.5.2(1), 4.24.1.6, 4.24.2.5, D2.2.6 and D2.3.5

In each of the above clauses delete '168 h,'.

## Instructions for the insertion of new and revised pages

**AMD 5513**  
**June 1989**

**Page 3.** Delete this page and insert the revised page 3 attached.

**Page 3a.** Insert the new page 3a attached.

**Page 4.** Delete this page and insert the revised page 4 attached.

**Pages 25 and 26.** Delete these pages and insert the revised page 25 backed by the new page 25a, and the revised page 26 attached.

**Pages 29 and 30.** Delete these pages and insert the revised pages 29 and 30 attached.

**Pages 30a and 30b.** Insert the new pages 30a and 30b attached.

**Pages 55 to 61.** Insert the new pages 55 to 61 attached.



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## SECTION 5 - BLANK DETAIL SPECIFICATIONS

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#### NOTE 1

The contents of Appendices A, B, and E, which were included in Issue 1, have been withdrawn from this issue for reasons given under the appropriate titles.

#### NOTE 2

A "side-line" in the left hand margin of this document indicates that the text deviates from that in the relevant IEC documents.



## FOREWORD

The CENELEC Electronic Components Committee (CECC) is composed of those member countries of the European Committee for Electrotechnical Standardization (CENELEC) who wish to take part in a harmonized System for electronic components of assessed quality.

The object of the System is to facilitate international trade by the harmonization of the specifications and quality assessment procedures for electronic components, and by the grant of an internationally recognized Mark, or Certificate, of Conformity. The components produced under the System are thereby accepted by all member countries without further testing.

This specification has been formally approved by the CECC, and has been prepared for those countries taking part in the System who wish to issue national harmonized specifications for FIXED RESISTORS. It should be read in conjunction with document CECC 00 100: Basic Rules (1974).

At the date of printing of this document the member countries of the CECC are Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, the Netherlands, Norway, Sweden, Switzerland, and the United Kingdom. Copies of it can be obtained from the addresses shown on the inside cover.

## PREFACE

This generic specification was prepared by CECC Working Group 4 : Resistors.

In accordance with the requirements of CECC 00 111 : Specifications (Issue 3) it is based, wherever possible, on the Recommendations of the International Electrotechnical Commission and in particular on IEC 115-1 : Fixed Resistors : Terms and methods of test.

The text of the first issue of this generic specification (1973) was circulated to the CECC for voting in the documents listed below :

| <u>Document</u>      | <u>Date of vote</u> | <u>Report on the voting</u> |
|----------------------|---------------------|-----------------------------|
| CECC(Secretariat)60  | 10 January 1972     | CECC(Secretariat)89         |
| CECC(Secretariat)83  | 30 June 1972        | CECC(Secretariat)118        |
| CECC(Secretariat)99  | 23 October 1972     | CECC(Secretariat)140        |
| CECC(Secretariat)102 | 13 November 1972    | CECC(Secretariat)161        |

This second issue of the generic specification results from amendments or additions to the text of Issue 1 which were circulated to the CECC for voting in the documents listed below and was approved by the CECC Management Committee for publication as a CECC specification:

|                       |                  |                       |
|-----------------------|------------------|-----------------------|
| CECC(Secretariat)156  | 30 July 1973     | CECC(Secretariat)204  |
| CECC(Secretariat)258  | 19 July 1974     | CECC(Secretariat)324  |
| CECC(Secretariat)334  | 27 May 1975      | CECC(Secretariat)396  |
| CECC(Secretariat)538  | 20 October 1976  | CECC(Secretariat)610  |
| CECC(Secretariat)543  | 28 December 1976 | CECC(Secretariat)612  |
| CECC(Secretariat)869  | 23 February 1980 | CECC(Secretariat)975  |
| CECC(Secretariat)1032 | 25 March 1981    | CECC(Secretariat)1099 |
| CECC(Secretariat)1242 | 3 January 1983   | CECC(Secretariat)1312 |
| CECC(Secretariat)1243 | 3 January 1983   | CECC(Secretariat)1311 |
| CECC(Secretariat)1245 | 3 January 1983   | CECC(Secretariat)1309 |

Introduction of the additions to the Issue 2 of the specification covered by Amendment 3, published in 1983, enables this generic specification to be used for the issue of specifications for FIXED RESISTORS OF ENHANCED ASSESSMENT OF QUALITY in accordance with RP 7 Part II (Issue 1).

The additional tests and requirements have been prepared with the co-operation of the European Space Agency (ESA) in accordance with the provisions of the Memorandum of Understanding between the CECC and the ESA. If the additional requirements of Appendix B to RP 7 Part II are met, then the components concerned can be supplied for use in space applications.

Amendment 4 to Issue 2 of this generic specification results from amendments or additions to the text which were circulated to the CECC for voting in the documents listed below and were approved by the President of the CECC for publication:

|                       |              |                       |
|-----------------------|--------------|-----------------------|
| CECC(Secretariat)949  | April 1980   | CECC(Secretariat)977  |
| CECC(Secretariat)1341 | August 1983  | CECC(Secretariat)1439 |
| CECC(Secretariat)1434 | Februar 1984 | CECC(Secretariat)1583 |
| CECC(Secretariat)1435 | Februar 1984 | CECC(Secretariat)1584 |
| CECC(Secretariat)1447 | März 1984    | CECC(Secretariat)1611 |

Sectional specifications, each dealing with a particular sub-family of resistors, will select those tests which are considered appropriate to the sub-family. They will also give more detailed information relevant to the sub-family.

## Effective dates

This second issue of CECC 40 000 shall become effective for all new qualification approvals on 1 October 1979. It shall become effective for all other qualification approvals by 1 October 1980.

Amendment 4 to Issue 2 of CECC 40 000 shall become effective for all new qualification approvals on 1 May 1986. It shall become effective for all other qualification approvals by 1 May 1987.



#### 4.14.6 Final measurements

4.14.6.1 After each of these tests, the resistors shall be visually examined.

There shall be no visible damage detrimental to satisfactory operation.

4.14.6.2 At the conclusion of the last of these tests, the resistance shall be measured as prescribed in 4.4.

The change of resistance with respect to the value measured in 4.14.1 shall not exceed the value quoted in the detail specification.

#### 4.15 Soldering

##### 4.15.1 Solderability

4.15.1.1 Resistors shall be subjected to Test Ta of IEC 68-2-20 (1979), using either the solder bath method (Method 1) or the soldering iron method (Method 2) or the solder globule method (Method 3) as prescribed in the detail specification.

4.15.1.2 When Method 1 is specified, the following requirements shall apply:

4.15.1.2.1 Bath temperature :  $(235 \pm 5)^{\circ}\text{C}$   
Immersion time :  $(2,0 \pm 0,5)$   
Depth of immersion (from the seating plane or resistor body):

- a) All resistors except those of b) below:  
 $(2,0 + 0/-0,5)$  mm, using a thermal insulating screen of  $(1,5 \pm 0,5)$  mm thickness
- b) Resistors indicated by the detail specification as being not designed for use on printed boards:  $(3,5 + 0/-0,5)$  mm.

4.15.1.2.2 Inspection shall be carried out under adequate light with normal eyesight or with the assistance of a magnifier capable of giving a magnification of 4X to 10X.

The dipped surface shall be covered with a smooth and bright solder coating with no more than small amounts of scattered imperfections such as pin-holes or un-wetted or de-wetted areas. These imperfections shall not be concentrated in one area.

- 4.15.1.2.3 When Method 1 is not applicable, the detail specification shall define the test method, test conditions and the requirements.

Note: When Method 3 is used, the requirements shall include the soldering time.

#### 4.15.2 Resistance to soldering heat

- 4.15.2.1 The resistors shall be dried using Procedure I or Procedure II of 4.2, as prescribed in the detail specification.

Where the resistance to soldering heat test is applied immediately after solderability, the drying procedure may be performed prior to the solderability test.

The resistance shall be measured as prescribed in 4.4.

- 4.15.2.2 Unless otherwise stated in the detail specification, the resistors shall undergo Test Tb of IEC 68-2-20 (1979) with the following requirements:

- a) All resistors except those of b) below:

Method 1A, with a duration of  $(5 \pm 1)$ s or  $(10 \pm 1)$ s, as specified in the detail specification.

Depth of immersion from the seating plane or resistor body:  $(2 \pm 0,5)$ mm, using a thermal insulating screen of  $(1,5 \pm 0,5)$ mm thickness

- b) Resistors not designed for use on printed boards as indicated by the detail specification:

Method 1B

Depth of immersion from the seating plane or resistor body:  $(3,5 \pm 0,5)$ mm

The period of recovery shall be not less than 1 h nor more than 2 h, unless otherwise specified by the detail specification.

4.15.2.3 When the test has been carried out the resistors shall be visually examined.

There shall be no visible damage and the marking shall be legible.

4.15.2.4 The resistance shall then be measured as specified in 4.4.

The change in resistance with respect to that measured in 4.15.2.1 shall not exceed the limit prescribed in the detail specification.

#### 4.16 Rapid change of temperature (IEC 115-1 Clause 20)

4.16.1 The resistance shall be measured as specified in 4.4.

4.16.2 The resistors shall be subjected to the procedure of Test Na of IEC 68-2-14 for five cycles. The duration of the exposure at each of the extremes of temperature shall be 30 min.

4.16.3 The resistors shall then remain under standard atmospheric conditions for recovery for not less than 1 h nor more than 2 h.

4.16.4 After recovery the resistors shall be visually examined. There shall be no visible damage.

4.16.5 The resistance shall be measured, as specified in 4.4.

The change of resistance with respect to the value measured in 4.16.1 shall not exceed the limit prescribed in the detail specification.

#### 4.17 Bump (IEC 115-1 Clause 21)

4.17.1 The resistance shall be measured as specified in 4.4.

4.17.2 The resistors shall be subjected to Test Eb of IEC 68-2-29 using the degree of severity prescribed in the detail specification. If the resistors are provided with specific means of mounting, these shall be used.



4.20.5.2 The test shall be carried out at a temperature between 15°C and 35°C.

The duration of the test shall be 1 h.

4.20.6 Damp heat, cyclic, remaining cycles

4.20.6.1 The resistors shall be subjected to the procedure of Test D of IEC 68-2-4 for the following number of cycles with the exception that the periodic variation in temperature shall be omitted.

| Categories | Number of cycles |
|------------|------------------|
| -/-/56     | 5                |
| -/-/21     | 1                |
| -/-/10     | 1                |
| -/-/04     | 0                |

NOTE : - This exception and category -/-/10 are not specified in IEC 115-1.

4.20.7 D.C. load (Applicable only to non-wirewound resistors)

At the end of the conditioning period, the resistors shall be subjected to the standard atmospheric conditions for recovery. The time of transfer shall be as short as possible and shall not in any case exceed 5 min. At  $30 \pm 5$  min after removal from the chamber for the damp heat, cyclic test, the resistors shall be subjected to a d.c. voltage for 1 min. The voltage shall be the rated voltage, or the limiting element voltage, whichever is the smaller. The resistors shall then be subjected to the standard atmospheric conditions for recovery for not less than 1 h and not more than 2 h.

4.20.8 Final measurements

The resistor shall then be visually examined. There shall be no visible damage and the marking shall be legible.

The resistance and (for insulated types only) the insulation resistance shall then be measured as specified in 4.4 and 4.5 respectively. The change of resistance with respect to the value measured in 4.20.1.2 shall not exceed the value prescribed in the detail specification.

The insulation resistance shall be not less than that prescribed in the detail specification.

4.21 Damp heat, steady state (IEC 115-1 Clause 24)

4.21.1 The resistance shall be measured as specified in 4.4.

4.21.2 The resistors shall be subjected to Test Ca of IEC 68-2-3, using the appropriate degree of severity prescribed in the detail specification.

4.21.2.1 Resistors which are normally mounted on or between metal plates, with or without additional insulation, or on printed wiring boards where the body of the resistor can be in contact with conductor lines shall be divided into three groups:

- (1) The first group shall be subjected to this test without voltage applied.
- (2) The second group shall be subjected to the test with a direct voltage between the terminations. The voltage to be applied shall be selected from the following series :

0 ; 4 ; 6,3 ; 10 and 16 V.

The voltage selected shall be the next lower value to that derived from a calculation of the voltage required so that the resistor is dissipating 0,01 times the rated dissipation, or 0,1 times the limiting element voltage, whichever is the smaller.

Throughout the period, the voltage shall be kept as closely as possible to the specified voltage, a tolerance of  $\pm 5\%$  is allowed for mains voltage fluctuations and similar factors.

- (3) The third group shall be subjected to the test under the following conditions:

All styles shall be connected by their terminations to flexible terminals. The spacing of the terminals shall be such that the length of each resistor termination is approximately 10 mm when measured from the connection with the supporting terminal to the resistor body. The sample units shall be covered with a V-shaped metal strap whose width is equal to the length of the resistor body as indicated in Figure 2A. The

strap shall be made of corrosion-resistant metal and shall be kept in contact with the resistor body by supporting the body, as indicated in Figure 2A, with a non-conducting, non-corrosive support whose width is small compared to the length of the body and which will not act as a moisture trap. The force exerted by the strap on the resistor body shall be  $(0,4 \pm 0,05) \text{ N}$ . The mounting straps may be individual for each resistor or continuous for all resistors. An example of a suitable test jig is given in Figure 2B.

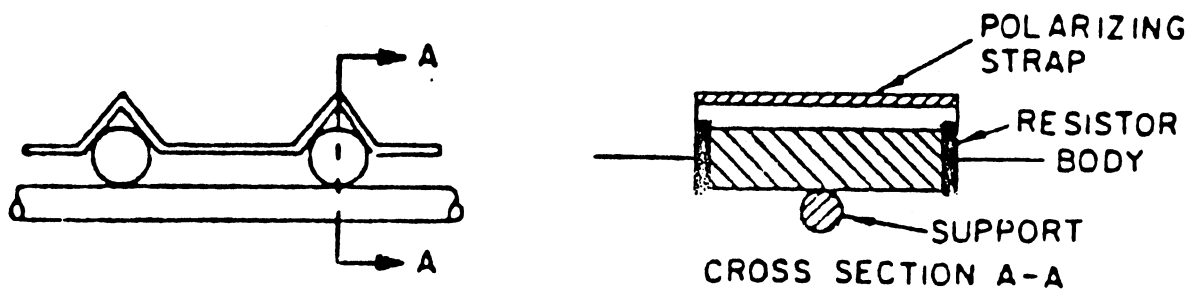
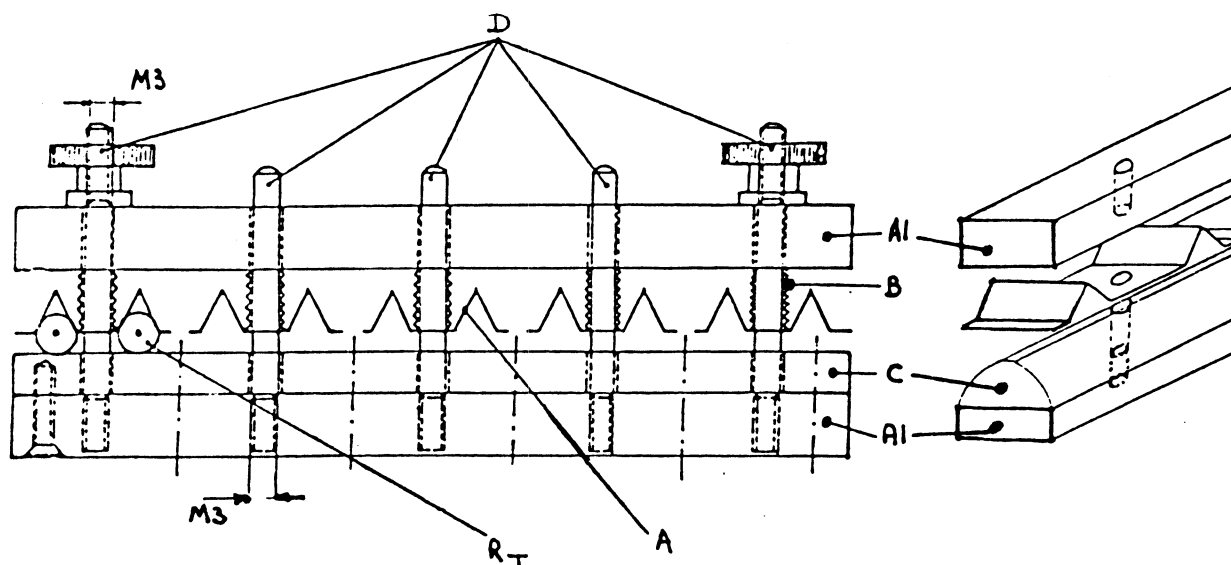


Figure 2A - Mounting Straps

During the test, a direct voltage of  $(20 \pm 2) \text{ V}$  shall be applied to the resistors. The voltage shall be applied with the positive lead connected to the resistor terminations tied together and the negative lead connected to the polarizing straps.



$R_T$  = Resistor under test

A = Mounting strap

B = Corrosion resistant spring

C = 'Nylatron' support

A1 = Aluminium supports

D = Corrosion resistant steel

Figure 2B - A suitable test jig for 10 resistors

4.21.2.2 For all other resistors, the resistors shall be divided into two groups and only the tests (1) and (2) of 4.21.2.1 shall be carried out.