

BRITISH STANDARD

BS 9500 : 1990

Specification for

Sockets of assessed quality for plug-in electronic components: generic data and methods of test

Socles de qualité contrôlée pour composants
électroniques enfichables: Données génériques
et méthodes d'essai - Spécifications

Gütebestätigte Steckdosen für steckbare
Bauteile der Elektronik: Fachgrunddaten und
Prüfverfahren

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Electronic Components Standards Policy Committee (ECL/-) to Technical Committee ECL/21, upon which the following bodies were represented:

British Telecommunications plc
Electronic Components Industry Federation
Electronic Engineering Association
Ministry of Defence
National Supervising Inspectorate
Society of British Aerospace Companies Ltd.
Telecommunication Engineering and Manufacturing Association (TEMA)

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 Ltd.)
Business Equipment and Information Technology Association

This British Standard, having been prepared under the direction of the Electronic Components Standards Policy Committee, was published under the authority of the Board of BSI and comes into effect on 30 November 1990

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First published August 1969
Second edition November 1990

The following BSI references relate to the work on this standard:
Committee reference ECL/21
Draft for comment 87/26089 DC

ISBN 0 580 18213 4

Amendments issued since publication

Amd. No.	Date	Text affected

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Foreword

This British Standard has been prepared under the direction of the Electronic Components Standards Policy Committee and it supersedes BS 9500 : 1969, which is withdrawn.

This second edition of this British Standard reflects the decline in the need for sockets for electronic valves. It increases the range of connectors covered by the BS 9000 series by the inclusion of sockets for devices such as pin grid arrays and dual-in-line packages.

WARNING. This British Standard calls for the use of substances and/or test procedures that may be injurious to health if adequate precautions are not taken.

This British Standard refers only to technical suitability and in no way absolves either the supplier or the user from statutory obligations relating to health and safety at any stage of manufacture or use.

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

Section 1. Principles and mandatory procedures

1.1 General

1.1.1 Scope

This British Standard specifies requirements for sockets for plug-in electronic components intended primarily for use on telecommunications and allied electronic equipment.

It specifies requirements for general data and test procedures and requirements for the preparation of detail specifications.

Requirements for quality assessment procedures, inspection and the preparation of certified test records are also specified.

This standard is intended to be read in conjunction with the appropriate Parts of BS 9000. All general details and definitions in the appropriate Parts of BS 9000 that are appropriate to this specification apply unless otherwise stated herein.

NOTE. The titles of the publications referred to in this British Standard are listed on the inside back cover.

1.1.2 Terminology

1.1.2.1 General

For the purposes of this British Standard the general electrical and telecommunication terms and definitions given in the appropriate Part of BS 4727 apply. In addition the specific terms and their definitions given in 1.1.2.2 to 1.1.2.6 are applicable to the family of components covered by this generic specification.

1.1.2.2 Basic terms

The following basic terms are inter-related and are used in the order given.

1.1.2.2.1 family

See 2.3.2 of BS 9000 : Part 1 : 1989.

1.1.2.2.2 type

A general outline, e.g. in-line (single, dual, tri- and quad), pin grid array, leadless chip carrier and TO pattern socket.

1.1.2.2.3 pattern

A design covered by an individual detail specification.

1.1.2.2.4 range

The moulding sizes (number of contact positions) within a pattern.

1.1.2.2.5 style

Configurations within a range, e.g. standard profile and low profile.

1.1.2.2.6 variant

An individual socket, within a range, having a feature or features different from the standard socket.

1.1.2.2.7 specimen

An individual socket in a sample.

1.1.2.3 General terms

1.1.2.3.1 characteristic

A quality or feature peculiar to, or inherent in, the design of a socket, e.g. its outline, mass, insertion and withdrawal force and contact retention force.

1.1.2.3.2 maximum operating temperature

The maximum temperature of the socket, comprising ambient temperature plus temperature rise due to load and wire/board characteristics.

1.1.2.3.3 rating

A limiting value placed on a particular function of the socket at stated conditions.

1.1.2.3.4 service life

The period of time for which the socket is expected to perform satisfactorily.

1.1.2.3.5 breakdown voltage

The point at which the current increase diverges from linear with linear increase of applied voltage.

1.1.2.3.6 proof voltage

A test voltage equivalent to the working voltage multiplied by an applicable safety factor.

1.1.2.3.7 working voltage

Maximum voltage at which a socket is rated to operate at the stated operating conditions.

1.1.2.4 Socket terms

1.1.2.4.1 insertion force

The force required to fully engage the mating plug-in component with the socket.

1.1.2.4.2 socket

An assembly incorporating female contacts for making electrical connection with the male contacts of a plug-in electronic component.

1.1.2.4.3 socket body

The basic dielectric part of the socket which may also provide the means of mounting.

1.1.2.4.4 socket compatibility

The requirement that sockets made to a common detail specification by various manufacturers are intermateable with the relevant plug-in electronic component(s), and intermountable and interchangeable with each other.

1.1.2.4.5 low insertion force socket

A socket requiring minimal insertion force to engage the mating component (typically 0.5 N per contact).

1.1.2.4.6 zero insertion force socket

A socket requiring essentially no force to engage the mating component.

1.1.2.4.7 polarization (coding) feature

A feature provided in a socket body, e.g. a notch, to indicate the correct alignment of the plug-in electronic component during mating, and to prevent accidental mating of a similar component.

1.1.2.4.8 withdrawal force

The force required to disengage the mated plug-in component from the socket.

1.1.2.4.9 latching device

A latch at each end of some in-line sockets to provide mechanical retention of the plug-in electronic component.

1.1.2.4.10 locking device

A linear action or lever-operated rotary cam system incorporated in zero insertion force in-line or grid sockets.

1.1.2.5 Contact and termination terms**1.1.2.5.1 connection**

A physical interface between conductors and/or contacts to provide an electrical path.

1.1.2.5.2 contact

The female conductive element in a socket which mates with the corresponding male element in the plug-in component to provide an electrical path.

1.1.2.5.3 contact lead-in

A chamfered or flared portion of a contact to facilitate engagement.

1.1.2.5.4 contact resistance

The electrical resistance of a pair of mated contacts under specified conditions.

1.1.2.5.5 contact holding force

The force required to keep a pair of resilient contacts fully engaged.

1.1.2.5.6 contact insertion and withdrawal forces

The force required to fully insert or withdraw a pair of mating contacts.

1.1.2.5.7 contact retention force

The axial load in either direction which a contact can withstand without being displaced from its intended position within the socket body.

1.1.2.5.8 wire wrap post

A terminal to accept a solderless wrapped joint.

1.1.2.5.9 solder tag

A terminal to which external connection is made by soldering.

1.1.2.5.10 solderless wrapped joint

A joint achieved solely by wrapping a wire conductor around a post having sharp corners.

1.1.2.5.11 termination

A permanent connection.

1.1.2.6 Tool and gauge terms**1.1.2.6.1 insertion force gauge**

A gauge simulating a mating plug-in component on maximum material condition (MMC) for measurement of maximum insertion force.

1.1.2.6.2 contact resistance gauge

A gauge simulating mating contacts of nominal cross section and engagement length, for plugging into a socket under test enabling electrical measurement to be made between specified points. Generally made of gold-plated beryllium copper.

1.1.2.6.3 contact holding force gauge

A gauge simulating a minimum size male contact and having a specified mass.

1.1.2.6.4 contact sizing gauge

A gauge simulating a specified maximum size male contact.

1.1.2.6.5 withdrawal force gauge

A gauge simulating a mating plug-in component for measurement of minimum withdrawal force.

1.1.2.6.6 latching device gauge

A gauge simulating a specified maximum or minimum size plug-in component with latching feature to test the corresponding latches incorporated in the relevant socket.

1.1.2.6.7 component insertion tool

A device for inserting a particular type of pluggable component, e.g. IC, PROM or DIP, into a socket.

1.1.2.6.8 component extraction tool

A device for extracting a particular type of pluggable component, e.g. IC, PROM or DIP, from a socket.

1.1.3 Letter symbols, signs and abbreviations

The letter symbols, signs and abbreviations which are employed in all documents applicable to electronic components covered by this specification shall be in accordance with BS 3939 or shall be derived in accordance with the principles of that standard.

1.1.4 Graphical symbols

The graphical symbols which are employed in all documents applicable to electronic components covered by this specification shall be in accordance with BS 3939 or shall be derived in accordance with the principles of that standard.

1.1.5 Marking of the component and package

The following particulars shall be legibly and durably marked on each socket in the given order:

- (a) the manufacturer's factory identification code;
- (b) the date code (see 4.2 of BS 9000 : Part 7 : 1989);
- (c) the individual reference number;
- (d) the British Standard detail specification number;
- (e) any additional marking as specified in the relevant detail specification.

The particulars shall be marked on the package or, if transparent packaging is used, the particulars shall be marked on a label which can be read without opening the package.

1.1.6 Eligibility for qualification approval

For the purpose of this standard, all processes subsequent to the manufacture of finished piece parts and subassemblies shall be subject to direct surveillance by the chief inspector or quality manager. A subassembly is defined as the permanent assembly of two or more piece parts. The subsequent process of surface finishing, if applicable, may be subcontracted in accordance with 3.2 of BS 9000 : Part 5 : 1989.

Eligibility for qualification approval is to be granted only to manufacturers approved in accordance with BS 9000 and BS 9500.

1.1.7 Structurally-similar components

In the case of sockets with common design features it is usually possible, for qualification sampling inspection and test purposes, to regard them as structurally similar in this respect. This will permit a reduction in the number of specimens but may be subject to the requirement that any inspection or test sequence includes at least one specimen of each component which that sequence is intended to cover. In such cases the manufacturer shall state the ground on which similarity is claimed.

1.1.8 Delayed delivery

Sockets held for a period exceeding 36 months following acceptance inspection shall be re-examined for group A inspection, excluding subgroup A5.

1.1.9 Supplementary procedures for qualification approval**1.1.9.1 General**

The requirements of clause 1, 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.8, 2.9, 2.10, 2.11, 2.13, 3.2, 3.3, 4.2, 4.3, 5.2, 5.3, 6.2, 6.4, and 6.6 of BS 9000 : Part 1 : 1989 shall apply, except as prescribed in the detail specification.

1.1.9.2 Procedure in the event of failure at group C or group D inspection

See 7.6 of BS 9000 : Part 5 : 1989 and 12.4 of BS 9000 : Part 6 : 1989.

1.1.9.3 Release before completion of group B tests

When the conditions for reduced inspection described in BS 6001 have been satisfied for all applicable group B tests, the manufacturer is permitted to release components before the completion of such tests.

1.1.10 Certified test records

Certified test records shall be prepared by the manufacturer for full assessment level sockets. NOTE. They are not required for the basic assessment level.

Certified test records shall be as shown in appendix D of BS 9000 : Part 7 : 1989, and shall be printed on international A4 size paper complying with BS 4000.

When the detail specification requires that attributes information shall be recorded, the total number of rejected sockets shall be recorded without reference to the parameter for which rejection was made.

1.1.11 Ratings and characteristics**1.1.11.1 General**

The preferred values for ratings and characteristics are as given in 1.1.11.2 to 1.1.11.5. If additional items are included in a detail specification, the values and conditions under which they apply shall be stated. Any interdependence of ratings and characteristics and any limiting conditions of use shall also be stated.

1.1.11.2 Electrical ratings**1.1.11.2.1 Maximum current**

The preferred values for maximum current are as follows:

100 mA and 250 mA; 1A, 2A, 3A, 4A, 5A, 10A, and 15A.

NOTE. The values are based on the R10 series of numbers in BS 2045.

1.1.11.2.2 Maximum working voltage

The preferred values for maximum working voltage (in V), d.c. or a.c. peak, are as follows:

30, 50, 85, 100, 150, 250, 350, 500, 600, 700, 1250, 1500 and 2000.

1.1.11.3 Environmental ratings**1.1.11.3.1 Environmental categories**

Sockets are grouped into the following preferred classifications according to their ability to withstand extremes of temperature and humidity:

55/155/56
55/125/56
55/085/56
55/125/21
55/100/21
25/085/21
10/070/04

NOTE. This system of climatic classification is fully described in BS 2011.

1.1.11.3.2 Preferred severities for environmental tests

The preferred severities for environmental tests are as follows.

- (a) Bump. BS 2011 : Part 2.1Eb; 390 m/s² (40 g_N): 400 $\pm$ 10 bumps
- (b) Vibration. BS 2011 : Part 2.1Fc procedure A; frequency range 10 Hz to 500 Hz or 10 Hz to 2000 Hz, amplitude 0.75 mm or 98 m/s² (10 g_N), duration 6 h or 30 h with continuous monitoring
- (c) Acceleration. BS 2011 : Part 2.1Ga; 98 m/s² (10 g_N), 196 m/s² (20 g_N), 490 m/s² (50 g_N), 981 m/s² (100 g_N).
- (d) Shock. BS 2011 : Part 2.1Ea; 294 m/s² (30 g_N), 490 m/s² (50 g_N), 981 m/s² (100 g_N).
- (e) Low air pressure. BS 2011 : Part 2.1M; 300 mbar (300 hPa).

1.1.11.3.3 Proof voltage ratings

The preferred values for proof voltage are as follows.

Socket rating	Proof voltage
≤ 1 kV	3E
> 1 kV	1.5E (with a minimum of 3 kV)

(where E is the working voltage, d.c. or a.c. peak)

1.1.11.4 Endurance ratings

1.1.11.4.1 Mechanical

The preferred number of operations are as follows: 10, 25 or 50.

1.1.11.4.2 High temperature

The preferred temperature levels (in °C) are as follows:

70, 85, 100, 125 or 155.

1.1.11.4.3 Duration

The preferred durations (in h) are as follows: 16, 50, 250, 500 or 1000.

1.1.11.5 Electrical characteristics

1.1.11.5.1 Minimum insulation resistance

The preferred minimum values for insulation resistance (in M Ω) are as follows:

10, 30, 50, 100, 500, 1000, 5000, 10 000, 50 000 or 100 000.

1.1.11.5.2 Maximum contact resistance

The preferred maximum values for contact resistance (in m Ω) are as follows:

2, 5, 10, 15 or 25.

1.1.11.5.3 Limits of change in contact resistance

The preferred limits of change in contact resistance (in m Ω) are as follows:

2, 5 or 10.

1.1.12 Unchecked parameters

The manufacturer may quote parameters additional to those given in the detail specification and may include suitable checks on these in his quality conformance (QC) procedures. However, these parameters will not be checked by the National Supervising Inspectorate (NSI) and can not be guaranteed by that authority.

1.2 Test procedures

NOTE. Where required for test purposes, sockets should be mated with a test gauge or simulated plug-in component. Consideration should be given to the mass and configuration of any plug-in device as specified in the detail specification.

1.2.1 Measurement conditions

1.2.1.1 General conditions

Unless otherwise specified, all tests shall be carried out under the standard atmospheric conditions for testing as specified in clause 5 of BS 2011 : Part 1.1 : 1983.

For the subsequent recovery periods, specimens shall remain mated or unmated as they were during the conditioning cycle(s). Where measurements are to be completed within a specified period, specimens measured early and failing to comply with the requirements may be measured again before the expiry of the period.

NOTE 1. The use of sharp probes to make contact for test purposes should be avoided.

Where tests are specified for individual contacts, they shall be applied to all contacts of specimens having up to and including six contacts. For specimens having seven or more contacts, a minimum of six test contacts shall be selected in accordance with the details, if any, given in the appropriate test clause. If the specimen includes more than one size of contact, those selected shall include specimens of each size, approximately in proportion to the total number of each size.

Tests involving successive measurements shall be made on the same contacts throughout the series.

Where an approved mating component is specified for engagement with the socket under test, the dimensions of the mating component shall be as given in the appropriate drawings.

NOTE 2. Wire used for test purposes should preferably have PTFE extruded insulation, in order that the true performance of the socket can be measured without possible wire dielectric weaknesses lowering its performance.

1.2.1.2 Order of tests

The tests described in 1.2.4 to 1.2.7 have been listed under the headings 'Electrical', 'Mechanical', 'Environmental' and 'Endurance' for convenience of reference. It is not intended that they shall be applied in the order listed but in accordance with 2.2 and as listed in the relevant detail specification.

1.2.2 Visual examination

The specimens shall be examined visually, using a device having a magnification of $\times 2$ to $\times 4$ diameters, for the following:

- (a) workmanship and finish, which shall be satisfactory;
- (b) marking, which shall be in accordance with 1.1.5;
- (c) permanence of marking (not easily removed by rubbing with fingers);
- (d) mechanical damage, movement or displacement of parts that would impair operation.

1.2.3 Dimensions and gauging procedures

1.2.3.1 Dimensions: outline

Dimensions shall be checked and shall be as given in the outline drawings in the detail specification.

1.2.3.2 Dimensions: detail and materials

The piece parts specified in the detail specification shall be checked and shall be as given in the relevant manufacturing drawings. Measured dimensions shall be recorded.

1.2.3.3 Gauging procedure

Where appropriate, a specified gauge or the appropriate simulated mating specimen shall be used. The polarizing feature shall engage and ensure correct mating.

1.2.4 Electrical test procedures

1.2.4.1 Mounting

Board mounting styles shall be mounted on test boards as specified in the detail specification. Where mounting on a metal plate is specified for electrical tests, the dimensions of the plate shall be such that the contour of the specimens is exceeded. The thickness shall be approximately 1.50 mm.

1.2.4.2 Contact resistance

1.2.4.2.1 General

Contacts shall be selected in accordance with 1.2.1. Measurements shall be carried out with d.c. or a.c. and the measuring apparatus shall be accurate to at least $\pm 10\%$. For a.c. measurements, the frequency shall not exceed 2 kHz. In the event of dispute, the d.c. measurement shall be used.

Measurement shall be made using a gauge as described in the detail specification, and contact resistance shall normally be derived from the voltage drop measured between the points specified in the detail specification (a pair consists of contact and gauge). The contact shall not be made or broken while a measuring voltage is applied. The gauge shall be cleaned or removed prior to measurement.

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

- (a) switching the controlled current in one direction followed by measurement of the voltage drop;
- (b) switching the controlled current in the opposite direction followed by measurement of the voltage drop;
- (c) switching off.

The average of the two measurements shall then be taken as the resultant value of contact resistance.

NOTE. Unless otherwise specified, the made contact(s) should not be disturbed between the end of the preceding test and the application of the voltage in this test, nor between successive cycles.

When measuring with a.c. one measuring cycle consists of the following:

- (1) switching on the controlled current;
- (2) measurement of the voltage drop;
- (3) switching off.

Where more than one cycle is required by the detail specification, the cycles shall be carried out in immediate succession.

1.2.4.2.2 Measurement methods

1.2.4.2.2.1 Light current

Contact resistance shall be measured with an r.m.s. alternating or direct current not exceeding 50 mA. During measurements, 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 (i.e. contact and gauge).

NOTE. For contacts designed for use in the microvolt range, modification of the measuring method and/or special requirements may be specified in the detail specification.

1.2.4.2.2.2 Rated current

On individual contacts, the contact resistance shall be measured with the rated r.m.s. alternating or direct current specified in the detail specification. During 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 (i.e. contact and gauge).

When the contact resistance test is specified, the following details shall be given in the detail specification:

- (a) the points on the gauge and the termination of the mating contact at which the voltage drop is to be measured;

NOTE. These points may be shown on the gauge outline drawing.

- (b) the number of contacts (mating pairs) to be measured and the number of measuring cycles, if more than one;
- (c) the maximum values of current and e.m.f. of the source;
- (d) the maximum limit of contact resistance;
- (e) details of gauge(s).

1.2.4.3 *Insulation resistance*

1.2.4.3.1 *General*

Sockets shall be mounted in accordance with 1.2.4.1.

The insulation resistance shall be measured with a d.c. voltage of either 100 ± 20 V or 500 ± 50 V, using either method A (see 1.2.4.3.2) or method B (see 1.2.4.3.3) as specified in the detail specification.

The insulation resistance shall be measured after an electrification time of 1 min, or earlier if a stable reading is achieved. In the event of dispute, the reading taken at the 1 min period shall be used.

NOTE. On sockets having closely spaced contacts the wires or cable cores may be held away from each other to avoid possibly spurious readings.

1.2.4.3.2 *Method A*

The contacts to be tested shall be selected in accordance with 1.2.1.1 and connected to suitable insulated wire. The insulation resistance shall be measured, using the specified test voltage applied for 1 min in turn between each contact being tested and all others connected together and to the ground track on the printed board, or to the mounting plate where applicable.

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

1.2.4.3.3 *Method B*

All contacts shall be tested. Alternate contacts shall be connected together to form two groups. The insulation resistance shall be measured using the specified test voltage applied for 1 min as follows:

- (a) between the first group of contacts and the second group connected to the ground track on the printed board, or to the mounting plate where applicable; and
- (b) between the second group of contacts and the first group connected to the ground track on the printed board, or to the mounting plate where applicable.

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

When the insulation resistance test is specified the following details shall be given in the detail specification:

- (1) value of the test voltage;
- (2) test method, i.e. A or B;
- (3) minimum value of the insulation resistance.

1.2.4.4 *Voltage proof*

1.2.4.4.1 *General*

The voltage specified in the detail specification shall be applied to sockets as specified below.

Sockets shall be mounted in accordance with 1.2.4.1.

The socket shall be subjected to the specified d.c. or a.c. peak voltage applied at a rate not exceeding 500 V/s using either method A (see 1.2.4.4.2) or method B (see 1.2.4.4.3). Where an alternating current is used it shall have a frequency of 40 Hz to 65 Hz and shall be approximately sinusoidal in waveform.

1.2.4.4.2 *Method A*

Contacts shall be selected in accordance with 1.2.1.1. The socket shall be subjected to the proof voltage as specified in the detail specification. The period of electrification for quality assurance testing shall be 1 min, unless otherwise specified in the detail specification. The voltage shall be applied between each contact in turn and the mounting plate, all other contacts being connected together and to the mounting plate. When using this method for acceptance testing the period of electrification shall be 5 s. There shall be no breakdown or flashover. Leakage current, if required to be measured, shall not exceed the specified maximum.

1.2.4.4.3 *Method B*

All contacts shall be tested. Alternate contacts shall be connected together to form two groups. The socket shall be subjected to proof voltage as specified in the detail specification. The period of electrification for quality assurance testing shall be 1 min, unless otherwise specified in the detail specification. The voltage shall be applied as follows:

- (a) between the first group of contacts and the second group connected to the ground track on the printed board, or to the mounting plate where applicable; and
- (b) between the second group of contacts and the first group connected to the ground track on the printed board, or to the mounting plate where applicable.

There shall be no breakdown or flashover. Leakage current, if required to be measured, shall not exceed the specified maximum.

NOTE. For safety reasons it is recommended that the power dissipated should be limited to 1 W.

When the voltage proof test is specified the following details shall be given in the detail specification:

- (1) value of the proof voltage;
- (2) test method, i.e. A or B;
- (3) period of electrification, if other than 1 min.

1.2.4.5 *Capacitance*

1.2.4.5.1 *General*

Sockets shall be mounted in accordance with 1.2.4.1.

The capacitance shall be measured at either 1 kHz (± 200 Hz) or 1 MHz (± 200 kHz), using a capacitance bridge or suitable test set. The measuring apparatus shall have an accuracy of $\pm 5\%$ or better.

1.2.4.5.2 Method A

Measurement shall be made between one contact and the remaining contacts in common with any metal parts and the ground track on the printed board, or the mounting plate where applicable, and connected to earth.

1.2.4.5.3 Method B

Measurement shall be made between any pair of adjacent contacts, with the remaining contacts in common with any metal parts and the ground track on the printed board, or the mounting plate where applicable, and connected to earth.

When the capacitance test is specified the following details shall be given in the detail specification:

- (a) method of test, i.e. A or B;
- (b) measuring frequency;
- (c) maximum capacitance value.

1.2.5 Mechanical test procedures**1.2.5.1 General**

For tests involving bump, shock, vibration or acceleration conditions, sockets shall be mounted on a suitable test board as specified in the detail specification, or where applicable a metal plate in accordance with 1.2.4.1, which has adequate rigidity to ensure that specimens experience the full effect of those test conditions.

Unless otherwise specified, all tests shall be carried out under standard atmospheric conditions for testing as defined in clause 5 of BS 2011 : Part 1.1 : 1983.

1.2.5.2 Mass

The mass of the specimen shall be measured and shall be within the limits stated in the detail specification. Only the heaviest specimen in each socket style or size shall be measured.

1.2.5.3 Insertion and withdrawal force

Sockets shall be mounted in the normal manner, or the normal method of mounting shall be simulated using a jig.

The socket and the specified gauge shall be fully engaged and separated in the normal manner. The respective forces for insertion and withdrawal shall be measured and shall be within the limits specified. Where the force limit is not specified, insertion and withdrawal shall be achieved by hand or by special tools specified in the detail specification.

1.2.5.4 Contact retention (in moulding)

Board mounting styles shall be mounted on test boards as specified in the detail specification. Not more than two contacts in the socket shall be tested, unless otherwise specified in the detail specification. The test contacts shall be as widely separated as possible, with one in or near the centre of the socket.

The force as specified shall be applied for at least 10 s along the axes of the contacts under test in both directions consecutively. The force shall be increased steadily, to the specified value at a rate of approximately 4.5 N/s. There shall be no permanent displacement of the contact in relation to the socket, unless otherwise specified in the detail specification, and no damage or loosening of parts.

When the contact retention test is specified the following details shall be given in the detail specification:

- (a) number of contacts to be tested (if more than two);
- (b) force to be applied;
- (c) maximum axial displacement.

1.2.5.5 Contact holding force

Contact holding force shall only be applied to resilient contacts. Contacts shall be selected in accordance with 1.2.5.4. The contacts shall be sized using the specified sizing gauge and for the number of operations specified in the detail specification. The specimens shall be held with the mating face on the underside so that when the holding gauge is inserted, the weight of the gauge will act vertically downwards in the direction of separation. The specified gauge for contact holding force shall be fully engaged with each selected contact in turn.

Each contact shall retain the gauge.

1.2.5.6 Probe damage

Contacts shall be selected in accordance with 1.2.5.4. The test tool and appropriate test probes shall be as specified in the detail specification and the test tool shall be set for the specified bending moment.

The test tool shall have its probe inserted into the contact to the depth specified in the appropriate detail specification. The socket shall be held with the axis of the test tool in a horizontal plane. With the test tool in position, and remaining unsupported, the socket shall be rotated in one direction through 360° about the axis of the contact in 10 s to 15 s. Where more than one test probe is specified, the test shall be repeated using each probe in turn.

The same contacts shall then be subjected to the contact holding force test specified in 1.2.5.5, excluding the application of the sizing gauge. Each contact shall retain the gauge.

1.2.5.7 Moulding ageing

NOTE. This test is only applicable to sockets having removable contacts.

The contacts shall first be subjected to the contact retention test specified in 1.2.5.4.

The contacts shall be inserted and withdrawn for the specified number of times using the tools specified in the detail specification. The time interval between the insertions and withdrawals

where required, shall be as specified in the detail specification. The contacts shall then be resubjected to the contact retention test described in 1.2.5.4.

1.2.5.8 *Robustness of terminations*

1.2.5.8.1 *General*

The socket shall be subjected to one of the procedures given in 1.2.5.8.2 to 1.2.5.8.4 as appropriate. Contacts shall be selected in accordance with 1.2.1.1.

1.2.5.8.2 *Wire, strip, tag or screw terminations*

One of the tests described in BS 2011 : Part 2.1U shall be applied. At the conclusion of the test the socket terminations shall be visually examined and there shall be no evidence of fracture or weakening.

When the robustness of termination test is specified the following details shall be given in the detail specification:

- (a) method of test described in BS 2011 : Part 2.1U
- (b) test severity.

1.2.5.8.3 *Solder bucket terminations*

A single tinned copper wire appropriate to its size shall be soldered to the termination. A steady force, as specified in the detail specification, shall be applied via the wire for 10 s in the direction most likely to cause damage. The socket terminations shall then be visually examined. There shall be no damage or loosening of parts.

When the solder bucket termination test is specified the force to be applied shall be given in the detail specification.

1.2.5.8.4 *Wire wrap terminations*

The post shall be wrapped with the maximum gauge wire of specified material appropriate to the size, using an appropriate production tool. The socket terminations shall then be visually examined using a magnification of not less than $\times 10$ and there shall be no permanent set or distortion in the posts.

When the wire wrap termination test is specified the number of turns of wire wrap shall be given in the detail specification.

1.2.5.9 *Latching integrity*

The socket shall be mounted in accordance with 1.2.4.1. A simulated plug-in component shall be latched in position, and a force as specified in the detail specification shall be applied for 10 s in the direction of withdrawal. The latches shall retain the simulated component and there shall be no damage that would impair their operation.

1.2.5.10 *Locking integrity*

(Method of test under consideration.)

1.2.5.11 *Termination torsion*

As in appendix S of BS 9520 : 1983. See also 1.2.1.1.

1.2.5.12 *Spring contact retention (in outer shell)*

This test may be carried out on loose contacts from the same batch as those used in the assembled sockets. (Method of test under consideration.)

1.2.6 *Environmental test procedures*

1.2.6.1 *General*

For tests involving shock or vibration conditions, fixed specimens shall be mounted on plates or jigs of such strength or rigidity that the specimens experience the true force specified in the test conditions. Unless otherwise specified in the detail specification, the basic environmental test methods of BS 2011 shall apply, and all tests shall be carried out under standard atmospheric conditions for testing as defined in BS 2011. Where specified, sockets shall be mounted in particular attitudes, the attitudes being recorded.

In tests where sockets are subjected to environmental conditions in test chambers, e.g. dry heat, cold, damp heat, low pressure and mould growth, the disposition of the sockets in the test chamber shall be such as to permit free circulation of air so that the specimens do not shield each other from the environment.

1.2.6.2 *Bump*

Unless otherwise specified in the detail specification, the sockets shall be mounted on a plate (see 1.2.4.1 and 1.2.6.1).

Specimens shall be fitted with a suitable plug-in component, or in-line adaptor where applicable, wired as appropriate. Latching and locking devices, where incorporated, shall be utilized.

The socket shall be subjected to the procedure described in BS 2011 : Part 2.1Eb using the preferred degree of severity.

During the last 200 bumps, continuous monitoring of electrical continuity shall be carried out on all contacts connected in series. There shall be no intermittency of current, as shown by a change of circuit resistance of 10 k Ω with a duration greater than 10 μ s, unless otherwise prescribed in the detail specification.

When the bump test is prescribed, the following details shall be given in the detail specification:

- (a) method of mounting;
- (b) axes and directions;
- (c) any deviations from preferred conditions;
- (d) mass and configuration of plug-in unit