
Radio-frequency connectors

Part 1. Specification for general requirements and measuring methods

[IEC title: 'Radio-frequency connectors'
Part 1 'General requirements and measuring methods']

Connecteurs pour fréquences radioélectriques
Partie 1. Spécification pour règles générales et méthodes de mesure

Hochfrequenzverbindungsstücke
Teil 1. Spezifikation für allgemeine Anforderungen und Meßverfahren

Foreword

This Part of this British Standard is identical with IEC Publication 169-1 'Radio-frequency connectors' Part 1 : 1965 'General requirements and measuring methods'. It has been prepared under the direction of the Electrical Components Standards Committee.

The previous 1958 edition of BS 3041 is superseded by Part 2 of this standard, whereas this Part 1 is intended to apply generally to radio-frequency connectors.

Terminology. The text of the IEC Publication has been accepted as suitable for publication, without deviation, as a British Standard. Certain terminology is used, however, that is not identical with that used in British Standards. Attention is therefore drawn to the following.

Wherever the word 'Recommendation', relating to this publication, appears, it should be interpreted as 'British Standard'.

Cross references. For each of the following references to other IEC Publications that are given in the text, there is an equivalent British Standard; these are as listed below.

Reference to IEC Publication	Equivalent British Standard
IEC 68 Basic environmental testing procedures	BS 2011 Basic environmental testing procedures
IEC 68-2-1 : 1974 Tests A: Cold	Part 2.1 A : 1977 Cold
IEC 68-2-2 : 1974 Tests B: Dry heat	Part 2.1 B : 1977 Dry heat
IEC 68-2-3 : 1960 Test C: Damp heat (long term exposure)*	Part 2.1 Ca : 1977 Damp heat, steady state
IEC 68-2-4 : 1960 Test D: Accelerated damp heat	Part 2.1 Da : 1977 Accelerated damp heat
IEC 68-2-5 : 1960 Test Fb: Fatigue†	Part 2.1 Fc : 1977 Vibration (sinusoidal)
IEC 68-2-10 : 1968 Test J: Mould growth	Part 2.1 J : 1977 Mould growth
IEC 68-2-11 : 1964 Test Ka: Salt mist	Part 2.1 Ka : 1977 Salt mist
IEC 68-2-12 Test L: Dust‡	Part 2.1 L Dust‡
IEC 68-2-13 : 1966 Test M: Low air pressure	Part 2.1 M : 1977 Low air pressure
IEC 68-2-14 : 1969 Test Na: Change of temperature	Part 2.1 N : 1977 Change of temperature
IEC 68-2-17 : 1968 Test Q : Sealing§	Part 2.1 Q : 1977 Sealing§
IEC 68-2-20 : 1968 Test T: Soldering	Part 2.1 T : 1977 Soldering
IEC 68-2-21 : 1975 Test U: Robustness of terminations and integral mounting devices	Part 2.1 U : 1977 Robustness of terminations and integral mounting devices

*Withdrawn; superseded by Test Ca : Damp heat, steady state (1969).

†Withdrawn; superseded by Test Fc : Vibration (Sinusoidal) (1970).

‡In course of preparation.

§ The specific test applicable for the purposes of this British Standard is Test Qa.

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British Standard

Radio-frequency connectors

Part 1. Specification for general requirements and measuring methods

CHAPTER 1: GENERAL

1. Scope

This Recommendation relates to connectors for r.f. transmission lines for use with electronic equipment.

2. Object

To establish uniform requirements for:

- a) the electrical, climatic and mechanical properties as well as safety aspects;
- b) test methods;
- c) interchangeability and compatibility both between connectors and between connectors and cables;
- d) classification of connectors into groups according to their ability to withstand extremes of temperature and humidity.

3. Terminology

3.1 *Connector*

A component, normally attached to a cable or to a piece of apparatus for the purpose of providing connection(s) through a suitable mating part between cables and/or pieces of apparatus.

3.2 *Free connector*

A connector, designed for attachment to a free end of a cable.

3.3 *Fixed connector*

A connector, designed for attachment to a chassis or a piece of apparatus.

3.4 *Adaptor*

A component designed to provide connection(s) between two or more other connectors where mechanical direct connection is impossible or electrical direct connection is undesirable.

3.5 *Mated set of connectors*

A mated pair of connectors designed to be mated with each other.

3.6 *Sub-division of connectors*

Connectors can further be sub-divided by reference to:

- a) their inner mating contacts (e.g. pin or socket);
- b) their outer electrical mating contacts (e.g. pin or socket);
- c) the type of locking device (e.g. screw or bayonet).

Note. — In all cases a socket is that part where the electrical contact is made on the inner surface, and a pin where the electrical contact is made on the outer surface.

3.7 *Reflection coefficient and voltage standing wave ratio (v.s.w.r.)*

Where the terms reflection coefficient and v.s.w.r. are used in this document they refer to the properties measured on a mated pair of connectors and determined according to the specified measuring method.

Note. — For the relation between the reflection coefficient and v.s.w.r. the following equation is applicable:

$$\text{v.s.w.r.} = \frac{1 + |r|}{1 - |r|}$$

where $|r|$ is the magnitude of the voltage reflection coefficient.

3.8 *Type*

A type comprises products having similar design features manufactured by the same techniques and falling within the manufacturer's usual range of ratings for these products.

Notes 1.) — Mounting accessories are ignored, provided they have no significant effect on the test results.

2.) — Ratings cover the combination of:

- a) electrical ratings;
- b) sizes;
- c) environmental group.

3.) — The limits of the range of ratings shall be agreed between customer and manufacturer.

3.9 *Type test*

The type test of a product is the complete series of tests to be carried out on a number of specimens representative of the type, with the object of determining whether a particular manufacturer can be considered to be able to produce products meeting the specification.

3.10 *Type approval**

Type approval is the decision by the proper authority (the customer himself or his nominee) that a particular manufacturer can be considered to be able to produce in reasonable quantities the type meeting the specification.

* As this Recommendation only covers type tests, these definitions are included solely for information.

3.11 *Acceptance tests**

Acceptance tests are tests carried out to determine the acceptability of a consignment on a basis of an agreement between customer and manufacturer. The agreement shall cover:

- a) the sample size;
- b) the selection of tests;
- c) the extent to which the test specimens shall conform to the requirements for the selected tests of the specification.

Note. — In cases of divergent test results the IEC standard test methods shall be used for acceptance tests.

3.12 *Factory tests**

Factory tests are those tests carried out by the manufacturer to verify that his products meet the specification.

4. **Classification into groups**

Connectors are classified into groups according to the general rules which are given in IEC Publication 68.

The following preferred groups have been selected:

GROUP
55 / 200 / 56
55 / 100 / 56
40 / 100 / 56
40 / 100 / 21
25 / 070 / 56
25 / 070 / 21
10 / 070 / 04

Notes 1.) — All the tests and the order in which they shall be made for each group are specified in Appendix A.

2.) — When other groups are necessary the relevant sheet may deviate from this clause.

5. **Electrical ratings**

For each type of connector, the electrical ratings shall be specified by the relevant sheet.

6. **Electrical and mechanical requirements**

For each type of connector, the electrical and mechanical requirements shall be specified by the relevant sheet.

* As this Recommendation only covers type tests, these definitions are included solely for information.

7. Construction

The dimensions of the cable entry shall be so chosen as to permit the introduction of the complete appropriate cable, including its sheath. It shall be possible to connect the inner conductor of the cable to the inner contact of the connector without deformation of the dielectric or centre conductor of the cable or connector or deterioration of the electrical properties of the insulation or of the resilient properties of flexible contacts.

There shall be no possibility of significant electrolytic corrosion of metal parts in contact with each other.

Metal parts shall be free of burrs. Plating shall be free of burning and flaking, particularly for internal surfaces.

Insulators shall be free of embedded foreign particles or voids.

It shall be possible to secure the outer conductor of the cable to the connector in such a way that good electrical and mechanical contact is obtained preferably by means of clamping, and so that bending of the cable does not affect the electrical characteristics.

8. Marking

8.1 When space permits, each connector shall have the following information clearly and indelibly marked upon it:

- a) IEC type designation;
- b) mark of origin (manufacturer's name or trade mark).

8.2 In addition, these indications shall be marked on the package.

9. IEC type designation

Connectors to which this Recommendation applies shall be designated by the following indications and in the order given:

- a) the number of the relevant sheet;
- b) the letters "IEC";
- c) additional identification as specified by the relevant sheet.

Note. — When an IEC type designation is used, either for the marking of the product or in a description of the product, it is the responsibility of the manufacturer to ensure that the item meets the requirements of the relevant specification. The IEC as a body cannot accept responsibility in this matter.

CHAPTER II: GENERAL REQUIREMENTS FOR TESTS AND MEASURING METHODS

10. Type tests

This Recommendation covers procedures for type tests only.

The schedule showing all possible tests and the order of their application is given in Appendix A. The relevant sheets shall specify which of these tests have to be applied to the product under consideration.

The samples shall be representative of the range of values of the type under consideration.

The appropriate number of specimens to be tested shall be agreed upon between customer and supplier (see note).

The minimum number of specimens to be subjected to any single test shall be not less than five.

This Recommendation does not specify the number of permissible failures; this is considered to be the prerogative of the authority giving type approval.

Note. — Part of a full range, or individual values, shown in this Recommendation may be submitted to these tests in order to gain a limited approval.

11. Standard conditions for testing

11.1 Unless otherwise specified, all tests shall be carried out under standard atmospheric conditions for testing as specified by IEC Publication 68. Before the measurements are made, the connectors shall be preconditioned under standard atmospheric conditions for testing for a time sufficient to allow the entire connector to reach thermal stability.

The ambient temperature and relative humidity at which the measurements are made shall be stated in the test report.

11.2 The tests shall be carried out with connectors as received from the supplier. In no case shall the contact parts be cleaned or otherwise prepared prior to tests, unless explicitly required.

11.3 When “mounting” is specified in a test, the connector shall be rigidly mounted on a metal plate using a clamp for free connectors or the normal fixing for fixed connectors.

The dimensions of the mounting plate shall be such that the contour of the specimen is exceeded.

12. Visual inspection

Visual inspection shall include a check on:

- a) The marking;
it shall be in accordance with Clause 8 and be legible after any of the specified tests.
- b) The manufacture;
it shall have been carried out in a careful and workmanlike manner.
- c) Deterioration after electrical, mechanical and climatic tests;
unless otherwise specified, there shall be no visible deterioration.

When necessary during type tests (e.g. for the inspection of the contact elements), connectors shall be partially dismantled according to normal practice for soldering or wiring the connections.

13. Dimensions

The dimensions shall be checked and shall comply with those specified by the relevant sheet.

Any suitable method may be used, except that gauges must be used where specified by the relevant sheet.

14. Electrical tests

14.1 *Reflection coefficient*

14.1.1 The quantity used to represent the reflection characteristics of a connector shall be the reflection coefficient measured on a connector pair consisting of the connector under test mated with a standard electrical connector.

Each specification sheet for a given type of connector shall also include the necessary details for the standard electrical connector which has to be used for the tests for that particular type of connector.

No deliberate modifications introduced for compensation of reflection shall appear in that section of the standard electrical connector within the range of the compatibility dimensions.

The mounting of the cable shall be in accordance with the instructions given by the connector manufacturer.

The cable to be used shall preferably be of the close-tolerance type as specified by the relevant cable specification.

All parts of the measuring circuit shall be so chosen that the introduction of discontinuities is avoided as far as possible.

14.1.2 The accuracy of the measurement and the frequency range over which the measurement has to be carried out shall be specified by the relevant sheet.

Note. — It should be noted that in practice mated sets of connectors, conforming to the above, may show a reflection coefficient deviating from the value found when measured with the standard electrical connector. The maximum of this deviation is a function of the results obtained by the standard test method.

14.1.3 Details of the measuring method are still under consideration.

Note. — In Appendix B some further information regarding this measurement is given as general guidance for the time being.

14.1.4 The reflection coefficient shall not exceed the value specified by the relevant sheet.

14.1.5 *Summary*

When this test is required by the relevant sheet, the following details shall be specified:

- a) necessary characteristics of the appropriate cable;
- b) frequency range in which the measurements have to be carried out;
- c) measuring accuracy;
- d) details of the standard electrical connector;
- e) any deviation from the standard test method.

14.2 *Power rating*

Under consideration.

14.3 *Contact resistance*

14.3.1 *General measuring requirements*

Measurement may be carried out with direct current or alternating current.

In the case of dispute the d.c. measurement shall govern. The contact resistance shall normally be calculated from the potential difference measured between the points intended for connection of the cable. The contact shall be made before the measuring voltage is applied.

In order to prevent the breakdown of insulating films on the contacts, the e.m.f. of the measuring circuit shall not exceed 20 mV (d.c. or a.c. peak).

In order to prevent undue heating of the contacts, the current flowing shall not exceed 1 A or the value specified by the relevant sheet.

Both for a.c. and d.c. the measuring apparatus shall be such as to ensure an accuracy of $\pm 10\%$.

For a.c. measurements the frequency shall be 1 kHz (kc/s) ± 200 Hz (c/s).

For each type of connector there are two series of measurements:

- a) determination of the mean value from a number of measurements of the total contact resistance (R_1) of mated sets of connectors;
- b) determination of the mean value from a number of measurements of the contact resistance (R_2) of resilient inner and outer conductor contacts individually.

Measurements a) and b) shall not be carried out on the same specimen.

14.3.2 *Measuring cycle*

14.3.2.1 *Measurement with d.c.*

One measuring cycle consists of:

- a) making the contact;
- b) connection of voltage source;
- c) measurement with current flowing in one direction;
- d) measurement with current flowing in the opposite direction;
- e) disconnection of voltage source;
- f) breaking the contact.

14.3.2.2 *Measurement with a.c.*

One measuring cycle consists of:

- a) making the contact;
- b) connection of voltage source;
- c) measurement;
- d) disconnection of voltage source;
- e) breaking the contact.

14.3.2.3 *Measuring cycles shall be carried out in immediate succession.*