

Specification for

Radio frequency connectors of assessed quality: Generic data and methods of test

UDC 621.315.21:621.315.683:621.391.31.029.5

NO COPYING WITHOUT BSI PERMISSION EXCEPT AS PERMITTED BY COPYRIGHT LAW



Document Sharing Hub

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Electronic Components Standards Committee (ECL/-) to Technical Committee ECL/6 upon which the following bodies were represented:

- British Plastics Federation
- British Telecommunications
- Crown Agents for Overseas Governments and Administrations
- Electric Cable Makers' Confederation
- Home Telephone Cable Makers' Association (1960)
- Ministry of Defence
- Society of British Aerospace Companies Limited

The following bodies were also represented in the drafting of the standard, through subcommittees and panels:

- Association of Manufacturers Allied to the Electrical and Electronic Industry (BEAMA)
- Electronic Components Industry Federation
- Electronic Engineering Association
- National Supervising Inspectorate
- Society of Cable Television Engineers
- United Kingdom Atomic Energy Authority

This British Standard, having been prepared under the direction of the Electronic Components Standards Committee, was published under the authority of the Board of BSI and comes into effect on 31 May 1984

© BSI 02-2000

First published March 1971
First revision May 1984

The following BSI references relate to the work on this standard:
Committee reference ECL/6
Draft for comment 82/28215 DC

ISBN 0 580 13528 4

Amendments issued since publication

Amd. No.	Date of issue	Comments
5015	September 1986	
5869	May 1990	
6629	September 1991	
7654	July 1993	Indicated by a sideline in the margin

Contents

	Page
Committees responsible	Inside front cover
Foreword	v
Section 1. Principles and mandatory procedure	
1.1 General matters	1
1.1.1 Scope	1
1.1.2 Related documents	1
1.1.3 Terminology	1
1.1.4 Letter symbols, signs and abbreviations	4
1.1.5 Graphical symbols	4
1.1.6 Marking	4
1.1.7 Eligibility for qualification approval	4
1.1.8 Structurally similar components	4
1.1.9 Delayed delivery	4
1.1.10 Supplementary procedure for qualification approval	4
1.1.11 Certified test records	5
1.1.12 Ratings and characteristics	5
1.1.13 Unchecked parameters	6
1.1.14 Procedure to be followed in the event of failures at group C or group D inspection	6
1.1.15 Ordering information	6
1.1.16 Drawings included in detail specification	6
1.2 Test procedures	6
1.2.1 Measurement and recovery conditions	6
1.2.2 Visual inspection	7
1.2.3 Dimensioning and gauging procedures	7
1.2.4 Electrical test procedures	7
1.2.5 Mechanical test procedures	9
1.2.6 Environmental test procedures	11
1.2.7 Endurance test procedures	15
1.2.8 Resistance to contaminating fluids	15
Section 2. Rules for the preparation of detail specifications	
2.1 Basic information	16
2.1.1 General	16
2.1.2 Originator	16
2.1.3 Specification number	16
2.1.4 Description of the component and intended application	16
2.1.5 Drawings	16
2.1.6 Ratings (including limiting conditions of use)	17
2.1.7 Characteristics	17
2.1.8 Related documents	17
2.1.9 Additional information (not for inspection purposes)	17
2.2 Inspection requirements	17
2.2.1 General	17
2.2.2 Group A inspection	17
2.2.3 Group B inspection	17
2.2.4 Group C inspection	18
2.2.5 Group D inspection	18
2.2.6 Connector variants	18

	Page
2.3 Certified test records	18
2.3.1 General	18
2.3.2 General information	18
2.3.3 Attributes information	18
2.3.4 Measurements information	18
2.3.5 Explanatory information	18
2.4 Instructions for ordering components	18
Section 3. Capability approval procedures	
3.1 General	22
3.2 Approval procedures	22
3.2.1 Capability manual	22
3.2.2 Primary stage of manufacture	22
3.2.3 Subcontracting	22
3.2.4 Rework	22
3.2.5 Screening test requirements	22
3.2.6 Capability Qualifying Components (CQCs)	22
3.2.7 Demonstration of capability	22
3.2.8 Test procedures	22
3.3 Boundaries and limits of approval	23
3.3.1 General	23
3.3.2 Electrical and mechanical attributes	23
3.3.3 Environmental attributes	23
3.3.4 Materials	23
3.3.5 Method of defining boundaries and limits of approval	23
3.4 Extension of range of approval	24
3.5 Maintenance of capability approval	24
3.6 Quality conformance inspection	24
3.7 Abstract of description of capability	24
3.8 Guidance to customers	24
3.8.1 General	24
3.8.2 Manufacturer's guidance to customers	24
3.8.3 Customer detail specification	24
3.8.4 Ordering information	24
Appendix A Guidance for the completion of blank detail specifications for the preparation of customer detail specifications or detail specifications for standard catalogue items	25
Appendix B Example of a certified test record	29
Appendix C Measurement of reflection factor	30
Appendix D Measuring method for r.f. shunt resistance	41
Appendix E	42
Appendix F Dust testing apparatus	42
Appendix G Typical tool for damage by test prod	44
Appendix H Suitable apparatus for monitoring electrical continuity	45
Appendix J List of contaminating fluids	45
Appendix K Guide to the presentation of drawing information	45
Appendix L	50
Appendix M Screening effectiveness test details	50

	Page
Appendix N Style reference numbers and designation of variants	51
Appendix P Connector variant suffix letters denoting r.f. cable grouping for use with both soldered and crimp connectors and relevant die size for crimp connectors	53
Appendix Q Example of groupings of style/variant combinations for qualification approval	60
Appendix R Guidance for the selection of CQCs	65
Appendix S Blank CQC specification for complete radio frequency connectors	68
Figure 1 — Bridge coupler or slotted line method without error recognition	31
Figure 2 — Measuring set-up for two connector procedure	31
Figure 3 — Voltage on slotted line as a function of frequency with probe position as parameter	32
Figure 4 — Bridge method with error recognition	33
Figure 5 — Complexor (phasor) diagram, according to set-up in Figure 4	33
Figure 6 — Return loss measurement, example according to set-up in Figure 4	35
Figure 7 — Detail A from Figure 6	35
Figure 8 — Extraction of r_c	36
Figure 9 — Broadband impedance discontinuity	36
Figure 10 — Example of a time domain reflectometer measurement recording	39
Figure 11 — Equipment set-up for the measurement of reflection in time domain	40
Figure 12 — Typical resonance curves	42
Figure 13 — Suitable measuring device for use during exposure to dust test	43
Figure 14 — Typical contact test prod	44
Figure 15 — Standardized system of lettering for fixed and free connector specification drawings (third angle projection)	48
Figure 16 — Standardized system of lettering for connector, fixed, right angle, solder bucket (style 12-03) specification drawings (third angle projection)	49
Figure 17 — Standardized system of lettering for cable-braid clamp, fixed, straight, single-hole mounting (style 21-12) specification drawings (third angle projection)	50
Figure 18 — Standardized system of lettering for adaptor connector fixed, straight, 4-hole fixing (style 20-05) specification drawings (third angle projection)	50
Figure 19 — Example process flow chart	67
Table 1 — Inspection requirements for basic assessment level	19
Table 2 — Inspection requirements for full assessment level	20
Table 3 — Setting-up and verification of equipment, selection of suitable elements and lines for use during subsequent measurements	38
Table 4 — Methods without error recognition according to C.1.2	39
Table 5 — Methods with error recognition according to C.1.3	40
Table N.1 — Style reference numbers (first two digits)	51
Table N.2 — Style reference numbers (third and fourth digits)	52
Table N.3 — Identification of variants	53

	Page
Table 6 — Flexible coaxial cables with 50 Ω impedance	54
Table 7 — Flexible coaxial cables with 75 Ω impedance	56
Table 8 — Flexible coaxial cables with 95 Ω impedance	57
Table 9 — Flexible coaxial cables with 100 Ω impedance	57
Table 10 — Flexible coaxial cables with 125 Ω (and over) impedance	57
Table 11 — Flexible screened coaxial cables (triaxial) with 50 Ω impedance	58
Table 12 — Flexible screened coaxial cables (triaxial) with 75 Ω impedance	58
Table 13 — Semi-rigid solid-sheathed coaxial cables with 50 Ω impedance	58
Table 14 — Supplementary data on 75 Ω coaxial cables and hexagon die sizes used by British Telecommunications	58
Table 15 — Supplementary data on superscreened 75 Ω , 50 Ω and 33 Ω coaxial cables to the UKAEA Specification AESS (TRG) 71181	59
Table 16 — Hexagon die sizes for outer ferrule (crimp sleeve)	60
Table 17 — Hexagon die sizes for centre contact	60
Table 18 — Group CD sequential list procedure	62
Table 19 — Example of a boundaries of capability/CQC matrix	66

Foreword

This British Standard, which has been prepared under the direction of the Electronic Components Standards Committee, is the generic specification for radio frequency connectors in the BS 9000 system of standards for electronic parts of assessed quality. It is a revision of BS 9210:1971 which is withdrawn.

Where references are made to other British Standards they are to the latest editions. Therefore, the references to BS 9000 in this revision differ from those in BS 9210:1971. The 1981 edition of BS 9000-1 gives a table showing the relationship of its clauses to the clause numbering of BS 9000:1971.

This revision takes account of IEC Publication 169-1, *“Radio frequency connectors”* Part 1 *“General requirements and measuring methods”*, published by the International Electrotechnical Commission, and includes changes to the test and measurement requirements in line with recent advances in technology.

This revised standard will eventually be superseded by the harmonized generic specification for radio frequency connectors, BS CECC 22000:1980, but for a period both standards will remain extant because of current approvals to BS 9210.

Section 3 of this standard defines those procedures necessary to enable an r.f. connector manufacturer to demonstrate his ability to design, manufacture and test r.f. connectors within claimed boundaries of technical skill and expertise. A single capability approval exercise covers the subsequent manufacture of all connector designs embodying, but not exceeding, the claimed and demonstrated boundaries of capability.

After the initial approval the manufacturer regularly carries out self-assessment by the testing of capability qualifying components to a programme agreed with the Supervising Inspectorate at the time when capability approval is granted.

Some appendices originally included in the 1971 edition of this standard have not been included in this revision. However, the appendix letters of the previous edition have been retained in order to facilitate compatibility of cross-referencing with the previous edition. For the same reason the tables in Appendix N have retained their reference numbers from the previous edition rather than being included in the general sequence of table numbering.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

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

Summary of pages

This document comprises a front cover, an inside front cover, pages i to vi, pages 1 to 71 and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

Section 1. Principles and mandatory procedure

1.1 General matters

1.1.1 Scope

This British Standard specifies the test procedures and other general requirements and gives information relating to radio frequency (r.f.) connectors and accessories.

For low frequency (l.f.) connectors, and for hybrid connectors containing r.f. contacts, reference should be made to BS 9520.

The rules for the preparation of detail specifications for use by the BSI Technical Committees or component manufacturers are given in section 2.

1.1.2 Related documents

BS 245, *Specification for mineral solvents (white spirit and related hydrocarbon solvents) for paints and other purposes.*

BS 308, *Engineering drawing practice.*

BS 410, *Specification for test sieves.*

BS 575, *Carbon tetrachloride.*

BS 580, *Trichlorethylene.*

BS 2011, *Basic environmental testing procedures.*

BS 2316, *Radio-frequency cables.*

BS 2856, *Precision conversion of inch and metric sizes on engineering drawings.*

BS 3763, *The International System of Units (SI).*

BS 4727, *Glossary of electrotechnical, power, telecommunication, electronics, lighting and colour terms.*

BS 4828, *Guide to partial discharge measurements.*

BS 5310, *Hand crimping tools for the termination of electric cables and wires for low frequency and radio frequency applications.*

BS 6000, *Guide to the use of BS 6001. Sampling procedures and tables for inspection by attributes.*

BS 6001, *Sampling procedures and tables for inspection by attributes (BS 9001 has the same technical content).*

BS 9000, *General requirements for a system for electronic components of assessed quality.*

BS 9210, *N004 Electronic components of assessed quality: Detail specification for radio frequency coaxial connector. Series BNC, unsealed, soldered, captive contact 50 ohm. Basic assessment level.*

BS 9210, *N0006 Detail specification for radio frequency connectors of assessed quality — Part 1: R.F. coaxial connectors series SMA, unsealed, soldered, 50 Ω . Full assessment level — Part 2: Control drawings, mating face details gauge information.*

BS 9520, *Specification for electrical connectors of assessed quality for d.c. and low frequency application. Generic data and methods of test.*

BS SP 20, *Panel type air filter elements for use with internal combustion engines and compressors on aircraft.*

IEC 457, *Rigid precision coaxial lines and their associated precision connectors.*

1.1.3 Terminology

For the purposes of this British Standard the definitions of general electrical and telecommunication terms given in BS 4727 apply together with the following.

1.1.3.1 Basic terms

1.1.3.1.1 series

a range of r.f. connectors having a common mating face, as defined in the detail specification

1.1.3.1.2 style

a particular form of component within a series, as defined in a detail specification

NOTE It is denoted by a four digit reference number. The first two digits signify its function as shown in Appendix N, Table N.1. The third and fourth digits signify the form of contact(s) at the mating face(s) of the connector, as detailed in Appendix N, Table N.2.

1.1.3.1.3 variant

a variation of style. It indicates the appropriate cable, group of cables or terminations

NOTE It is denoted by suffix letters and numbers as indicated in Appendix P unless otherwise specified in the detail specification. For an explanation of the identification system refer to Appendix N.

1.1.3.2 connector

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

1.1.3.2.1 cable connector

a connector for attachment to a cable

1.1.3.2.2 fixed connector

a connector designed for attachment to a chassis or to a piece of apparatus. If not specified as fixed, a connector is assumed to be free

1.1.3.2.3**free connector**

a connector that is not specified as fixed

1.1.3.2.4**general purpose connector: grade 2**

a connector making use of the widest permitted tolerances which will guarantee good performance and intermateability

NOTE The requirement for the worst reflection factor may, or may not, be specified in the detail specification.

1.1.3.2.5**high performance connector: grade 1**

A connector for which limits for the reflection factor are specified as a function of frequency in the detail specification. No tighter mechanical tolerances than those applicable to grade 2 are specified

1.1.3.2.6 precision connector

a connector with normally coincident mechanical and electrical reference planes, air dielectric, and hermaphroditic contacts. It is intended for mounting on an air line and is used only for measurement purposes.

There are two types of precision connector (see 1.1.3.2.6.1 and 1.1.3.2.6.2).

1.1.3.2.6.1**general precision connector (G.P.C.)**

a precision connector which has a self-contained dielectric support and is capable of supporting, in a simple manner, the unsupported L.P.C. centre conductor

1.1.3.2.6.2**laboratory precision connector (L.P.C.)**

a precision connector which does not have a dielectric support for the centre conductor

1.1.3.2.7**standard test connector: grade 0 (also called reference connector)**

a precisely made connector of a particular series used as a standard connector to carry out reflection factor measurements on grade 1 and grade 2 connectors

NOTE Often, the standard test connector may be part of an inter-series adaptor which allows connection with a precision (hermaphroditic) connector forming part of the measuring equipment.

The dimensions and tolerances are specified in the detail specification where applicable.

1.1.3.3 Connector versions**1.1.3.3.1****composite connector**

a connector requiring separate parts to effect electrical continuity of inner and/or outer conductors, and mechanical coupling

NOTE Detailed terminology for these parts will be included in the appropriate detail specification.

1.1.3.3.2**female connector**

a connector containing a female (socket) contact

1.1.3.3.3**hermaphroditic connector**

a connector with contacts for inner and outer connection whose configuration is such that it cannot be classified as male or female, but will make electrical connection with a connector of identical design

1.1.3.3.4**male connector**

a connector containing a male (pin) centre contact

1.1.3.4 Connector styles**1.1.3.4.1****fixed adaptor**

an adaptor designed for attachment to a chassis or a piece of apparatus

if not specified as fixed, an adaptor is assumed to be free

1.1.3.4.2**free adaptor**

an adaptor that is not specified as fixed

1.1.3.4.3**inter-series adaptor**

a component to permit connection(s) between two connectors, having mating faces of differing series, where direct connection is not achievable or suitable

1.1.3.4.4**mated set**

a set of two or more connectors designed to be mated with each other, using an adaptor, or separate parts in the case of a composite connector, if necessary

1.1.3.4.5**plug**

a connector featuring the active part of the coupling mechanism, unless otherwise defined in the relevant detail specification

1.1.3.4.6**socket**

a connector featuring the coupling mechanism complementary to a plug

1.1.3.4.7**standard test adaptor**

a particular form of inter-series adaptor used for test purposes. One mating face is that of a standard test connector and the other a precision connector

1.1.3.4.8**within-series adaptor**

a component to permit connection(s) between two connectors, having mating faces of the same series, where direct connection is not achievable or suitable

1.1.3.5 Types of contacts**1.1.3.5.1****female contact (socket contact)**

a contact where electrical engagement is made on the inner surface

1.1.3.5.2**hermaphroditic contact**

a contact whose configuration is such that it cannot be classified as male or female, but is intended to mate with an identical contact

1.1.3.5.3**male contact (pin contact)**

a contact where electrical engagement is made on the outer surface

1.1.3.6 Seals**1.1.3.6.1****barrier seal**

a seal preventing the passage of moisture or gases between the dielectric insert, the contacts, and the body shell of a connector or adaptor

1.1.3.6.2**hermetic seal**

a barrier and/or panel seal capable of meeting the requirements of test Qk of BS 2011-2.1Q:1981

1.1.3.6.3**mating face seal**

a seal preventing the passage of moisture or gases into the connecting interface of two connectors when they are in the mated condition

1.1.3.6.4**panel seal**

a seal provided between a fixed connector/adaptor and a panel to prevent the passage of moisture or gases through the gap between the connector/adaptor and the appropriate panel cut out

1.1.3.7 Additional terms**1.1.3.7.1****cable simulator**

a very precisely specified and controlled section of transmission line simulating the transmission line to which the connector to be measured is normally attached

NOTE The design is to provide both the closest simulation of the usual transition from line to connector, and a substantially similar reflection factor to that obtained using the normal transmission line of the necessary precision.

1.1.3.7.2**contact bullet**

a double-ended male centre contact with or without dielectric support for the inter-connection of the inner conductor of two composite connectors

1.1.3.7.3**free connector coupler**

a connector designed for attachment to a free end of a cable, having the same mating face as a fixed connector of the same series

1.1.3.7.4**nominal impedance**

the named value of impedance without indication of tolerance

1.1.3.7.5**normal coupling torque**

the torque (expressed as a maximum/minimum value) to be applied, in normal use, to the screw-coupling mechanism of a connector

1.1.3.7.6**proof coupling torque**

the maximum torque to be applied to the screw-coupling mechanism of a specific connector series for testing the mechanical strength of the coupling mechanism

1.1.3.7.7**reference line**

a standard air line but with dielectric support

NOTE The design of the line is such that the reflection factor is held at a minimum value so that it does not affect the measurements within the defined frequency range.

1.1.3.7.8**reflection factor**

the ratio of the voltage magnitude of the reflected wave to the voltage magnitude of the incident wave

1.1.3.7.9**restricted entry**

a design of female contact or insert which prevents the insertion of an oversize male contact or test prod

1.1.3.7.10**standard air line**

an homogenous air-dielectric transmission line having minimal discontinuities in diameter, without supports between inner and outer conductors and using the same non-magnetic material with good conductivity for both inner and outer conductors

1.1.3.7.11**voltage standing wave ratio (V.S.W.R.)**

the ratio of the maximum value to the minimum value of the voltages measured on a low-loss homogenous transmission line

1.1.3.7.12**environmental voltage (a.c., r.m.s.)**

the r.m.s. voltage at 40 Hz to 60 Hz applied during environmental testing

NOTE This was formally referred to as working voltage.

1.1.4 Letter symbols, signs and abbreviations

Where these are applicable, details shall be given in the detail specification.

1.1.5 Graphical symbols

The graphical symbols to be used shall be as given in C.1.4.

1.1.6 Marking

1.1.6.1 Marking of the connector. Unless otherwise specified in the relevant detail specification, each connector shall be clearly and durably marked, where space permits with the following information:

- a) manufacturer's factory identity code;
- b) date code.

1.1.6.2 Marking and contents of package. The package shall be clearly and durably marked with the following information:

- a) the manufacturers factory identity code;
- b) the date code;
- c) the detail specification number;
- d) the style and variant designations;
- e) the nominal impedance and series designation;
- f) any additional information required in the detail specification or customer requirement.

If the nominal impedance is indicated by colour coding on either connector body or the insulating material, the following convention should be used:

- 50: No additional colouring
- 75: Yellow

Unless otherwise stated in the detail specification, assembly instructions and details of any special tools required for the assembly shall be included in the primary pack.

When connectors are supplied in kit form with the cable clamping kit in a separate pack from the main connector pack, the manufacturer's code, the date code and the variant description shall also be marked, where possible, on the cable entry nut. Full cable preparation and connector assembly details shall also be included in the pack.

The two packs shall be firmly secured/bagged together.

NOTE Alternative bulk packaging arrangements are acceptable where larger quantities are involved.

1.1.7 Eligibility for qualification approval

The first stage of processing in accordance with 14.2 of BS 9000-1:1981 is the first process subsequent to the manufacture of finished piece parts and sub-assemblies. A sub-assembly is defined as the permanent assembly of two or more piece parts.

NOTE The subsequent process of surface finishing, if applicable, may be sub-contracted under the terms of BS 9000-1:1981.

1.1.8 Structurally similar components

Structurally similar components shall be in accordance with clause 19 of BS 9000-1:1981. In general, the range of structurally similar components will be contained in one detail specification. The manufacturer claiming structural similarity shall demonstrate this to the satisfaction of the National Supervising Inspectorate (NSI).

A claim of structural similarity may be valid when:

- a) the results of a given test carried out can be regarded as valid for other structurally similar components;
- b) the components are produced by one manufacturer with essentially the same design, materials, processes and methods;
- c) the components are of a common principle of cable attachment.

1.1.9 Delayed delivery

Items held by a manufacturer or stockist for a period exceeding three years following acceptance testing shall be re-examined for the group A inspection as specified in the relevant detail specification, before being reconsigned.

The date of the re-examination shall be indicated.

1.1.10 Supplementary procedure for qualification approval

Manufacturers applying for qualification approval for a particular series and climatic category of r.f. connector shall submit samples representative of all styles/variants for which qualification approval is being sought.

Manufacturers shall prepare a plan for the grouping of the style/variant combinations in the form of the example given in Appendix Q.

When structurally-similar styles or variants are to be added to an existing approval certificate, they shall be assembled and subjected to group A and group B testing, and the distinguishing piece part(s) subjected to subgroup D3(i) testing (see Table 1) before inclusion on the approval certificate.

NOTE Connector styles, and variants of styles may be qualified by invoking structural similarity when applicable. It may not always be considered necessary to assemble and test all structurally-similar styles and variants as complete connectors. During the initial qualification approval exercise the declared structurally similar styles and variants may be included in the approval by merely subjecting the distinguishing piece parts to subgroup D3(i) testing (see Table 1).

Further, if the distinguishing feature(s) of a variant consist of a simple dimensional difference, such as the length of a protruding contact and/or its associated insulator, it may not always be considered necessary to manufacture and submit samples of every alternative length merely to satisfy the requirements of subgroup D3(i). Representative structurally similar piece parts may be submitted for testing only as required by the NSI.

For qualification approval, initial group C tests need not be carried out.

1.1.11 Certified test records

The results of certain tests from the A, B, C and D group shall be summarized and presented in the form of a certified test record (CTR). Details of the information required and the method of presentation are given in section 2.

Certified test records are required for r.f. connectors in the full and full assessment plus levels, they are not required for components designed for basic and basic assessment plus levels.

When the relevant detail specification requires that attributes information shall be recorded, the following procedures shall be used.

- a) Where a subgroup comprises a single conditioning test, the total number of rejected connectors shall be recorded without reference to the parameter for which the rejection was made.
- b) Where a subgroup comprises a number of conditioning tests, the relevant detail specification shall state whether the result shall be recorded for the individual conditioning tests or for a number of them as a group.

1.1.12 Ratings and characteristics

1.1.12.1 General. There are no standard ratings and characteristics, but preferred values are listed in 1.1.12.2 to 1.1.12.9.

In all cases the values of the ratings and the conditions under which they apply shall be stated. Any interdependence of ratings and any limiting conditions of use, e.g. mounting, shall be stated.

NOTE Additional ratings may be included at the manufacturer's discretion.

Full assessment level connectors shall meet the minimum ratings and characteristics as designated in 1.1.12.2 to 1.1.12.9.

1.1.12.2 Nominal characteristic impedance.

Unless otherwise specified, selection shall be made from the following values:

- 50 Ω
- 75 Ω

1.1.12.3 Nominal maximum frequency up to which specification requirements are maintained. Unless otherwise specified, selection shall be made from the following values:

- 200 MHz, 500 MHz and 1, 3, 4, 8, 10, 12.4, 18, 24 and 40 GHz.

1.1.12.4 Climatic categories (Appendix A of BS 2011-1.1:1983). Unless otherwise specified, selection shall be made from the following groups:

- | | |
|-----------|-----------|
| 10/070/04 | 55/155/21 |
| 25/085/21 | 55/085/56 |
| 40/070/21 | 55/125/56 |
| 40/100/21 | 55/155/56 |
| 40/155/21 | 65/200/56 |

1.1.12.5 Environment test severities. Unless otherwise specified, selection shall be made from the following values:

- a) *Shock* (in accordance with BS 2011-2.1Ea)
 - 294 m/s² for 18 ms
 - 490 m/s² for 11 ms
 - 981 m/s² for 6 ms
- b) *Bump* (in accordance with BS 2011-2.1Eb)
 - 390 m/s², 4 000 $\pm$ 10 bumps total
- c) *Vibration* (in accordance with BS 2011-2.1Fc)
 - At 0.75 mm amplitude with cross-over frequency of 57 Hz to 62 Hz, and an acceleration of 98 m/s² above cross-over frequency
 - 10 Hz to 150 Hz
 - 10 Hz to 500 Hz
 - 10 Hz to 5 000 Hz
- d) *Acceleration* (in accordance with BS 2011-2.1Ga)
 - 98 m/s²
 - 196 m/s²
 - 490 m/s²
 - 980 m/s²
- e) *Low air pressure* (in accordance with BS 2011-2.1M)
 - 30 kPa/m² (300 mbar)
 - 1 kPa/m² (10 mbar)

1.1.12.6 Sealing

1.1.12.6.1 Panel and barrier. The allowable maximum leakage rate, with a pressure differential of 100 kPa to 110 kPa (1 000 mbar to 1 100 mbar), is 1 cm³/h.

1.1.12.6.2 Hermetic. The permissible leakage rate is 10⁻⁶ cm³/s using helium gas with a pressure differential of 100 kPa to 110 kPa (1 000 mbar to 1 100 mbar).

1.1.12.7 Environmental test voltage

(a.c., r.m.s.). Unless otherwise specified, the voltage between the centre and outer conductors shall be selected from the following values:

50, 100, 250, 500, 1 000, 2 000, 4 000 and 6 500 V

NOTE Where working voltage is required by a test procedure the environmental test voltage should be used.

1.1.12.8 Contact resistance, outer conductor continuity and screen continuity. Unless otherwise specified, selection shall be made from the following values:

1, 2, 3, 5, 7, 10 and 15 mΩ

1.1.12.9 Reflection factor. Where applicable, the ratings shall be the maximum values as specified in the relevant detail specification. Alternative methods of expressing reflection factor and voltage standing wave ratio (V.S.W.R.) are:

$$|r| = x + yf$$

$$\text{V.S.W.R.} = x' + y'f$$

where

- $|r|$ is the reflection factor;
- x and x' are the initial reflection factor and V.S.W.R., respectively;
- y and y' are constants;
- f is the frequency (in GHz).

1.1.13 Unchecked parameters

If parameters other than those specified in the detail specification are quoted by manufacturers, they shall not be used for inspection purposes.

NOTE The power ratings of r.f. connectors are not normally specified because:

- a) the maximum average power that can be transmitted via them is normally restricted by the power handling capabilities of the associated cables, rather than by the connectors, and
- b) the maximum peak power capability is determined by the level of the voltage breakdown which in turn varies with frequency.

In this respect, the attachment of the cable to the connector is as important as the connector mating interface.

1.1.14 Procedure to be followed in the event of failures at group C or group D inspection

Where failures occur at group C or group D inspection the general requirements of **20.11** of BS 9000-1:1981 shall apply. Where failures occur on long term endurance or damp heat tests at the full assessment level the following shall also apply.

- a) *Endurance tests.* A test of 50 h duration under the conditions of the endurance test shall be carried out on a lot-by-lot basis.
- b) *Damp heat tests.* A short term climatic sequence shall be applied on a lot-by-lot basis.

1.1.15 Ordering information

The following ordering information shall be included in purchasing contracts for items complying with this standard, in accordance with Table N.3:

- a) series;
- b) designation from Appendix N;
- c) any additional information or requirements.

1.1.16 Drawings included in detail specification

The essential purpose of the drawings is to ensure mechanical interchangeability; they are not intended to restrict details of construction which do not affect interchangeability, nor are they to be used as manufacturing drawings.

NOTE Equipment designers should work to the limits stated and not to dimensions of individual specimens.

Recommendations for the preparation of drawings are given in Appendix K and are applicable for use in the detail specification.

1.2 Test procedures**1.2.1 Measurement and recovery conditions**

1.2.1.1 Measurement conditions. Unless otherwise specified in the detail specification, all tests shall be carried out under standard atmospheric conditions for testing as specified in clause 5 of BS 2011-1.1:1983. Before 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 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 the tests, unless explicitly stated in the detail specification.

Where it is required that a cable shall be attached to a connector, this shall be done in accordance with the connector manufacturer's instructions (normally supplied with the connector).

Tests on connector sets requiring mounting shall be securely mounted using only the normal fixing means for the fixed connector. In the case of two mated free connectors, one only shall be securely clamped to the mounting plate.

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

Mated sets of connectors shall be fully engaged, and screw coupled connectors shall be tightened to the normal coupling torque prescribed in the relevant detail specification.

1.2.1.2 Recovery conditions. Unless otherwise specified in the detail specification, recovery conditions for the interval after a conditioning test shall be as stated in 5.4 of BS 2011-1.1:1983.

1.2.2 Visual inspection

The specimen shall be visually examined to ensure that:

- a) the condition, workmanship and finish are satisfactory;
- b) the marking is in accordance with 1.1.6 and is legible and durable;
- c) there is no mechanical damage, movement or displacement of parts;
- d) no pitting or flaking of materials or finishes is apparent.

NOTE Generally, examination may be carried out using a magnification of up to X3, or greater if specified in the relevant detail specification.

1.2.3 Dimensioning and gauging procedures

1.2.3.1 Outline dimensions and mass. The outline dimensions shall be as specified by the relevant detail specification.

The mass shall not exceed the maximum specified in the relevant detail specification. However, mass need not be specified for connectors of less than 100 g.

1.2.3.2 Dimensions and materials (piece parts). Sets of piece parts supplied to the requirements of a detail specification shall be checked for compliance with the relevant manufacturing drawings quoted on the qualification approval application or certificate.

1.2.3.3 Gauging procedure. Where compatibility gauges are specified by a detailed specification, the relevant specimens shall accept the gauges. Where GO-NOT GO gauges are specified the GO gauge only shall accept the component.

1.2.4 Electrical test procedures

1.2.4.1 Reflection factor. The reflection factor of r.f. connectors or adaptors shall be determined by using one of the procedures given in Appendix C.

Cable mounted connectors shall be attached to an appropriate cable in accordance with the instructions supplied by the connector manufacturer.

Where appropriate, the detail specification shall specify the connector frequency range, the frequency intervals for measurements, and the maximum values for reflection factor and/or V.S.W.R.

NOTE Additional frequencies or swept-frequency bands may also be specified.

Unless otherwise specified, the uncertainty of each test frequency shall be no greater than + 10 %, – 0 %. In the case of swept-frequency bands, the band limits shall be met.

The detail specification shall specify the nominal characteristic impedance of the connector.

NOTE For measurement and test purposes, the reference characteristic impedance may be determined by a coaxial air line whose dimensions give this characteristic impedance “at infinite frequency”, i.e. for zero skin depth.

The control drawings may specify recommended reference connector interfaces for measurement and test purposes.

Mated pairs of reference connectors shall exhibit constancy of characteristic impedance throughout the pair and for a sufficient distance into each connector for the verification of nominal characteristic impedance for measurement and test purposes.

A connector shall be accepted if the maximum value of reflector factor and/or V.S.W.R. specified for the range is not exceeded when measured by one of the procedures given in Appendix C.

NOTE In the case of a dispute after delivery, measurements may also be made at mutually agreed frequencies within the rated frequency range.

1.2.4.2 Alternative methods of test. Alternative methods of electrical test procedures are permitted provided they are acceptable to NSI. See 20.5 of B5 9000-1:1981.

1.2.4.3 Contact resistance

1.2.4.3.1 General measuring requirements.

Measurements shall be carried out with d.c. or a.c.

For a.c. measurements, the frequency shall not exceed 2 kHz. The measuring apparatus shall be such as to ensure that the total permissible measuring error does not exceed $\pm 10\%$. In case of dispute the d.c. measurement shall take precedence.

Normally the contact resistance shall be derived from the voltage drop measured between the points intended for connection of the wiring of the contacts, as specified in the relevant detail specification. The contact shall neither be made nor broken while the measuring voltage is applied.

Where the termination end of the contact is not directly accessible, the conductor resistance of the cable or wire used shall be taken into consideration in arriving at the contact resistance.

In cases where a conditioning sequence does not require significant lengths of cable to be fitted to connectors, the length shall be as short as is practicable and shall be of known resistance.

Where significant lengths are specified the overall resistance of the assembly shall be measured at stated intervals.

In all cases appropriate cable shall be used.

1.2.4.3.2 Measuring cycle

a) When measured with d.c., one measuring cycle consists of the following:

- 1) making the contact;
- 2) measurements with the current flowing in one direction;
- 3) measurements with the current flowing in the opposite direction;
- 4) breaking the contact.

b) When measured with a.c., one measuring cycle consists of the following:

- 1) making the contact;
- 2) measurement;
- 3) breaking the contact.

c) When more than one cycle is required by the detail specification, they shall be carried out in immediate succession.

1.2.4.3.3 Measurement on mated sets. All contact resistances shall be measured in accordance with the relevant detail specification.

a) *Light current.* Contact resistance shall be measured with an alternating or direct current not exceeding 50 mA. During the measurement the open circuit e.m.f. of the source shall not exceed 20 mV d.c. or a.c. peak. The contact resistance shall be not greater than that specified for each mating pair of contacts.

b) *Rated current.* On individual contacts, the contact resistance shall be measured with the rated alternating or direct current as specified in the detail specification. During the measurements, the open circuit e.m.f. of the source shall not exceed 2.5 V d.c. or a.c. peak. The contact resistance shall be not greater than that specified for each mating pair of connectors.

c) *Low current.* For low current contacts for use in the microamp/microvolt range, it is permissible to modify the measuring method as specified in the detail specification.

1.2.4.3.4 Requirements. The values of the contact resistances shall not exceed those specified by the relevant detail specification which shall indicate the maximum values of contact resistance before and after conditioning. Preferred values for the upper limit of contact resistance to be quoted by the relevant detail specification are:

- 1, 2, 3, 5, 7, 10 or 15 mΩ

In the case where the resistance of cables/connectors has been measured, the increase due to conditioning shall comply with the requirements of **1.2.4.4**.

Where measurements are made on sets of connectors, including more than one mating interface in series, the specified values for resistance or increase in resistance shall be taken to apply per mating face.

Any deviation from the specified procedure shall be clearly indicated in the test report.

1.2.4.3.5 Summary. When this test is required, the following details shall be given in the detail specification:

- a) the circuit diagram (where applicable);
- b) the number of measuring cycles (if more than one);
- c) the maximum value of current and voltage source;
- d) the maximum limit of contact resistance.

1.2.4.4 Continuity measurement (assembled connectors)

1.2.4.4.1 Centre contact continuity. This test is suitable for connectors assembled on to the appropriate cables for environmental conditioning thus making access to the centre contact impractical.

The appropriate mating sets shall be fully engaged and the resistance shall be measured between the ends of the inner conductor. The current and voltage shall be as specified in **1.2.4.3**.

The overall centre conductor resistance of a mated pair of connectors, inclusive of the cable resistance, shall not deviate after conditioning by more than the contact resistance change permitted by the detail specification or by more than 10 % of the initial measured total resistance, whichever is the greater.

1.2.4.4.2 Outer conductor continuity. Fixed specimens shall be mounted as specified in **1.2.1.1**. Appropriate mating sets shall be fully engaged and the resistance measured through all joints in series from the cable outer conductor to the mounting plate and/or from the cable outer conductor to the conductor of mating specimens using a current and voltage as specified in **1.2.4.3**. The outer conductor resistance shall be measured between the points specified and shall not deviate after conditioning by more than the value specified in the relevant detail specification for outer conductor continuity or by more than 10 % of the initial measured total resistance, whichever is the greater.

1.2.4.5 Screen continuity (triaxial systems only). Fixed specimens shall be mounted as specified in 1.2.1.1. Appropriate mating sets shall be fully engaged and the resistance measured through all joints in series from the cable screen(s) to the mounting plate (or from cable screen(s) to cable screen(s) of mating free specimens) using a current and voltage as specified in 1.2.4.3.

The screen series resistance shall be measured between the points specified and shall not deviate after conditioning by more than the value specified in the relevant detail specification for screen continuity or by more than 10 % of the initial measured total resistance, whichever is the greater.

1.2.4.6 Insulation resistance. The insulation resistance shall be measured between the parts specified in the relevant detail specification with a d.c. circuit having a voltage of 100 ± 20 V or 500 ± 50 V, as required in the detail specification. Fixed specimens shall be mounted as specified in 1.2.1.1.

The value of resistance shall be measured after an electrification time of $1 \text{ min} \pm 5 \text{ s}$, or earlier if a stable reading is achieved. In case of dispute the reading taken at the 1 min period shall take precedence.

The insulation resistance shall be not less than the value specified in the relevant detail specification.

1.2.4.7 Voltage proof. The proof voltage indicated in the relevant specification shall be applied using a peak a.c. voltage at a frequency of 40 Hz to 60 Hz, or a d.c. voltage equal to the peak a.c. voltage, between the inner contact and the outer conductor of the connector.

For qualification approval (QA) testing, application of the specified voltage shall be for 1 min in both the mated and unmated condition. For lot-by-lot testing the application shall be for 5 s in the mated condition only.

Connectors having a specified environmental test voltage of 1 kV and above shall be tested in the mated condition only.

There shall be no breakdown or flashover.

NOTE The relationship between the rated environmental test voltage U and the proof voltage E , (both expressed as a.c. peak or d.c.) is normally given by:

$$E = 3U, \text{ for connector/cable combinations having a value } U \text{ up to and including } 1 \text{ kV, or}$$

$$E = 1.5U, \text{ for connector/cable combinations having a value } U \text{ exceeding } 1 \text{ kV}$$

1.2.4.8 Voltage proof (combined with water immersion). Mated connectors attached to an appropriate cable, the ends of which have been sealed, shall be submerged in a salt solution at 70 ± 20 °C to a depth of 200 mm.

The salt used for the test shall be high quality sodium chloride (NaCl) containing, when dry, not more than 0.1 % sodium iodide and not more than 0.3 % of total impurities.

The salt solution concentration shall be 5 ± 1 % by mass.

The solution shall be prepared by dissolving 5 ± 1 parts by mass of salt in 95 parts by mass of distilled or demineralized water.

After 1 h, the water shall be allowed to cool to room temperature (see 5.4 of BS 2011-1.1:1983).

The connectors shall then remain under water until 24 h have elapsed from the time of starting the test.

Proof voltages shall be applied as in 1.2.4.7 within 15 min of removal from the water.

There shall be no breakdown or flashover.

1.2.4.9 Overall screening effectiveness

This matter is being discussed currently at national and international level. When the findings have been published a suitable amendment will be made to this standard.

1.2.4.10 Capacitance. The capacitance between the inner and outer contact of a connector shall be determined at a frequency not greater than 2 MHz with an accuracy better than ± 5 % or ± 0.1 pF, whichever is the greater.

The capacitance shall not exceed the value specified by the relevant detail specification.

1.2.4.11 R.F. shunt resistance. The r.f. shunt resistance of a connector shall be measured by determining the parallel resistance introduced by the connector under test in an inductive/capacitive circuit at resonance at a frequency specified by the relevant detail specification.

A suitable method for this test is described in Appendix D. The value of the r.f. shunt resistance shall be not less than the value specified by the relevant detail specification.

1.2.4.12 Partial discharge test

Unless otherwise specified in the detail specification, the test shall follow the procedure given in BS 4828.

Connectors with a specified environmental voltage equal to, or greater than, 1 kV under standard atmospheric conditions shall be tested and then only in the mated condition.

1.2.5 Mechanical test procedures

1.2.5.1 General. Measurements to be made at any stage of these tests shall be indicated in the relevant detail specification. Any adaptor required to facilitate application of the force shall not act as a reinforcement of the connector shell.

1.2.5.2 Gauge retention force (resilient contacts). This test shall be carried out on the individual resilient contacts by using gauges in accordance with the drawings in the relevant detail specification.

The contact shall first have the sizing (maximum material) gauge applied three times unless otherwise specified in the relevant detail specification.

The retention force (minimum material) gauge shall then be engaged with the contact. The contact shall support the mass of the gauge in a vertical downwards attitude.

1.2.5.3 Contact and insert retention. With the cable or wire attached, where applicable, separately defined axial forces, as specified in the relevant detail specification, shall be applied, smoothly and in a controlled manner, from the mating face towards the opposite end of the connector:

- a) firstly to the centre contact;
- b) secondly to the insert;

for a period of 10 s in each case.

The permitted displacement(s) shall not be exceeded.

1.2.5.4 Static load (for fixed connectors only).

The connector shall be mounted as specified in 1.2.1.1. A steady force shall be applied to the outer shell of the connector through a mating connector in a direction parallel to the reference plane. The value of the force and its point of application shall be specified by the relevant detail specification.

There shall be no damage or loosening of parts such as would impair operation.

1.2.5.5 Engagement and separation. Fixed specimens shall be mounted as specified in 1.2.1.1. Mating sets shall be fully engaged and separated in the normal manner. The forces and/or torques required for engagement and separation shall be measured.

The forces and/or torques shall be within the limits specified in the relevant detail specification.

Where no force or torque is specified, engagement and separation shall be achieved by hand or by special tools where these are specified.

1.2.5.6 Impact of free specimens intended for use with flexible cables only. The cable shall be extended mechanically (using the same type of cable) or replaced if necessary to make the overall length equal to the specified drop height plus 600 mm.

The end of the cable remote from the connector to be tested shall be secured at the drop height. The connector/cable assembly shall be held horizontally and the connector allowed to fall freely on to a horizontal concrete surface. The number of impacts shall be specified.

There shall be no loosening of parts or other mechanical damage such as would impair operation.

1.2.5.7 Damage by test prod (female contacts only). The test shall be carried out on fully assembled specimens.

During this test the contact shall not rotate relative to the connector.

The tool shown in Appendix G shall be used together with the specified test prods. The specimen shall be held with the major axis of the contact in the horizontal plane and the mating end unsupported. The test prod tool shall be set for the specified moment.

The prod shall be fully inserted into the contact and the tool allowed to remain unsupported.

With the test prod tool in position, the specimen shall be rotated about the contact axis, in one direction only, for one complete revolution.

When more than one test prod is specified, the test shall be repeated using each prod in turn.

The contacts shall then be subjected to the gauge retention force test (1.2.5.2) using the retention force gauge only.

1.2.5.8 Mechanical tests on cable attachment and on coupling mechanism

1.2.5.8.1 General. The object of these tests is to determine:

- a) that the device for fixing or clamping the cable is effective when forces in different directions are applied to the attached cable;
- b) that the coupling mechanism of a pair of mated connectors will not fail when axial tension is applied to the attached cable;
- c) that the external sheath of the cable will not be damaged by either unsatisfactory shaping or inadequate finishing of the cable entry.

For these tests, an appropriate cable of specified length shall be attached to the connector under test in accordance with the manufacturer's instructions.

1.2.5.8.2 Effectiveness of cable attachment against cable pulling. With the connector firmly mounted, a tensile force, as specified in the relevant detail specification, shall be applied to the free end of the cable along the common axis of the cable and the cable entry.

The duration and the method of application of the tensile force also shall be specified in the relevant detail specification.

1.2.5.8.3 Resistance to cable nutation. The free end of the cable(s) shall be deflected at an angle of 45° to 50° to the axis of the entry of the connector and rotated. The number of rotations shall be as specified in the detail specification. During the test the cable shall not rotate about its axis.

The specimen shall be examined visually at the junction of the cable and the clamping device. There shall be no damage such as would impair operation.

1.2.5.8.4 Effectiveness of cable attachment against cable bending. The appropriate cable shall be attached in the normal way to the connector. The length of the cable shall be specified in the relevant detail specification. The connector is clamped so that the axis of the cable clamp is horizontal. A bending moment is then produced by applying a specified force at a distance from the plane of the cable entry, as specified in the relevant detail specification. The force is then removed and the cable is brought back to the original position. These operations are considered to be one bend.

The number of bends shall be given in the relevant detail specification. After the test, the cable shall not have moved in relation to the connector.

1.2.5.8.5 Effectiveness of cable attachment against cable torsion. A connector shall be attached in the normal manner to an appropriate cable, the length of which shall be specified in the relevant detail specification. The detail specification shall also specify the torque, and the point of application which shall be expressed as the distance from the cable entry of the connector. The torque shall be applied in each direction sequentially.

Dependent upon cable type, a torque as specified in the detail specification shall be attained or cable failure shall occur without slip or rotation within the cable attachment.

1.2.5.8.6 Effectiveness of coupling mechanism against cable pulling. A tensile force shall be applied to a mated pair of connectors, one of which shall be firmly mounted.

In the case of screw coupled connectors, couplings shall be tightened to the normal coupling torque. The force shall be applied to the body of the free connector, along the axis of the coupling.

The value and duration of the force shall be specified in the relevant detail specification.

No damage shall occur and the coupling mechanism shall not fail.

The mated pair of connectors shall then be subjected to the engagement and separation test in 1.2.5.5.

1.2.5.9 Mechanical compatibility. For gauging, the specified compatibility gauge(s) shall be applied.

For assurance, where compatibility gauges are not prescribed, a compatibility assurance test shall be applied.

For this test the specimen shall be checked by a method approved by the NSI.

The specimen shall comply with the compatibility requirements of the control drawing.

1.2.6 Environmental test procedures

The tests or measurements prescribed after the environmental conditioning are omitted between the environmental conditionings when these form part of a sequence. The appropriate tests shall be included at the end of each sequence.

Regarding dynamic tests, connectors normally are not susceptible to gravitational effect. Mounting test fixtures and procedures shall take account of the provisions of BS 2011-4.1.

1.2.6.1 Soldering

1.2.6.1.1 Solderability. This test may be carried out on components taken from batches prior to their assembly into connectors.

The contacts shall be subjected to test Ta of BS 2011-2.1T:1981 using solder bath (method 1) or soldering iron (method 2) as applicable. Application time 3 s with proper wetting of the terminations within the first 2 s. Connectors shall be subjected to test Ta. Requirements shall be laid down in the relevant detail specification.

When the soldering iron method is prescribed, the size of the soldering iron bit shall be given in the detail specification.

1.2.6.1.2 Resistance to soldering heat. For the purpose of this test, assembled connectors shall be in the unmated condition.

The connector shall be subjected to method 1B or 2 of test Tb of BS 2011-2.1T:1981. When this soldering test is required, the following details shall be given in the detail specification:

- a) the method of test selected from BS 2011;
- b) the size of bit or any deviation from the depth of immersion;
- c) details of the heat shunt (if required);
- d) if a thermal screen is not required;
- e) the period of recovery;
- f) any measurement and/or examination required to be made after the test.

1.2.6.2 Robustness of termination (solder bucket styles only). Unless otherwise stated in the detail specification, the component shall be rigidly mounted in the normal manner. A length (250 mm approximately) of tinned copper wire of gauge appropriate to the connector series shall be soldered and connected to the terminations (see 1.2.1.1).

A steady pull as specified in the detail specification shall be applied for 10 s to the wire in the direction most likely to cause damage.

The connector shall then be visually examined. There shall be no damage or loosening of parts.

1.2.6.3 Bump. The connectors shall be mounted as specified in 1.2.1.1 and an appropriate cable shall be attached to each connector according to the manufacturer's instructions.

The type of cable, its free length and the manner in which the end of the cable remote from the connector is secured shall be specified in the relevant detail specification.

Unless specified, all specimens shall be mated throughout the test. For mated sets of screw-coupled type connectors, the coupling nut shall be tightened to the normal coupling torque as specified by the relevant detail specification.

The connectors shall be subjected to test Eb of BS 2011-2.1Eb at the severity and temperature specified in the relevant detail specification.

For dynamic tests, when the connectors under test possess symmetry about the major axis, testing along the major axis and one other axis only is required. If the connectors are asymmetrical, the detail specification shall indicate which planes and senses are to be used.

The specimens shall be subjected to the same number of bumps in each plane and sense, so that each specimen receives a total of $4\,000 \pm 10$ bumps. During the bumping, continuous monitoring shall be carried out on all contacts and screen if fitted, connected in series, using a current not exceeding 50 mA.

The permissible change in circuit resistance and its duration shall both be specified in the detail specification.

At the conclusion of the bumping, the specimens, unless otherwise specified, shall be subjected to the following tests:

- a) visual inspection [1.2.2 c)];
- b) centre conductor continuity (1.2.4.4.1);
- c) outer conductor continuity (1.2.4.4.2);
- d) screen continuity (1.2.4.5);
- e) sealing (1.2.6.11).

1.2.6.4 Vibration (sinusoidal). Unless otherwise specified, all specimens shall be mated during the test.

The connectors shall be mounted as specified in 1.2.1.1 and an appropriate cable shall be attached to each connector according to the manufacturer's instructions.

The relevant detail specification shall specify the type of cable, its free length and the manner in which the end of the cable remote from the connector shall be secured. For mated sets of screw-coupled type connectors the coupling nut shall be tightened to the specified normal coupling torque as specified in the relevant detail specification.

The temperature severity, frequency range and duration at which the tests are carried out shall be specified in the relevant detail specification.

Unless otherwise specified, the connectors shall be tested along the axis through the mating faces and in two planes at right angles to each other and perpendicular to the reference axis.

The requirements for testing, including conditioning, recovery and all measurements are detailed in clause 8 of BS 2011-2.1Fc:1983.

During the vibration, continuous monitoring shall be carried out on all contacts and screen where fitted, connected in series, using a current not exceeding 50 mA.

Both the permissible change in circuit resistance and its duration shall be specified in the detail specification.

At the conclusion of the vibration, the specimens, unless otherwise specified, shall be subjected to the following tests:

- a) visual inspection [1.2.2 c)];
- b) centre conductor continuity (1.2.4.4.1);
- c) outer conductor continuity (1.2.4.4.2);
- d) screen continuity (1.2.4.5);
- e) sealing (1.2.6.11).

1.2.6.5 Shock. The connectors shall be mounted as specified in 1.2.1.1 and an appropriate cable shall be attached to each connector in accordance with the manufacturer's instructions. The type of cable, its free length and the manner in which the end of the cable remote from the connector is secured shall be specified in the relevant detail specification.

Unless otherwise specified, all specimens shall be mated during the test.

For mated sets of screw-coupled type connectors the coupling nut shall be tightened to the specified normal coupling torque.

The connectors shall be subjected to test Ea of BS 2011-2.1Ea at the severity and temperature and using the pulse shape specified in the relevant detail specification. Unless otherwise stated, the pulse shape shall be half-sine.

During the shock test, continuous monitoring shall be carried out on all contacts and the screen where fitted, connected in series, using a current not exceeding 50 mA.

Both the permissible change in circuit resistance and its duration shall be specified in the detail specification.

At the conclusion of the shock the specimens shall be subjected to the following tests:

- a) visual inspection [1.2.2 c)];
- b) centre conductor continuity (1.2.4.4.1);
- c) outer conductor continuity (1.2.4.4.2);
- d) screen continuity (1.2.4.5);
- e) sealing (1.2.6.11).

1.2.6.6 Acceleration. Unless otherwise specified, all the connectors shall be mounted as specified in 1.2.1.1, and an appropriate cable shall be attached in accordance with the manufacturer's instructions. They shall be tested in accordance with test Ga of BS 2011-2.1Ga. The type of cable, its free length and the manner in which the end of the cable remote from the connector is secured shall be specified in the relevant detail specification.

Unless otherwise specified, all specimens shall be mated throughout the test.

For mated sets of screw-coupled type connectors the coupling nut shall be tightened to the specified normal coupling torque.

The connectors shall be subjected to the appropriate severity of acceleration and temperature for a period of 10 s, as specified in the relevant detail specification.

Where the component under test possesses symmetry, the reference axis and one other axis need only be tested. The connectors shall then be subjected to the following tests:

- a) visual inspection [1.2.2 c)];
- b) centre conductor continuity (1.2.4.4.1);
- c) outer conductor continuity (1.2.4.4.2);
- d) screen continuity (1.2.4.5);
- e) sealing (1.2.6.11).

1.2.6.7 Climatic tests

1.2.6.7.1 General. For these tests the specimens shall be mated for the conditioning cycles and subsequent recovery periods. An appropriate cable shall be attached to the connectors and the free ends of the cable treated to prevent ingress of moisture. The back of panel portions of fixed sealed items where appropriate shall be treated in a similar manner.

Screwed coupled connectors shall be tightened to the specified coupling torque.

1.2.6.7.2 Climatic sequence. This test shall be carried out in accordance with procedure 1 of test Z/ABDM of BS 2011-2.1Z/ABDM:1968, using the degrees of severity specified in the relevant detail specification. During the conditioning cycles, the tests appropriate to each condition shall be applied and shall comply with the requirements specified in the relevant detail specification. Intermediate measurements between the conditioning cycles shall not be applied.

After recovery, the connectors shall then be subjected to the following tests and shall meet the requirements specified in the relevant detail specification where applicable:

- a) insulation resistance (1.2.4.6) (to be carried out within 30 min of completion of the recovery period);
- b) voltage proof (1.2.4.7) (to be carried out within 30 min of completion of the recovery period);
- c) centre conductor continuity (1.2.4.4.1) (during which the mated connectors shall not be disturbed prior to the first measurement after exposure);
- d) outer conductor continuity (1.2.4.4.2);
- e) screen continuity (1.2.4.5);
- f) visual inspection (1.2.2);
- g) engagement and separation (1.2.5.5);
- h) sealing (1.2.6.11).

1.2.6.8 Damp heat, steady state. This test shall be carried out in accordance with test Ca of BS 2011-2.1Ca. using the appropriate degree of severity as specified in the relevant detail specification.

A polarizing voltage as specified in the relevant detail specification shall be applied to mated sets and to two unmated specimens, between inner contact and shell.

The connectors shall be subject to this test for the duration specified in the relevant detail specification.

Within 15 min following the conclusion of the conditioning the environmental test voltage specified in the detail specification shall be applied for 5 min.

There shall be no breakdown or flashover.

The connectors shall be subjected to the following tests:

- a) insulation resistance (1.2.4.6) (to be carried out within 30 min of completion of the recovery period);
- b) voltage proof (1.2.4.7) (to be carried out within 30 min of completion of the recovery period);
- c) centre conductor continuity (1.2.4.4.1) (during which the mated connectors shall not be disturbed prior to the first measurement after exposure);
- d) outer conductor continuity (1.2.4.4.2);
- e) screen continuity (1.2.4.5);
- f) visual inspection (1.2.2),
- g) engagement and separation (1.2.5.5).

1.2.6.9 Rapid change of temperature. This test shall be carried out in accordance with test Na of BS 2011-2.1N on mated sets of connectors.

Unless otherwise specified, the period of exposure to both high and low temperature shall be 30 min each and the total number of cycles shall be five.

The connectors shall then be removed from the chamber and exposed to the standard recovery conditions.

Unless otherwise specified, after recovery, the connectors shall be subjected to the following tests:

- a) insulation resistance (1.2.4.6);
- b) voltage proof (1.2.4.7);
- c) centre conductor continuity (1.2.4.4.1);
- d) outer conductor continuity (1.2.4.4.2);
- e) screen continuity (1.2.4.5);
- f) sealing (1.2.6.11);
- g) visual inspection [1.2.2 c)].

1.2.6.10 Thermal cycling for crimped types only
Under consideration.

1.2.6.11 Pressure sealing: air leakage of barrier and/or panel sealed connectors. When prescribed in the detail specification, this test shall be carried out in accordance with test Qa of BS 2011-2.1Q:1977.

Connectors are regarded as having type A static seals. Fixed and free connectors shall be tested separately. Fixed specimens shall be mounted in the normal manner in a suitable test jig. Free specimens shall be fixed to the test jig by a suitable adaptor, e.g. the shell of a fixed specimen.

When specified, fixed specimens shall be mated with the appropriate free specimen and the test repeated on mated sets.

The pressure differential and permissible leakage shall be as specified in the relevant detail specification.

1.2.6.12 Pressure sealing: gas leakage of hermetic sealed connectors. When prescribed in the detail specification, this test shall be carried out in accordance with test Qk of BS 2011-2.1Q:1977. The type of tracer gas and leakage rate shall be as specified in the relevant detail specification.

1.2.6.13 Mould growth. The test shall be carried out in accordance with test J of BS 2011-2.1J for 28 days.

The specimens shall be unmated during the inoculation, whilst in the conditioning chamber, and during recovery.

For sealed specimens the back of the panel portion of fixed items shall be suitably protected to prevent ingress of moisture.

Mould growth is acceptable up to and including scale 2, unless otherwise specified.

1.2.6.14 Salt mist. This test shall be carried out in accordance with test Kb of BS 2011-2.1Kb:1987 at the severity specified and using the solution as specified in National appendix A of BS 2011-2.1Kb:1987 unless otherwise prescribed in the detail specification.

The specimens shall be divided into two groups of mating sets. For the conditioning cycles and the subsequent recovery periods, one group shall be mated and the other unmated. For sealed specimens, the back portion of the fixed items and the free ends of the cable shall be suitably protected to prevent the ingress of moisture.

Unless otherwise specified in the detail specification, specimens shall then be subjected to the following tests, with the exception that unsealed connectors or those not mated during exposure to salt mist shall only be subjected to test(e):

- a) the environmental test voltage shall be applied within 15 min after removal from the chamber, between contact and shell, for 5 min; there shall be no breakdown or flashover;
- b) centre conductor continuity (1.2.4.4.1);
- c) outer conductor continuity (1.2.4.4.2);
- d) screen continuity (1.2.4.5);
- e) engagement and separation (1.2.5.5).

All specimens shall then be cleaned as in test Kb of BS 2011-2.1Kb, after which they shall be visually examined in accordance with 1.2.2 b) and d).

All specimens shall be allowed to recover after cleaning as in test Kb of BS 2011-2.1Kb and shall again be visually examined in accordance with 1.2.2 b) and d).

1.2.6.15 Dust. This test shall be carried out in a chamber complying with the requirements of Appendix F. The specimens shall be divided into two groups of mating sets, equal in numbers and variants. The test shall be carried out on mated specimens and shall include protective covers if these are submitted for qualification approval. One group shall be mated and specimens of the other group shall have their protective covers or suitable mating connectors in position. Fixed specimens shall have their protective covers in position.

Fixed specimens shall have the back of the panel portions suitably protected to exclude dust.

Specimens shall remain within the chamber for 30 min.

After removing from the conditioning chamber, specimens shall be subjected to the following tests:

- a) centre conductor continuity (1.2.4.4.1);
- b) outer conductor continuity (1.2.4.4.2).

After removal from the conditioning chamber, disengagement and engagement shall be achieved in the normal manner by hand, or by special tools when specified. There shall be no visible evidence of penetration of dust to the mating surface.

1.2.6.16 Flammability

This test shall be carried out in accordance with test PZ of BS 2011-2.1PZ.¹⁾

Unless otherwise stated, the flame shall be directed for 15 s against the assembled connector without cable in the zone as indicated as follows:

- a) for a fixed connector, at the rear panel portion;
- b) for a free connector, at the mating face.

If ignition occurs, unless otherwise specified, the connectors shall not continue to burn for more than 15 s after removal of flame.

At no time during the tests shall burning particles become detached from the connectors.

1.2.7 Endurance test procedures

1.2.7.1 Mechanical endurance. Connectors shall be subjected to a mechanical endurance test in accordance with the relevant detail specification. The mechanical endurance test can be divided into two parts separated by other tests. For this test the connectors shall be engaged and disengaged with an appropriate mating component.

The number and speed of operations shall be as specified in the relevant detail specification.

All coupling devices such as bayonet fittings or coupling nuts shall be fully engaged at each mating, the normal coupling torque being applied.

Unless otherwise specified, when this test is one of a sequence of tests, the connectors shall then be subjected to the following tests and shall comply with the requirements specified in the relevant detail specification:

- a) centre conductor continuity (1.2.4.4.1);
- b) outer conductor continuity (1.2.4.4.2);
- c) screen continuity (1.2.4.5);
- d) voltage proof (1.2.4.7);
- e) engagement and separation (1.2.5.5);
- f) sealing (1.2.6.11 or 1.2.6.12 as appropriate);
- g) gauge retention force (1.2.5.2).

1.2.7.2 High temperature endurance. Unless otherwise prescribed, mated sets shall be exposed to one of the following preferred durations at the specified temperature severity:

50 h, 250 h, 1 000 h, 2 000 h

During this period, it is permissible for the contacts to carry the specified current if stipulated in the detail specification.

During the last quarter of the test duration the specimens shall be subjected to the insulation resistance test (1.2.4.6) whilst the specimens are at high temperature.

After completion of the test, the specimens shall be removed from the chamber and allowed to remain under standard recovery conditions (see BS 2011-1.1) until temperature equilibrium is reached.

They shall then be subjected to the following tests:

- a) centre conductor continuity (1.2.4.4.1);
- b) outer conductor continuity (1.2.4.4.2);
- c) screen continuity (1.2.4.5);
- d) insulation resistance (1.2.4.6);
- e) voltage proof (1.2.4.7);
- f) sealing (1.2.6.11).

1.2.8 Resistance to contaminating fluids

This test shall be carried out in accordance with the procedure for occasional exposure of test Rb given in 10.1 of BS 2011-2.1R:1976.

Fluids shall be selected from Table 2 of BS 2011-2.1R:1976 (see also Appendix J of this standard).

¹⁾ It is possible that test PZ of BS 2011-2.1 PZ will be withdrawn, but for the purposes of this standard the test procedures should be followed until an amendment is published to this standard giving new test requirements.

The detail specification shall state the fluid and storage temperatures together with the list of contaminants against which the connector is resistant.

After recovery, each connector shall be subjected to the following tests:

- a) visual examination [1.2.2 d)];
- b) insulation resistance (1.2.4.6);
- c) engagement and separation (1.2.5.5).

Section 2. Rules for the preparation of detail specifications

2.1 Basic information

2.1.1 General

The purpose of these rules is to indicate the manner in which the information contained in the generic specification shall be incorporated in the individual detail specifications. In addition it specifies the mandatory tests which are required for basic assessment level and full assessment level together with recommended AQLs and inspection levels.

If detail specifications specify additional assessment levels, they shall contain tests in addition to the mandatory requirements for full or basic assessment levels (see 5.12 of BS 9000-1:1981) as appropriate.

The object of the detail specification is to describe a particular type of r.f. connector and its accessories in such a manner that the physical, electrical and mechanical parameters are fully defined. It shall also state the tests which are necessary to determine that the r.f. connector and its accessories comply with these parameters and the subsequent inspection procedures which are to be adopted to ensure that the item continues to comply with the original standard.

All detail specifications shall be published on A4 paper.

The front page of the specification shall contain as a minimum the information required by 2.1.2 to 2.1.9.

For examples of detail specifications see BS 9210 N004, basic assessment level and BS 9210 N0006, full assessment level.

Crimp type connectors should be crimped using a tool covered by BS 5310. When none of these tools is appropriate, the detail specification shall include information on the designation and manufacturer of the tool to be used together with details of any relevant national or military approval.

2.1.2 Originator

The name of the originator of the detail specification shall be quoted.

2.1.3 Specification number

The number of the detail specification, the issue number and the date of issue shall be quoted. Specification numbers will be allocated by BSI in accordance with 6.3 of BS 9000-1:1981.

If a detail specification is re-issued, the issue number and the date of issue of the superseded document shall be given in addition to the information relating to the re-issue. All changes shall be clearly marked with an arrow or by a marginal line.

2.1.4 Description of the component and intended application

A brief description of the r.f. connector shall be given, and it shall be stated whether it is designed for full assessment level, basic assessment level or additional assessment level (see 5.12 of BS 9000-1:1981).

Any additional information, given for the guidance of users, shall be designated "non-mandatory".

2.1.5 Drawings

2.1.5.1 Outline drawings. Drawings showing the envelope dimensions of the various styles of r.f. connector in the family covered by the detail specifications shall be given.

Sufficient information shall be given so that the connector can be easily recognized and compared with similar items. A drawing showing the panel cutout for each style shall be shown, where applicable.

If the range of styles covered by the detail specification is such that the drawings cannot be conveniently placed on one page, they shall be shown on inner pages and only a typical mating pair of connectors shown on the front page for easy identification.

The various style designations shall be as in Appendix N.

Detail drawings for gauging and inspection purposes shall be listed and the source of drawings indicated.

Dimensions shall be tabulated and separate from the drawings.

2.1.5.2 Control drawings. To ensure intermateability, control drawings shall be prepared in accordance with Appendix K.