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British Standard

**Harmonized system of quality  
assessment for electronic components:  
Sectional specification: Film resistor  
networks (Capability approval)**

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## National foreword

The British Standard has been prepared under the direction of the Electronic Components Standards Policy Committee. It is identical with CENELEC Electronics Committee (CECC) 64200 : 1988 'Harmonized System of quality assessment for electronic components : Sectional specification : Film resistor networks (Capability approval)'.

This standard is a harmonized specification within the CECC system.

**Cross-references.** The British Standard which implements CECC 00100 is BS 9000 'General requirements for a system for electronic components of assessed quality : Part 2 : 1983 'Specification for national implementation of CECC basic rules and rules of procedure'.

| International Standard* | Corresponding British Standard                                                                                                                          |
|-------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| IEC 68                  | BS 2011 Environmental testing<br>(Identical)                                                                                                            |
| CECC 64000 : 1988       | BS CECC 64000 : 1989 Harmonized system of quality assessment for electronic components<br>Generic specification : Film resistor networks<br>(Identical) |

The Technical Committee has reviewed the provisions of IEC 63 to which reference is made in the text and has decided that they are acceptable for use in conjunction with this standard. The related British Standard is BS 2488 'Schedule of preferred numbers for the resistance of resistors and capacitance of capacitors for telecommunications equipment'.

**Compliance with a British Standard does not in itself confer immunity from legal obligations.**

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\*Undated in the text.

Förderverein für Elektrotechnische Normung (FEN) e. V.  
Cenelec Electronic Components Committee

**CECC**

English version

Harmonized System of Quality Assessment for  
Electronic Components

SECTIONAL SPECIFICATION

# FILM RESISTOR NETWORKS

(CAPABILITY APPROVAL)

Système Harmonisé d'Assurance de la Qualité  
des Composants Electroniques

SPECIFICATION INTERMEDIAIRE

# RESEAUX RESISTIFS A COUCHES

(AGREMENT DE SAVOIR-FAIRE)

Harmonisiertes Gütebestätigungssystem für  
Bauelemente der Elektronik

RAHMENSPEZIFIKATION

# NETZWERKE AUS FESTWIDERSTÄNDEN IN SCHICHTTECHNIK

(ANERKENNUNG DER BEFÄHIGUNG)



**1**

Edition  
Issue  
Ausgabe

**CECC 64 200**

1988

**AVA** Documents  
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## 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 FILM AND HYBRID INTEGRATED CIRCUITS. It should be read in conjunction with the current regulations for the CECC System.

At the date of printing of this specification, the member countries of the CECC are Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom, and copies of it can be obtained from the addresses shown on the blue fly sheet.

## PREFACE

This specification was prepared by CECC WG 21 : "HYBRID MICRO-CIRCUITS".

It is based, wherever possible, on the Publications of the International Electrotechnical Commission.

The text of this specification was circulated to the CECC for voting in the document indicated below and was ratified by the President of the CECC for printing as a CECC Specification.

| <u>Document</u>       | <u>Date of voting</u> | <u>Report on the voting</u> |
|-----------------------|-----------------------|-----------------------------|
| CECC(Secretariat)1922 | May 1986              | CECC(Secretariat)2105       |

## SECTION 1

### SCOPE

This sectional specification applies to fixed film resistor networks the quality of which is assessed on the basis of capability approval.

The resistor elements may be individually isolated or interconnected in any circuit configuration.

It selects preferred values for ratings and characteristics, from the appropriate tests and measuring methods in the generic specification CECC 64 000 and gives general performance requirements to be used in detail specifications for resistor networks derived from this specification.

The concept of preferred values is directly applicable to catalogue products but does not necessarily apply to custom built products.

Resistor networks can be qualified to this specification or to CECC 63 200.

## SECTION 2

### GENERAL, PREFERRED CHARACTERISTICS, RATINGS AND SEVERITIES FOR ENVIRONMENTAL TESTS

#### 2.1 RELATED DOCUMENTS

|             |        |                                                                                                  |
|-------------|--------|--------------------------------------------------------------------------------------------------|
| IEC 63      | (1963) | Preferred number series for resistors and capacitors<br>Amendment 1 (1967)<br>Amendment 2 (1977) |
| IEC 68      | -      | Basic environmental testing procedures                                                           |
| CECC 64 000 | (1988) | Generic specification for fixed film resistor networks for use in electronic equipment           |

Note : The above references apply to the current editions except for IEC 68, for which the referenced edition in the applicable test clauses of CECC 64 000 shall be used.

#### 2.2 PREFERRED RATINGS AND CHARACTERISTICS

The values given in detail specifications shall preferably be selected from the following :

##### 2.2.1 Preferred climatic categories

The resistor networks covered by this document are classified into climatic categories according to the general rules given in IEC 68-1.

The lower and upper category temperature and the duration of the damp heat, steady state test shall be chosen from the following :

Lower category temperature : -55 °C, -40 °C and -25 °C

Upper category temperature : +85 °C, +100 °C, +125 °C and +155 °C

Duration of the damp heat, steady state test : 4, 10, 21 and 56 days.

The severities for the cold and dry heat tests are the lower and upper category temperatures respectively. Because of the construction of some resistor networks these temperatures will occur between two of the preferred temperatures given in IEC 68-2. In this event the nearest preferred temperature within the actual range of the resistor network shall be chosen for this severity.

### 2.2.2 Temperature coefficients and temperature characteristics of resistance

The preferred limits of change in resistance for the temperature characteristic of resistance test are given in Table 1.

Each line in the table gives the preferred temperature coefficient and corresponding temperature characteristic for 20 °C to 70 °C and limits of change and differential changes in resistance for the measurement of the temperature characteristic of resistance on the basis of the category temperature ranges of 2.2.1.

TABLE 1a - TEMPERATURE CHARACTERISTICS OF RESISTANCE

| Temp. coeff.         | Temp. char<br>20/70 °C | Temperature characteristic of resistance<br>(limits of percentage change in resistance) |               |                  |                                          |               |                  |                  |
|----------------------|------------------------|-----------------------------------------------------------------------------------------|---------------|------------------|------------------------------------------|---------------|------------------|------------------|
|                      |                        | Reference temp./<br>lower cat. temp.                                                    |               |                  | Reference temp./<br>upper category temp. |               |                  |                  |
| 10 <sup>-6</sup> /°C | %                      | +20/-55                                                                                 | +20/-40       | +20/-25          | +20/+85                                  | +20/+100      | +20/+125         | +20/+155         |
| - 150/<br>- 1500/    | - 0,75/<br>- 7,5       | + 1,13/<br>+11,3                                                                        | + 0,9/<br>+ 9 | + 0,68/<br>+ 6,8 | - 0,98/<br>- 9,8                         | - 1,2/<br>-12 | - 1,58/<br>-15,8 | - 2,03/<br>-20,3 |
| ± 250                | ± 1,25                 | ± 1,88                                                                                  | ± 1,5         | ± 1,13           | ± 1,62                                   | ± 2           | ± 2,62           | ± 3,38           |
| ± 100                | ± 0,5                  | ± 0,75                                                                                  | ± 0,6         | ± 0,45           | ± 0,65                                   | ± 0,8         | ± 1,05           | ± 1,35           |
| ± 50                 | ± 0,25                 | ± 0,375                                                                                 | ± 0,3         | ± 0,23           | ± 0,325                                  | ± 0,4         | ± 0,525          | ± 0,675          |
| ± 25                 | ± 0,125                | ± 0,188                                                                                 | ± 0,15        | ± 0,113          | ± 0,162                                  | ± 0,2         | ± 0,262          | ± 0,338          |
| ± 15                 | ± 0,075                | ± 0,113                                                                                 | ± 0,09        | ± 0,068          | ± 0,098                                  | ± 0,12        | ± 0,158          | ± 0,203          |

TABLE 1b - DIFFERENTIAL RESISTANCE/TEMPERATURE CHARACTERISTICS AND TEMPERATURE COEFFICIENTS

| Diff. temp. coeff.   | Diff. Res./Temp. characteristics<br>+ 20/70 °C | Differential resistance/temp. characteristics in % |         |         |                                          |          |          |          |
|----------------------|------------------------------------------------|----------------------------------------------------|---------|---------|------------------------------------------|----------|----------|----------|
|                      |                                                | Reference temp./<br>lower category temp.           |         |         | Reference temp./<br>upper category temp. |          |          |          |
| 10 <sup>-6</sup> /°C | %                                              | +20/-55                                            | +20/-40 | +20/-25 | +20/+85                                  | +20/+100 | +20/+125 | +20/+155 |
| ± 5                  | ± 0,025                                        | ± 0,038                                            | ± 0,03  | ± 0,023 | ± 0,033                                  | ± 0,04   | ± 0,052  | ± 0,068  |
| ± 10                 | ± 0,05                                         | ± 0,075                                            | ± 0,06  | ± 0,045 | ± 0,065                                  | ± 0,08   | ± 0,011  | ± 0,135  |
| ± 25                 | ± 0,13                                         | ± 0,188                                            | ± 0,15  | ± 0,113 | ± 0,162                                  | ± 0,2    | ± 0,262  | ± 0,338  |
| ± 50                 | ± 0,25                                         | ± 0,37                                             | ± 0,3   | ± 0,23  | ± 0,325                                  | ± 0,4    | ± 0,525  | ± 0,675  |
| ± 100                | ± 0,5                                          | ± 0,75                                             | ± 0,6   | ± 0,45  | ± 0,65                                   | ± 0,8    | ± 1,05   | ± 1,35   |
| ± 200                | ± 1                                            | ± 1,5                                              | ± 1,2   | ± 0,9   | ± 1,3                                    | ± 1,6    | ± 2,1    | ± 2,7    |

### 2.2.3 Limits for change in resistance

- For each stability class the preferred limits of change in resistance of any individual resistor element for each of the tests listed in the heading of Table 2 are as indicated.

TABLE 2

**Note :** The clause numbers in the heading of the table refer to CECC 64 000.

| Stability class in % | (LONG TERM TESTS)                                                                                                                                          | (SHORT TERM TESTS)                                                                                                                                              |
|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                      | 4.5.7 Climatic sequence<br>4.5.8 Damp heat, steady state<br>4.5.9 Endurance<br>4.5.10 Endurance at 70 °C<br>4.5.11 Endurance at upper category temperature | 4.4.8 Overload<br>4.5.1 Robustness of terminations<br>4.5.3 Resistance to soldering heat<br>4.5.4 Rapid change of temperature<br>4.5.5 Shock<br>4.5.6 Vibration |
| 10                   | $\pm (10 \% + 0,5 \Omega )$                                                                                                                                | $\pm (2 \% + 0,1 \Omega )$                                                                                                                                      |
| 5                    | $\pm (5 \% + 0,1 \Omega )$                                                                                                                                 | $\pm (1 \% + 0,05 \Omega )$                                                                                                                                     |
| 2                    | $\pm (2 \% + 0,1 \Omega )$                                                                                                                                 | $\pm (0,5 \% + 0,05 \Omega )$                                                                                                                                   |
| 1                    | $\pm (1 \% + 0,05 \Omega )$                                                                                                                                | $\pm (0,25 \% + 0,05 \Omega )$                                                                                                                                  |
| 0.5                  | $\pm (0,5 \% + 0,05 \Omega )$                                                                                                                              | $\pm (0,1 \% + 0,01 \Omega )$                                                                                                                                   |
| 0.25                 | $\pm (0,25 \% + 0,05 \Omega )$                                                                                                                             | $\pm (0,05 \% + 0,01 \Omega )$                                                                                                                                  |
| 0.1                  | $\pm (0,1 \% + 0,01 \Omega )$                                                                                                                              | $\pm (0,02 \% + 0,01 \Omega )$                                                                                                                                  |

- Differential resistance change

The preferred limits of differential resistance changes are :  
 $\pm 0,1 \%$ ;  $\pm 0,25 \%$ ;  $\pm 0,5 \%$ ;  $\pm 1 \%$ .

### 2.2.4 Functional characteristics

Depending on the function, the characteristics to be prescribed are different. Details related to function characteristics e.g. voltage division ratio, characteristic impedance, attenuation etc., shall be given in the relevant detail specification.

### 2.2.5 Preferred values of ratings

- Rated resistance

See 2.2.7 of CECC 64 000.

- Tolerances on rated resistance

$\pm 10 \%$ ,  $\pm 5 \%$ ,  $\pm 2 \%$ ,  $\pm 1 \%$ ,  $\pm 0,5 \%$ ,  $\pm 0,25 \%$  and  $\pm 0,05 \%$ .

- Tolerances on resistance ratio

The preferred tolerances on rated resistance ratio are :  
 $\pm 0,05 \%$ ;  $\pm 0,1 \%$ ;  $\pm 0,25 \%$ ;  $\pm 0,5 \%$ ;  $\pm 1 \%$ .

- Rated dissipation

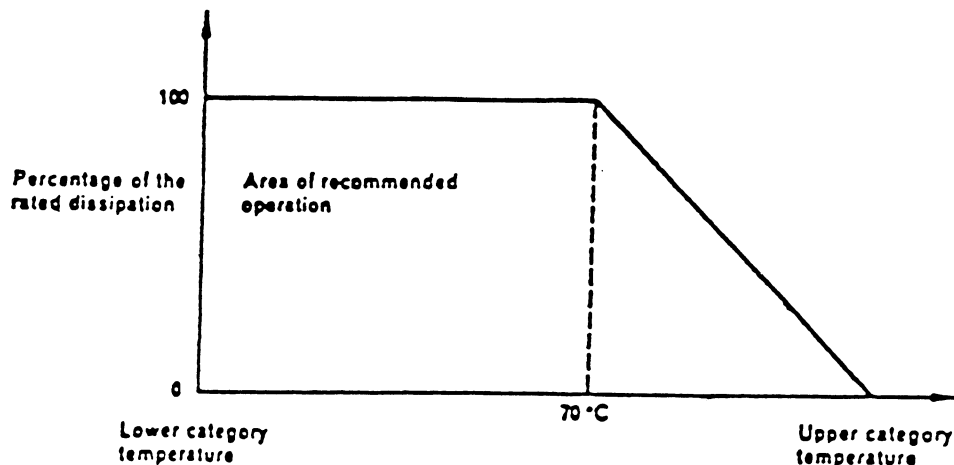
The preferred values of rated dissipation, at 70 °C, are :

For the network : 0,125 W, 0,25 W, 0,5 W, 1 W, 1,5 W, 2 W and 4 W.

For the resistor element : 0,05 W, 0,10 W, 0,25 W, 0,5 W and 1 W.

The detail specification shall prescribe the applicable value of rated dissipation for each resistor element in the network and also the maximum allowable total dissipation for the network.

The derated values of dissipation at temperatures in excess of 70 °C shall be as indicated by the following curve :



A larger area of operation may be given in the detail specification, provided it includes all the area given above. In this event the detail specification shall state the maximum allowable dissipation at temperatures other than 70 °C. All break points on the curve shall be verified by test.

- Limiting element voltage

The preferred values of limiting element voltage are :

10 V, 15 V, 25 V, 35 V, 50 V, 100 V and 500 V d.c. or a.c. r.m.s.

- Isolation voltage between individual resistor elements (when applicable)

The value of the isolation voltage between the individual resistor elements shall be given in the detail specification.

- Insulation resistance between individual resistor elements (when applicable)

The preferred minimum limit for insulation resistance between resistor elements shall be 1 G $\Omega$  unless otherwise prescribed in the detail specification.

## 2.3 INFORMATION TO BE GIVEN IN A DETAIL SPECIFICATION

Detail specifications shall be derived from the relevant blank detail specification.

If possible, a short description of the function of the network shall be given.

Detail specifications shall not specify requirements inferior to those of the Generic or Sectional specification. When more severe requirements are included, they shall be listed in the detail specification and indicated in the test schedules, for example by an asterisk.

**Note :** The informations given may, for convenience, be presented in tabular form.

The following information shall be given in each detail specification and the values quoted shall preferably be selected from those given in the appropriate clause of this sectional specification.

Each detail specification shall state all tests and measurements required for lot-by-lot inspection.

Environmental tests, measurements, severities and end points limits for periodic tests shall be included in the detail specification(s) for the CQC(s). They shall be in accordance with the applicable parts of CECC 64 000 and this specification.

### 2.3.1 Outline drawing and dimensions

There shall be an illustration of the network as an aid to easy recognition and for comparison of the network with others. Dimensions and their associated tolerances, which affect interchangeability and mounting, shall be given in the detail specification. All dimensions shall be stated in mm.

Normally numerical values shall be given for the length of the body, the width and height of the body and the termination spacing or for cylindrical types the body diameter, and the length and diameter of the terminations.

When necessary, for example when in a detail specification more than one package is covered, the dimensions and their associated tolerances shall be placed in a table below the drawing.

When the configuration is other than described above, the detail specification shall state such dimensional information as will adequately describe the resistor network.

### 2.3.2 Mounting

The detail specification shall specify the method of mounting to be applied for normal use and for the application of the vibration and the bump or shock tests. The resistor networks shall be mounted by their normal means. The design of the resistor network may be such that special mounting fixtures are required in its use. In this case the detail specification shall describe the mounting fixtures and they shall be used in the application of the vibration and bump or shock tests.

### 2.3.3 Style

For the purpose of this specification the style may be represented by a code which is arbitrarily chosen per detail specification and is generally based on dimensional factors. The style designation, therefore, has no meaning unless the number of the detail specification is also given.

### 2.3.4 Ratings and characteristics

The ratings and characteristics shall be in accordance with the relevant clauses of this specification.

The preferred values for rated resistance ranges are those of the E-series of IEC 63.

**Note** : When products approved to the detail specification have different ranges, the following statement should be added :  
"The range of values available in each style is given in the qualified products list".

### 2.3.5 Marking

The detail specification shall specify the content of the marking on the network and on the primary package. Deviations from 2.5 of CECC 64 000, shall be specifically stated.

### 2.3.6 Ordering information

The detail specification shall state that the following information is required when ordering resistor networks :

- 1) Network type e.g.: thick film resistor network
- 2) Number of the detail specification and issue reference and if appropriate style reference and assessment level
- 3) Function of the circuit if appropriate
- 4) Basic functional characteristics with tolerances, if appropriate.

### 2.3.7 Additional information (not for inspection purposes)

The detail specification may include information (which is not normally required to be verified by the inspection procedure), such as network diagrams, curves, drawings and notes needed for the clarification of the detail specification.

## 2.4 PREFERRED TEST SEVERITIES

Test severities given in detail specifications shall preferably be selected from the following :

### 2.4.1 Drying

Procedure I, 4.2.1(5) of CECC 64 000.

### 2.4.2 Vibration

4.5.6 of CECC 64 000 with the following details :

Frequency range : 10 to 500 Hz

Amplitude : 0,75 mm or acceleration  $98 \text{ m/s}^2$   
(whichever is the less severe)

Sweep endurance : Total duration: 6 h

The detail specification shall prescribe the mounting method to be used. (See 2.3.2)

The detail specification shall prescribe whether electrical measurements shall be made during vibration to check intermittent or open or short circuits.

### 2.4.3 Low air pressure

4.5.7(4) of CECC 64 000 with the following details :

Air pressure : 8,5 kPa (85 mbar)

### 2.4.4 Overload

4.4.8 of CECC 64 000 with the following details :

The detail specification shall specify the terminals between which the overload shall be applied and the magnitude of the load to be applied between such terminals.

### 2.4.5 Endurance at 70 °C

4.5.10 of CECC 64 000 with the following details :

When required, the detail specification shall specify how the load shall be applied to the network.

2.4.6 Insulation resistance between adjacent resistor elements (when applicable)

4.4.4 of CECC 64 000 with the following details :

The insulation resistance shall be measured between each isolated element and all other elements connected together. The measuring voltage shall be specified in the detail specification.

2.4.7 Voltage proof between adjacent resistor elements (when applicable)

4.4.5 of CECC 64 000 with the following details :

The voltage proof shall be made by testing between each isolated element and all other elements connected together.

2.4.8 Robustness of terminations

4.5.1 of CECC 64 000 with the following details :

Test  $U_a$  shall be applied to one out of each 5 terminations on the network. The terminations tested for each network shall be varied so that each termination position has been tested in the test part.

## SECTION 3

### CAPABILITY APPROVAL PROCEDURES

3.6 of CECC 64 000 applies with the following details :

#### 3.1 SELECTION OF CAPABILITY QUALIFYING CIRCUITS (CQCs)

- (1) The CQCs for approval testing shall be taken from the following sources :
  - Special circuits designed to qualify the design rules, processes and products. Terminations of film elements and added components shall be individually accessible for electrical measurement without influence from other circuit elements
  - Circuits intended for shipment to customers.

Any or all of these CQCs in combination with process test vehicles shall be adequate to assess the complete design rules, material and manufacturing processes, including any subcontracted process.
- (2) The CQCs shall be used to carry out the tests prescribed for initial capability approval and for periodic testing and hence to demonstrate to the ONS that :
  - Performance limits claimed for individual film element types are achieved
  - Environmental limits claimed for structures intended for shipment are met
  - The electrical function performances claimed in the capability manual (see Appendix B) and the detail specifications are met.
- (3) Circuits which have received qualification approval according to the sectional specifications CECC 64 100, may be counted as CQCs for the purposes of capability approval subject to ONS agreement on relevant structural similarity claims.
- (4) A manufacturer who has received capability approval is not debarred from obtaining a separate qualification approval for any individual circuit he makes, provided all appropriate testing in the sectional specification CECC 64 100 has been completed successfully.
- (5) A manufacturer using customer circuits among those selected as CQCs may vary the types tested according to his production plan. In this case the CQCs need not necessarily assess all the claimed boundaries of his capability all of the time, but they shall be representative of those released and assess all their important features.

His CQC selection shall be made available to the ONS every 3 months.
- (6) When production material divides into separate procedures or processes after a common process, for example, encapsulation, the common process can be assessed by a single sample.

### 3.2 STRUCTURAL SIMILARITY

- (1) The CQCs shall be selected by the Chief Inspector and agreed by the ONS before commencing the initial approval programme.
- (2) Rules for structural similarity applicable to the grouping of completed networks for electrical, dimensional and environmental (including mechanical) tests are given in Appendices A and C of this specification.
- (3) These rules shall be used to establish the basis of selection for initial approval. They shall also be used to determine whether new networks are within the existing approved Capability, or require its extension to enable their release.
- (4) Where CQCs are structurally similar for a test sequence, they may be grouped to form the required numbers in the test tables. Each test sequence has its own structural similarity rules and criteria (see Appendices A and C).

### 3.3 CAPABILITY APPROVAL

3.3.1 The procedures for capability approval are given in 3.6 of CECC 64 000.

The test tables for initial capability approval by CQCs, release of circuits (lot-by-lot tests) and for periodic tests collectively prescribe the minimum test programme on completed networks.

The manufacturer may select which assessment level D, E, F or G he wishes to include, but a manufacturer with approved capability may only release products as follows

| <u>Approval assessment level</u> | <u>Release assessment levels</u> |
|----------------------------------|----------------------------------|
| D                                | D, E, F or G                     |
| E                                | E, F or G                        |
| F                                | F or G                           |
| G                                | G                                |

A manufacturer may upgrade the assessment level of his approval by following the procedures given in CECC 64 000 and he may downgrade without further periodic testing until current test interval dates expire. In either case the ONS shall be notified.

Any additional tests required for specific applications shall be given in the detail specification and be subject to agreement between the customer and manufacturer.

The post-test electrical limits for the relevant environmental tests shall be given in the detail specification.

### 3.3.2 Initial Capability Approval - (Fixed sample size procedures)

#### (1) Sampling

The sample size and criteria of acceptability are as shown in Table 3.

When additional groups are introduced into the test schedule, the number of specimens required for Group "0" shall be increased by the same number as that required for the additional groups.

#### (2) Tests

Tests in Table 3 are intended to validate the design rules, materials, processes, piece parts and package range by testing all the CQCs and process test vehicles.

For each test group, different CQCs may be grouped together according to the structural similarity rules given in Appendix A, to reach the required number of samples for that group.

The complete series of tests specified in Table 3 are required for the approval of capability covered by the capability manual. The tests in each group shall be carried out in the given order.

The whole sample shall be subjected to the tests of Group "0" and then divided for the other groups.

Specimens found defective during the tests of Group "0" shall not be used for the other groups.

"One defective" is counted when a CQC has not satisfied the whole or a part of the tests of a group.

The approval is granted when the number of defectives does not exceed the specified number of permissible defectives for each group or sub-group and the total number of permissible defectives.

**TABLE 3 - TEST SCHEDULE FOR CAPABILITY APPROVAL**

**Notes :** 1. Sub-clause numbers of test and performance requirements refer to CECC 64 000 except for the functional characteristics, resistance ratio, differential resistance/ temperature characteristics, which refer to this specification. In these cases the clause number is given between brackets. Since performance requirements depend very much on the configuration of the network, they will be given by the detail specification.

The limits shown under "performance requirements" for the functional requirements following the environmental tests, are relative to those given for the corresponding functional requirements prior to the test.

Whenever appropriate these performance requirements shall be selected from the Tables 1, 1a and 2 of this specification.

2. In this Table : n = sample size  
                           c = group acceptance criterion (permitted number of defectives per group or sub-group)  
                           D = destructive  
                           ND = non-destructive

3. A total of 31 specimens is required for test; however the specimens for Group 4 are not to be included in Group 0.

| Sub-clause number<br>and Test<br>(see Note 1)    | D<br>or<br>ND | Conditions of test<br>(see Note 1) | Sample size<br>& criterion<br>of accepta-<br>bility(see<br>Note 2) |   | Performance<br>requirements<br><br>(see Note 1)                                   |
|--------------------------------------------------|---------------|------------------------------------|--------------------------------------------------------------------|---|-----------------------------------------------------------------------------------|
|                                                  |               |                                    | n                                                                  | c |                                                                                   |
| <u>Group 0</u>                                   | ND            |                                    | 26<br>(Note<br>3)                                                  | 1 |                                                                                   |
| 4.3.1 Visual examination                         |               |                                    |                                                                    |   | As in 4.3.1<br>Legible marking and<br>as specified in the<br>detail specification |
| 4.2.2 Dimensions (gauging)                       |               |                                    |                                                                    |   | As specified in the<br>detail specification                                       |
| 4.4.1 Resistance                                 |               |                                    |                                                                    |   | As in 4.4.1                                                                       |
| 4.4.3 Functional characteristics (if applicable) |               |                                    |                                                                    |   |                                                                                   |
| 4.4.2 Resistance ratio (if applicable)           |               |                                    |                                                                    |   | ... ± ... %                                                                       |
| 4.4.5 Voltage proof (Insulated networks only)    |               | Method : ...                       |                                                                    |   | As in 4.4.5                                                                       |

(Continued)

(Continuation)

| Sub-clause number<br>and Test<br>(see Note 1)                             | D<br>or<br>ND | Conditions of test<br>(see Note 1)                                                                                     | Sample size<br>& criterion<br>of accepta-<br>bility (see<br>Note 2) |    | Performance<br>requirements<br>(see Note 1)                                                                                                                            |
|---------------------------------------------------------------------------|---------------|------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                           |               |                                                                                                                        | n                                                                   | c  |                                                                                                                                                                        |
| <u>Group 1A</u><br><u>Half of the sample</u><br><u>of Group 1</u>         | D             |                                                                                                                        | 5                                                                   | 1* |                                                                                                                                                                        |
| 4.5.1 Robustness of terminations                                          |               | See 2.4.8 of this specification<br>Visual examination<br>Resistance                                                    |                                                                     |    | As in 4.5.1(a)<br>$\Delta R \leq \pm(\dots\%R + \dots\Omega)$                                                                                                          |
| 4.5.13 Resistance to soldering heat                                       |               | Resistance to soldering heat<br>(Solder bath method 1A)<br>Visual examination                                          |                                                                     |    | As in 4.5.13<br>$\Delta R \leq \pm(\dots\%R + \dots\Omega)$                                                                                                            |
| 4.4.6 Variation of resistance with temperature                            |               | Lower category temperature/20 °C<br><br>20 °C/upper category temperature                                               |                                                                     |    | $\frac{\Delta R}{R} \dots\% \text{ or } \alpha: \dots 10^{-6}/^{\circ}\text{C}$<br><br>$\frac{\Delta R}{R} \dots\% \text{ or } \alpha: \dots 10^{-6}/^{\circ}\text{C}$ |
| 2.3.22 Differential resistance/temperature characteristic (if applicable) |               | Lower category temperature/20 °C<br><br>20 °C/upper category temperature                                               |                                                                     |    | $\Delta R.T.C. \leq \dots\%$<br><br>$\Delta R.T.C. \leq \dots\%$                                                                                                       |
| 4.4.8 Overload                                                            |               | See 2.4.4 of this specification<br>Visual examination<br>Resistance                                                    |                                                                     |    | As in 4.4.8<br>$\Delta R \leq \pm(\dots\%R + \dots\Omega)$                                                                                                             |
| <u>Group 1B</u><br><u>Other half of the</u><br><u>sample of Group 1</u>   | D             |                                                                                                                        | 5                                                                   | 1* |                                                                                                                                                                        |
| 4.5.4 Rapid change of temperature                                         |               | $\theta_A$ : Lower category temperature<br>$\theta_B$ : Upper category temperature<br>Visual examination<br>Resistance |                                                                     |    | As in 4.5.4<br>$\Delta R \leq \pm(\dots\%R + \dots\Omega)$                                                                                                             |

(Continued)

\* Total number of permissible defectives for Group 1 including Group 1A and Group 1B shall not exceed 1.

(Continuation)

| Sub-clause number<br>and Test<br>(see Note 1)                                                                                                                                                  | D<br>or<br>ND | Conditions of test<br>(see Note 1)                                                                                                                                                                                        | Sample size<br>& criterion<br>of accepta-<br>bility (see<br>Note 2) |    | Performance<br>requirements<br>(see Note 1) |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|----|---------------------------------------------|
|                                                                                                                                                                                                |               |                                                                                                                                                                                                                           | n                                                                   | c  |                                             |
| 4.5.6 Vibration                                                                                                                                                                                |               | For mounting method<br>see detail spec.<br>Procedure B4<br>Frequency range :<br>10 Hz to 500 Hz<br>Amplitude : 0,75 mm<br>or acceleration<br>98 m/s <sup>2</sup> , whichever<br>is the less severe<br>Total duration : 6h |                                                                     |    |                                             |
|                                                                                                                                                                                                |               | Visual examination                                                                                                                                                                                                        |                                                                     |    | As in 4.5.6                                 |
|                                                                                                                                                                                                |               | Resistance                                                                                                                                                                                                                |                                                                     |    | $\Delta R \leq \pm (... \% R + ... \Omega)$ |
| <u>Group 1</u><br><u>All specimens of the</u><br><u>sample of Group 1</u>                                                                                                                      | D             |                                                                                                                                                                                                                           | 10                                                                  | 1* |                                             |
| 4.5.7 Climatic<br>sequence<br>- Dry heat,<br>- Damp heat<br>cyclic, Test<br>Db, first<br>cycle<br>- Cold<br>- Low air<br>pressure<br>- Damp heat,<br>cyclic, Test<br>Db, remain-<br>ing cycles |               | 8,5 kPa (85 mbar)                                                                                                                                                                                                         |                                                                     |    |                                             |
|                                                                                                                                                                                                |               | Visual examination                                                                                                                                                                                                        |                                                                     |    | As in 4.5.7                                 |
|                                                                                                                                                                                                |               | Resistance                                                                                                                                                                                                                |                                                                     |    | $\Delta R \leq \pm (... \% R + ... \Omega)$ |
|                                                                                                                                                                                                |               | Insulation resis-<br>tance between<br>resistor elements<br>(if applicable), see<br>2.4.6 of this spec.<br>Meas. volt. ....V                                                                                               |                                                                     |    | $R \geq 1 \text{ G}\Omega$                  |
|                                                                                                                                                                                                |               | Voltage proof<br>between resistor<br>elements (if appli-<br>cable), see 2.4.7<br>of this spec.                                                                                                                            |                                                                     |    | As in 4.4.5                                 |

(Continued)

\* Total number of permissible defectives for Group 1 including Group 1A and Group 1B shall not exceed 1.

(Continuation)

| Sub-clause number<br>and Test<br>(see Note 1)                                                     | D<br>or<br>ND | Conditions of test<br>(see Note 1)                                                                                                                                                                                                       | Sample size<br>& criterion<br>of accepta-<br>bility (see<br>Note 2) |   | Performance<br>requirements<br>(see Note 1)     |
|---------------------------------------------------------------------------------------------------|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|---|-------------------------------------------------|
|                                                                                                   |               |                                                                                                                                                                                                                                          | n                                                                   | c |                                                 |
|                                                                                                   |               | Visual examination                                                                                                                                                                                                                       |                                                                     |   |                                                 |
|                                                                                                   |               | Resistance                                                                                                                                                                                                                               |                                                                     |   |                                                 |
|                                                                                                   |               | Differential<br>resistance change<br>(if applicable)                                                                                                                                                                                     |                                                                     |   |                                                 |
| <u>Group 2</u><br>4.5.8 Damp heat,<br>steady state                                                | D             | Visual examination                                                                                                                                                                                                                       | 6                                                                   | 1 |                                                 |
|                                                                                                   |               | Resistance                                                                                                                                                                                                                               |                                                                     |   | $\Delta R \leq \pm(\dots\%R + \dots\Omega)$     |
|                                                                                                   |               | Insulation resis-<br>tance between<br>resistor elements<br>(if applicable),<br>see 2.4.6 of this<br>specification<br>Meas. volt. :...V<br>Voltage proof<br>between resistor<br>elements (if appli-<br>cable), see 2.4.7<br>of this spec. |                                                                     |   | $R \geq 1\text{ G}\Omega$                       |
| <u>Group 3A</u><br><u>Half of the sample</u><br><u>of Group 3</u><br>4.5.10 Endurance at<br>70 °C | D             | See 2.4.5 of this<br>specification<br>Duration : 1000 h<br>Examination at 48 h<br>500 h and 1000 h :                                                                                                                                     | 5                                                                   | 1 |                                                 |
|                                                                                                   |               | Visual examination                                                                                                                                                                                                                       |                                                                     |   |                                                 |
|                                                                                                   |               | Resistance                                                                                                                                                                                                                               |                                                                     |   | $\Delta R \leq \pm(\dots\%R + \dots\Omega)$     |
|                                                                                                   |               | Insulation resis-<br>tance between<br>resistor elements<br>(if applicable), see<br>2.4.6 of this spec.<br>Meas. volt. :...V<br>Differential<br>resistance change<br>(if applicable)                                                      |                                                                     |   | $R \geq 1\text{ G}\Omega$<br><br>$\leq \dots\%$ |

(Continuation)

| Sub-clause number<br>and Test<br>(see Note 1)                                                                                          | D<br>or<br>ND | Conditions of test<br>(see Note 1)                                                                                                                                                                                                                                                                                      | Sample size<br>& criterion<br>of accepta-<br>bility (see<br>Note 2) |   | Performance<br>requirements<br>(see Note 1)                                             |
|----------------------------------------------------------------------------------------------------------------------------------------|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|---|-----------------------------------------------------------------------------------------|
|                                                                                                                                        |               |                                                                                                                                                                                                                                                                                                                         | n                                                                   | c |                                                                                         |
| <u>Group 3B</u><br><u>Other half of the</u><br><u>sample of Group 3</u><br>4.5.11 Endurance at<br>upper cate-<br>gory tempe-<br>rature | D             | Duration : 1000 h<br>Examination at 48h,<br>500 h and 1000 h :<br>Visual examination<br>Resistance<br>Differential<br>resistance change<br>(if applicable)<br>Examination at<br>1000 h :<br>Insulation resis-<br>tance between<br>resistor elements<br>(if applicable), see<br>2.4.6 of this spec.<br>Meas. volt. ....V | 5                                                                   | 1 | $\Delta R \leq \pm (... \% R + ... \Omega)$ $\leq ... \%$<br>$R \geq 1 \text{ G}\Omega$ |
| <u>Group 4</u><br>4.5.2 Solderability                                                                                                  | D             | Without ageing<br>Method : ...                                                                                                                                                                                                                                                                                          | 5                                                                   | 1 |                                                                                         |

### 3.3.3 Maintenance of capability approval

#### (1) 100% screening and lot-by-lot acceptance tests

Testing on a lot-by-lot basis, including 100% screening (if prescribed) for all networks intended for release to customers is prescribed in the blank detail specification, Table 2.

For Group A and B tests, the sample shall be collected from one week's production, or such other period as declared by the manufacturer up to a maximum of one month.

#### (2) Periodic tests

The periodic tests for CQCs are prescribed in the blank detail specification, Table 2.

Where customer circuits are used as CQCs, samples for periodic testing shall be drawn from lots which have passed the tests of 100% screening when appropriate and lot-by-lot inspection.

#### (3) Tests

The complete series of tests specified in the blank detail specification are required for the maintenance of capability approval.

The tests in each group shall be carried out in the order given.

"One defective" is counted when a circuit has not satisfied the whole or a part of the tests of a group.

The approval is maintained when the number of defectives does not exceed the specified number of permissible defectives for each group and the total number of permissible defectives.

### 3.3.4 Quality Conformance Inspection

#### (1) Test schedule

The schedule for the lot-by-lot and periodic tests for quality conformance inspection is given in Section 2, Table 2 of the blank detail specification.

#### (2) Assessment levels

The assessment level(s) given in the blank detail specification shall preferably be selected from the following Tables 4A and 4B :

TABLE 4A

In this table : IL = inspection level  
AQL = acceptable quality level

| Inspection<br>sub-group<br>(2) | D (1) |          | E   |          | F (2) |          | G (2) |          |
|--------------------------------|-------|----------|-----|----------|-------|----------|-------|----------|
|                                | IL    | AQL<br>% | IL  | AQL<br>% | IL    | AQL<br>% | IL    | AQL<br>% |
| A1                             |       |          | S-4 | 1,0      |       |          |       |          |
| A2                             |       |          | S-4 | 1,0      |       |          |       |          |