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DECEMBER 1993

Specification for

Potentiometers of assessed quality: Generic data and methods of test

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Foreword

This British Standard, which has been prepared under the authority of the Telecommunications Industry Standards Committee, is the generic specification for potentiometers in the system of standards for electronic components of assessed quality. It has been issued in the United Kingdom, where it is urgently required, but if a similar procedure is adopted in other countries changes in the specification will be considered for the purposes of harmonization.

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 iv, pages 1 to 51 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 procedures

1.1 General matters

1.1.1 Scope

This British Standard gives details of the essential test procedures and other general requirements and information relating to resistive potentiometers.

It is to be read in conjunction with the standards in the series BS 9000 to BS 9009. Such general details and definitions given in those standards as are appropriate to this standard shall be held to be part of this standard.

The rules for the preparation of detail specifications for use by BSI technical committees or components manufacturers are given in Section 2, and the relevant specific rules for each sub-family are given in separate publications.

1.1.2 Related documents

BS 1852 (IEC 62), *Marking codes for values and tolerances of resistors and capacitors*.

BS 1991, *Letter symbols, signs and abbreviations*.

BS 2011 (IEC 68¹⁾), *Methods for the environmental testing of electronic components and electronic equipment*.

BS 2045, *Preferred numbers*.

BS 2488 (IEC 63), *Schedule of preferred numbers for the resistance of resistors and the capacitance of capacitors for telecommunication equipment*.

BS 3939, *Graphical symbols for electrical power, telecommunications and electronics diagrams*.

BS 4000 (ISO/R 101), *Sizes of papers and boards*.

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

BS 5054, *Dimensions of spindle ends for manually operated components*.

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

BS 9001, *Sampling procedures and tables for inspection by attributes for electronic components of assessed quality*.

When reference to an ISO Recommendation or an IEC Publication is given in parentheses, the British Standard is identical in technical content with the ISO Recommendation or IEC Publication, except where deviation(s) are indicated in the British Standard.

1.1.3 Terminology

For the purposes of this British Standard, the following terms and their definitions apply in addition to those given in BS 4727.

1.1.3.1

type

a sub-family of potentiometers, comprising products having similar design features manufactured by the same techniques and falling within the manufacturer's usual range of ratings for these products

NOTE 1 Mounting accessories are ignored, provided they have no significant effect upon the test results.

NOTE 2 Ratings cover the combination of:

- a) electrical and environmental ratings;
- b) sizes.

1.1.3.2

style

a variation, within a sub-family of potentiometers, having a specific rating

1.1.3.3

pattern

a variation within a style and usually describes a potentiometer of unique design and rating

¹⁾ Additional tests are included in BS 2011 pending submission to, and decision by, the appropriate technical committee of the International Electrotechnical Commission.

1.1.3.4

potentiometer Type 1

a mechanically variable resistor of a type suitable for application in circuits where high stability of the resistance value, an exactly defined resistance law and close tolerances are essential. The dissipation is generally not of major importance

1.1.3.5

potentiometer Type 2

a mechanically variable resistor of a type suitable for application in circuits where stability of the resistance value, resistance law and tolerance are generally not of major importance. In certain types, the power dissipation facilities may be essential

1.1.3.6

preset potentiometers

those potentiometers which are designed for relatively infrequent adjustment

1.1.3.7

ganged potentiometers

those potentiometers consisting of two or more sections operated by a common spindle

1.1.3.8

dual potentiometers

those potentiometers consisting of two sections operated independently by concentric spindles

NOTE Potentiometers of all types are further subdivided according to temperature and humidity categories.

1.1.3.9

rated resistance

the nominal resistance value marked upon a potentiometer

1.1.3.10

critical resistance

that resistance above which the rated voltage may not be applied to the potentiometer (see **1.1.3.17** and **1.1.3.18**)

1.1.3.11

category temperature range

the range of ambient temperatures for which the potentiometer has been designed to operate continuously

1.1.3.12

upper category temperature

the maximum ambient temperature for which a potentiometer has been designed to operate continuously at that portion of the rated dissipation which is indicated in the category dissipation (see **1.1.3.16**)

1.1.3.13

lower category temperature

the minimum ambient temperature at which a potentiometer has been designed to operate continuously

1.1.3.14

rated dissipation

the maximum allowable dissipation between terminations a) and c) of a potentiometer at an ambient temperature of 70 °C under the conditions of the electrical endurance test which will result in a change in resistance not greater than that specified for the electrical endurance test of 1 000 h duration

NOTE In practice the dissipation is modified by the following conditions:

- a) For high values of resistance, the limiting element voltage may prevent the rated dissipation being attained.
- b) For the dissipation at temperatures other than 70 °C, reference should be made to the de-rating graph in the relevant detail specification.
- c) For situations when only terminations *a* and *b* or terminations *b* and *c* (see **1.1.3.23**) are being used, and the control spindle is set at an angle less than 100 % of the angle of effective rotation. In this case, the limiting slider current should also be taken into account.

1.1.3.15**A.C. r.m.s. voltage**

where the term a.c. r.m.s. voltage is used in this standard the peak voltage shall not exceed 1.42 times the r.m.s. value

1.1.3.16**category dissipation**

that portion of the rated dissipation applicable at the upper category temperature taking account of the derating curve in the relevant detail specification

NOTE For some types of potentiometer, the category dissipation is zero.

1.1.3.17**rated voltage**

that d.c. or a.c. r.m.s. voltage calculated from the square root of the product of the rated resistance and the rated dissipation

NOTE At high values of resistance, the rated voltage may not be applicable because of the size and construction of the potentiometer (see 1.1.3.10 and 1.1.3.18).

1.1.3.18**limiting element voltage**

the maximum d.c. or a.c. r.m.s. voltage which may be applied across the element of a potentiometer

1.1.3.19**isolation voltage**

the maximum peak voltage under continuous operating conditions which may be applied between the potentiometer terminations and other external conducting parts connected together. The value of the isolation voltage is not less than 1.42 times the limiting element voltage

1.1.3.20**limiting slider current**

the maximum current that may be passed between the resistance element and the moving contact

1.1.3.21**terminal resistance**

the minimum resistance which can be obtained between an end termination, *a* or *c*, and the termination connected to the moving contact *b* (see 1.1.3.23)

NOTE The lowest resistance value need not correspond with the mechanical end stops.

1.1.3.22**direction of rotation**

rotation is defined as clockwise or anti-clockwise when viewing the face of the potentiometer which includes the means of actuation. Where doubt exists, the reference face shall be marked in accordance with the detail specification

1.1.3.23**designation of terminations**

the preferred designation of the three terminations of the potentiometer is as follows (see Figure 6):

- a* is the end termination electrically nearest to the moving contact with the spindle set fully anticlockwise as defined in 1.1.3.22;
- b* is the termination of the moving contact;
- c* is the other end termination.

the numerals 1, 2 and 3 or colours yellow, red and green, are used as alternatives to *a*, *b* and *c* respectively (The designation of terminations of ganged and tapped potentiometers is under consideration.)

1.1.3.24**resistance law**

the relationship of the resistance value between terminations a and b (see 1.1.3.23) and the mechanical position of the moving contact, or of the output ratio V_{ab}/V_{ac}

NOTE Non-wirewound potentiometers are classified as follows:

Potentiometers with linear law: Law A (see Figure 1).

Potentiometers with logarithmic law: Law B (see Figure 2).

Potentiometers with reversed logarithmic law: Law C (see Figure 3).

Figure 1 to Figure 3 indicate the approximate laws.

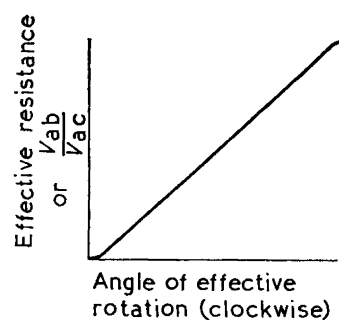


Figure 1

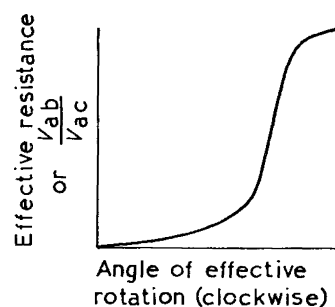


Figure 2

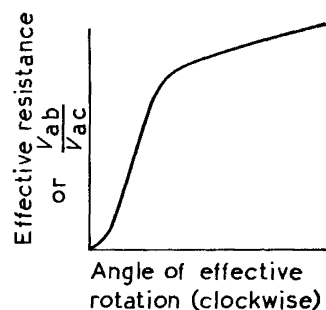


Figure 3

NOTE 2 Wirewound potentiometers are classified as follows:

Potentiometers with linear law: Law A (see Figure 4).

Potentiometers with non-linear law: Law B (see Figure 5).

Figure 4 and Figure 5 indicate the approximate laws.

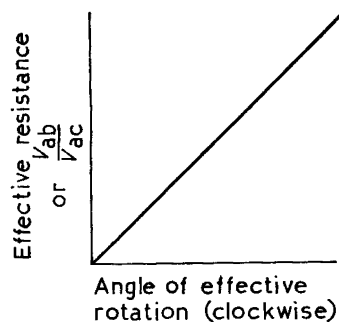


Figure 4

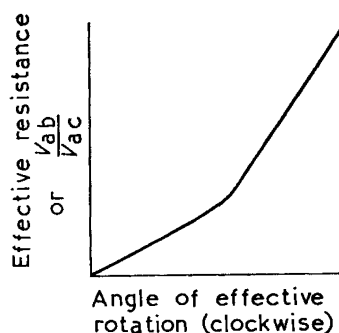


Figure 5

NOTE 3 Potentiometers having laws other than those described in Notes 1 and 2 (e.g. sine or cosine) may be required for special applications. In such a case, the requirements should be stated in the relevant detail specification.

1.1.3.25 Resistance/rotation relationships

Terms 1.1.3.25.1 to 1.1.3.25.7 below relate to rotary potentiometers only. These terms are redefined in detail specifications for potentiometers other than rotary.

1.1.3.25.1

total mechanical rotation

the full extent of the travel of the actuating device between the end stops (see Figure 6)

in potentiometers fitted with a slipping clutch, the position of the end stops is defined as those points where the clutch starts to slip at each end of the travel of the moving contact

1.1.3.25.2

angle of effective rotation

that angle throughout which the resistance changes in the manner prescribed by the declared resistance law (see Figure 6)

1.1.3.25.3

angle of ineffective rotation

the angle over which the declared resistance law is not applicable (see Figure 6)

1.1.3.25.4

minimum effective resistance

the resistance value at each end of the effective rotation between termination *b* and the nearer end termination *a* or *c* (see 1.2.4.5)

1.1.3.25.5**effective resistance**

that portion of the total resistance over which the resistance changes in the manner prescribed by the declared resistance law. It is the total resistance less the sum of the two minimum effective resistance values

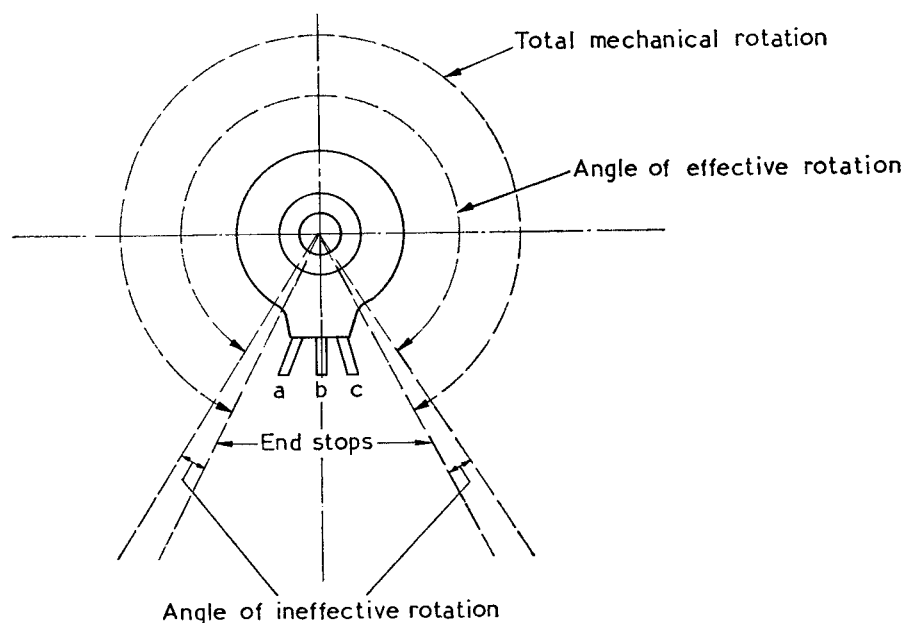


Figure 6 — Example of an application of the definitions to single turn potentiometers (spindle end view)

1.1.3.25.6**conformity**

the fidelity of the relationship between the actual resistance law and the theoretical resistance law. The degree of conformity is the maximum deviation of the actual from the theoretical resistance law when this is expressed as a percentage of the effective resistance (see Figure 7)

1.1.3.25.7**linearity**

a specific type of conformity where the theoretical law or the voltage ratio is shown as a straight line (see Figure 8)

NOTE Additional definitions, applicable to precision potentiometers only, are given in Appendix D.

1.1.3.26**resolution**

this term is used in the description of wirewound potentiometers, and is a measure of the sensitivity to which the output ratio of the potentiometer may be set

the theoretical resolution is the reciprocal of the number of turns of the resistance winding in the actual electrical travel and is expressed as a percentage

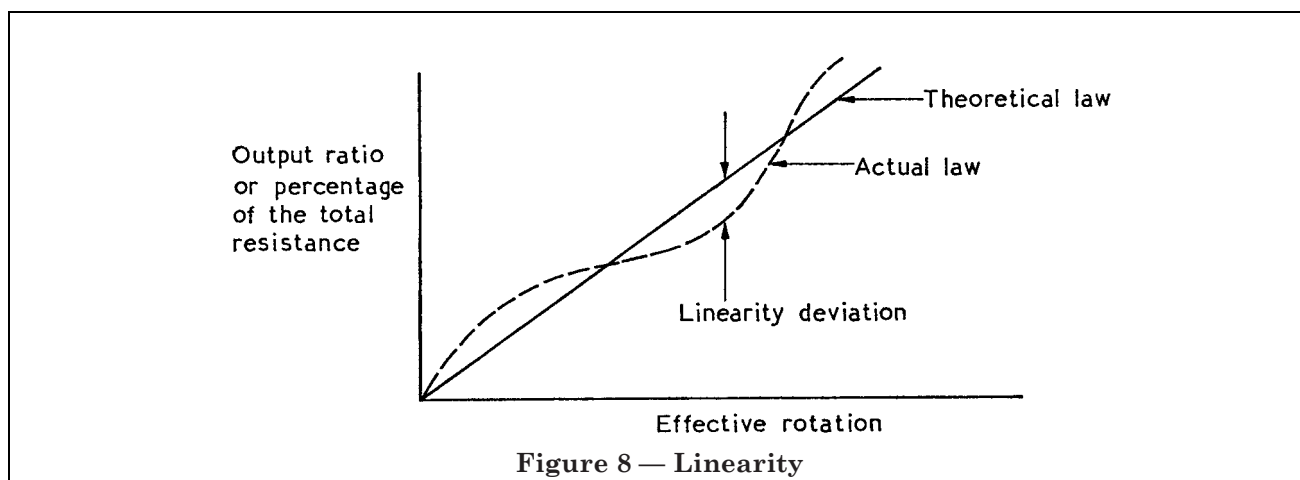
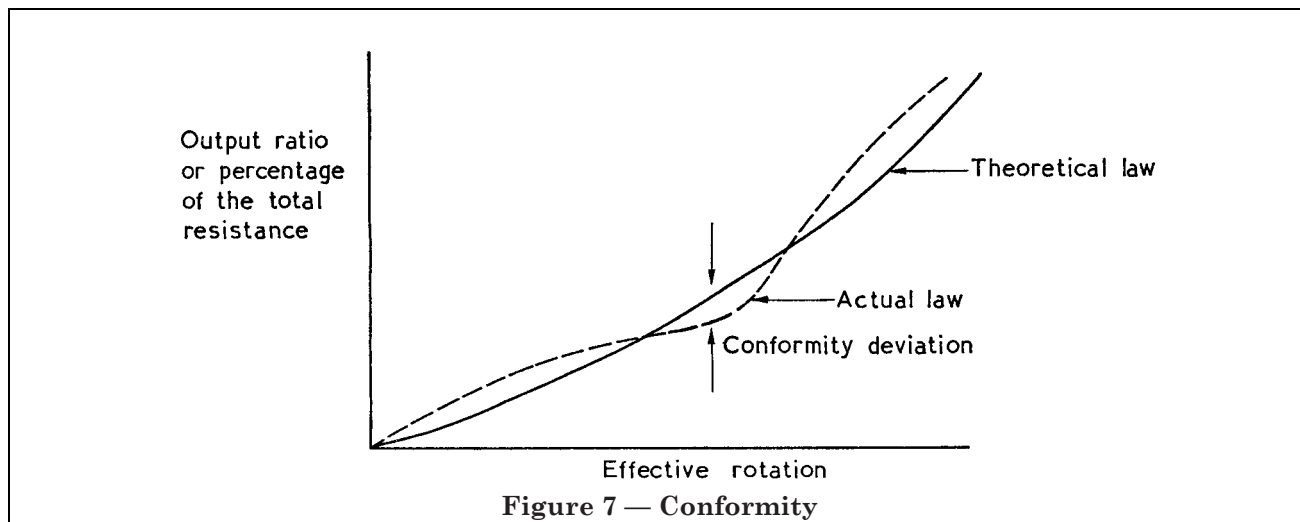
1.1.3.27**container sealed potentiometer**

a potentiometer in which the spindle bearing and the container housing of the potentiometer itself are gas-tight. Such potentiometers are designed to meet the requirements of Test Qc of BS 2011 (IEC Publication 68-2-17)

1.1.3.28

potentiometers with a panel seal, spindle seal or both

those potentiometers in which a spindle seal and/or panel seal are provided to prevent particles and fluid from entering any equipment in which they are mounted. Such potentiometers are designed to meet the requirements of Tests Qa and Qb or BS 2011 (IEC publication 68-2-17).



1.1.4 Letter symbols, signs and abbreviations. For the purposes of this standard, the letter symbols signs and abbreviations in BS 1991 apply.

1.1.5 Graphical symbols. For the purposes of this standard, the graphical symbols in BS 3939 apply.

1.1.6 Marking of the component and package

1.1.6.1 Each potentiometer shall be marked with 1) in the list below; with 2) unless otherwise prescribed in the detail specification; and with as many of the remaining items in the order given below as practical

- 1) Rated resistance, tolerance and (if other than linear) resistance law.
- 2) Date code (see 2.6.8 of BS 9000).
- 3) Manufacturer's name or trade mark.
- 4) Number of the detail specification.
- 5) Style reference (as prescribed in the detail specification).

Marking of terminations shall be in accordance with 1.1.3.23 where applicable.

When a switch is fitted it shall be marked with the following:

- 6) Rated voltage (a.c. and d.c. ratings where appropriate).

7) Rated current (a.c. and d.c. ratings where appropriate).

8) Corresponding terminals (on double pole switches) and terminals to be connected to supply.

1.1.6.2 All the information required by **1.1.6.1** with the exception of 8), shall be marked on the package of the potentiometers.

NOTE Where a transparent package is used, the information may be marked on a label which can be read without opening the package.

1.1.7 Eligibility for qualification approval. The first stage of processing in accordance with **2.3.2 3)** of BS 9000 is:

- 1) *For film types*: the deposition of the resistive film.
- 2) *For composition types*: the process which produces the greatest change in polymerization of the binder.
- 3) *For wirewound types*: the winding of the resistance wire (or ribbon) on the former.

1.1.8 Structurally similar components. Structurally similar components are a range of styles as defined in **1.1.3.2** and are usually covered by a single detail specification. (See BS 9000.)

The detail specification shall state whether results of tests are to be recorded separately for certified test record (CTR) purposes.

1.1.9 Delayed delivery. Potentiometers held by the manufacturer or stockist for a period exceeding twelve months following acceptance inspection shall, before release, be visually examined and re-examined for resistance as specified in the Group A tests of the relevant detail specification.

1.1.10 Supplementary procedure for qualification approval. Not applicable. (Information concerning the standard qualification approval procedure is given in BS 9000.)

1.1.11 Certified test records

1.1.11.1 Certified test records (CTRs) shall be prepared by the manufacturer, as specified in BS 9000, for potentiometers in the S and general application categories. Certified test records are not required for potentiometers in the C application category.

1.1.11.2 Certified test records shall be printed on international size A4 paper conforming to BS 4000, “*Sizes of papers and boards*”.

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

- 1) Where a subgroup of the test schedule comprises a single conditioning test the total number of rejected potentiometers shall be recorded without reference to the parameter for which the rejection was made.
- 2) Where a subgroup of the test schedule comprises a number of conditioning tests the relevant detail specification shall state whether the results shall be recorded for the individual conditioning tests or for a number of them as a group. For the purposes of this specification, the climatic sequence shall be deemed to form a single conditioning test.

1.1.11.4 The relevant detail specification shall state from which tests data is required for inclusion in the certified test record as measurements information. It shall also state whether results may be aggregated, e.g. by rated dissipation, ranges of rated resistance, etc.

As a minimum, the results of all specified electrical endurance tests shall be presented as measurements information.

1.1.11.5 To ensure a standard presentation, measurements information for endurance tests shall be given in the following manner:

For the endurance tests, the intervals for the parametric change shall be % ΔR : 0.05, 0.1, 0.2, 0.5, 1.0, 2.0, 3.0, 5.0, 10.0, 15.0 and 20.0 % and the time intervals shall be 168, 500 and 1 000 h.

If the number of results to be presented is 20 or less, the actual values shall be stated but the identity of the measurements need not be retained (see BS 9000). Where the number of results exceeds 20, the results shall be presented as in the table given on the following page.

Presentation of endurance test results

			Duration (in hours)								
			168	500	1 000	168	500	1 000	168	500	1 000
Percentage change in resistance	Positive	> 20									
		> 15 but ≤ 20									
		> 10 but ≤ 15									
		> 5 but ≤ 10									
		> 3 but ≤ 5									
		> 2 but ≤ 3									
		> 1.0 but ≤ 2									
		> 0.5 but ≤ 1.0									
		> 0.2 but ≤ 0.5									
		> 0.1 but ≤ 0.2									
	> 0.05 but ≤ 0.1										
	± 0.05										
Negative	> 0.05 but ≤ 0.1										
	> 0.1 but ≤ 0.2										
	> 0.2 but ≤ 0.5										
	> 0.5 but ≤ 1.0										
	> 1.0 but ≤ 2										
	> 2 but ≤ 3										
	> 3 but ≤ 5										
	> 5 but ≤ 10										
	> 10 but ≤ 15										
	> 15 but ≤ 20										
	> 20										
	Resistance range										

1.1.12 Standard ratings and characteristics. Ratings and characteristics shall preferably be taken from the following lists. 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 be stated.

1) *Rated resistance*

Type 2. 1.0 : 2.2 : 4.7 in each decade [i.e. alternate values of the E6 series of BS 2488 (IEC 63)].

Type 1. These shall be taken from the series specified in BS 2488 (IEC 63).

2) *Selection tolerance:* ± 0.1, 0.25, 0.5, 1, 2, 5, 10, 20 and 30 %

3) *Limiting element voltage chosen from the R10 series*

of BS 2045: 100 : 125 : 160 : 200 : 250 : 315 : 400 : 500 : 630 : 800 : 1 000 V

4) *Isolation voltage.* The detail specification shall state the value of the isolation voltage, rounded off to the nearest 10 V (see 1.1.3.17). The numerical value of the isolation voltage shall be not less than 1.42 times the limiting element voltage.

5) *Rated dissipation chosen from the R10 series of BS 2045:*

0.125 : 0.25 : 0.5 : 1 : 2 : 2.5 : 4 : 6.3

10 : 16 : 25 : 40 : 50 : 63 : 80 : 100

125 : 160 : 200 : 250 : 315 : 400 : 500

630 : 800: and 1 000 W

6) *Groupings of environmental classifications [see BS 2011-1, (IEC Publication 68-1), Appendix A]*

55/155/56 55/085/56 25/070/21

55/155/21 40/100/21 25/070/04

55/125/56 40/100/04 10/070/21

55/125/21 40/070/56 10/070/04

55/100/21 40/070/21

7) *Severities for environmental tests*

<i>Vibration:</i>	Test Fc, (BS 2011-2F)
	Frequency range 10 Hz to 500 Hz
	Vibration amplitude 0.75 mm or 98 m/s ² , whichever is the less
	Sweep endurance 6 h
<i>Bump:</i>	Test Eb, (BS 2011-2Eb)
	390 m/s ² : 4 000 ± 10 bumps total
<i>Low air pressure:</i>	Test M, (BS 2011-2M)
	8.5 kN/m ² (85 mbar)

8) *Temperature characteristic of resistance*

Standard values of temperature characteristic of resistance over the range 20 °C to 70 °C			
%			
+ 0.125	to	– 0.125	
+ 0.25	to	– 0.25	
+ 0.50	to	– 0.50	
+ 0.63	to	– 0.63	
+ 0.75	to	– 0.75	
+ 1.00	to	– 1.00	
+ 1.25	to	– 1.25	
+ 2.00	to	– 1.00	
+ 2.00	to	– 5.00	
+ 2.50	to	– 2.50	
+ 2.75	to	– 2.75	
+ 3.5	to	– 3.5	
+ 4.0	to	– 4.0	
+ 5.0	to	– 5.0	
+ 6.5	to	– 6.5	
+ 11.5	to	– 11.5	
+ 14.0	to	– 14.0	

9) *Permissible resistance drift after endurance test*

0.01, 0.025, 0.05, 0.1, 0.25, 0.5, 1.0, 1.5, 2.0, 3.0, 5.0 and 10.0 %

Where more than one rating is applied, each with an associated stability, an electrical endurance test at laboratory temperature or at 70 °C as appropriate shall be carried out for each individual rating.

1.1.13 Unchecked parameters. Detail specifications prepared by BSI technical committees give no information on the operation of potentiometers under special conditions, e.g. at radio-frequencies or under pulse conditions. Consistent performance under such conditions cannot be relied upon.

Where a requirement exists for operation under such conditions, it shall be given in a detail specification prepared by the manufacturer. The test method shall be fully described and appropriate limits, AQLs and inspection levels specified.

1.1.14 Procedure to be followed in the event of failures in Group C or D inspection. Where failures occur on long term Group C tests, the procedure specified in 1.1.14.1 and 1.1.14.2 shall apply.

1.1.14.1 Endurance tests. A test of 48 h duration under the conditions of the endurance test during which failures have occurred shall be carried out on a lot-by-lot basis. The detail specification shall indicate an appropriate Group B test in accordance with the provisions of BS 9000.

1.1.14.2 Damp heat tests. Any accelerated damp heat test already included in Group B shall be carried out at the next tighter acceptable quality level, in accordance with the provisions of BS 9000. Where there is no accelerated damp heat test already in Group B, the detail specification shall give details of an appropriate test.

1.1.15 Ordering information. When ordering potentiometers the following information shall be given:

- 1) Value of rated resistance.
- 2) Tolerance on rated resistance.
- 3) Style.
- 4) Temperature characteristic of resistance (where applicable).
- 5) BS number of the detail specification.
- 6) Mounting arrangements [if not already implicit in 3)].
- 7) Spindle dimension(s) [if not already implicit in 3)].

1.1.16 Release for delivery before the completion of Group B tests. When the conditions for reduced inspection specified in BS 9001 have been satisfied for all Group B tests, the manufacturer is permitted to release components before the completion of such tests.

1.2 Test procedures

This section comprises a schedule of tests. Not all clauses are applicable in all cases.

Where reference is made to a control spindle it shall apply to any other adjusting device, as appropriate. In this case mechanical or effective rotation shall be taken to mean mechanical or effective travel of the actuating device.

1.2.1 Test and measurement conditions. Unless otherwise specified, all tests shall be carried out under standard atmospheric conditions for testing as specified in BS 2011 (IEC Publication 68).

Before the measurements are made, the potentiometer shall be stored at the measuring temperature for a time sufficient to allow the entire potentiometer to reach this temperature. The recovery period called for after conditioning is sufficient for this purpose. Standard conditions for normal and assisted recovery are given in BS 2011 (IEC Publication 68).

When measurements are made at a temperature other than the specified temperature, the results shall, where necessary, be corrected to the specified temperature. The ambient temperature during the measurements shall be stated in the test report.

During measurements the potentiometer shall not be exposed to draughts, direct sun-rays or other influences likely to cause error.

1.2.2 Visual inspection. The condition, workmanship, marking and finish of the potentiometer shall be satisfactory as determined by visual inspection.

1.2.3 Dimensioning and gauging procedures

1.2.3.1 Dimensions (gauging). The dimensions indicated in the detail specification as being suitable for gauging shall be checked and shall comply with the values prescribed in the detail specification.

1.2.3.2 Dimensions (detail). All the dimensions prescribed in the detail specification shall be checked and they shall comply with the values prescribed.

1.2.3.3 Total mechanical rotation. The total mechanical rotation (see 1.1.3.25.1) shall be measured. It shall comply with the value prescribed in the detail specification.

1.2.4 Electrical test procedures

1.2.4.1 Drying. When drying is specified in this standard the potentiometer shall be conditioned before measurement is made using Procedure I or II as specified in the relevant detail specification.

Procedure I: Condition for 24 ± 4 h in an oven at a temperature of 55 ± 2 °C at a relative humidity not exceeding 20 %

Procedure II: Condition for 96 ± 4 h in an oven at 100 ± 5 °C.

The potentiometer shall then be allowed to cool in a desiccator using a suitable desiccant, such as activated alumina or silica gel, and shall be kept therein from the time of removal from the oven to the beginning of the specified tests.

1.2.4.2 Continuity

1.2.4.2.1 The resistance variation between terminations *a* and *b* shall be reasonably smooth and unidirectional over the resistance element when the spindle is rotated slowly (or the moving contact of a lead-screw actuated device is traversed slowly).

1.2.4.2.2 The potentiometer shall be loaded in such a way that none of its ratings is exceeded throughout the measurement. The resistance variation between terminations *a* and *b* is observed whilst the spindle or lead-screw is operated steadily in each direction at a rate of 4 ± 1 cycles per minute (1 cycle = 1 traverse of the resistive element and return).

The method is applicable to:

- 1) single turn rotary potentiometers;
- 2) lead screw actuated preset potentiometers.

For multiturn potentiometers where the completed element is formed into a helix the number of cycles per minute shall be divided by the number of turns of angular travel.

For slider operated potentiometers the rate shall be as prescribed in the detail specification.

1.2.4.2.3 Unless otherwise specified there shall be no electrical discontinuity when the moving contact is moved over the total mechanical travel.

1.2.4.2.4 There shall be no electrical discontinuity when the clutch is acting at each end of the travel of the moving contact of potentiometers fitted with slipping clutches.

1.2.4.3 Measurement of resistance

1.2.4.3.1 Conditions of measurement. The measuring voltage shall be such that the power dissipated during measurement does not exceed 10 % of the rated dissipation. Additionally, for non-wirewound potentiometers, the following table gives the recommended test voltage to be applied to the terminations of a potentiometer when making resistance measurements. Other test voltages may be used but, in no case shall the test voltage exceed that shown in the table. In the event of conflicting results, attributable to such test voltages, the voltage specified in the table shall be used for referee purposes.

Rated resistance	Measuring voltage (+ 0 – 10 %)
Ω	V
Less than 10	0.1
10 to 99	0.3
100 to 999	1
1 000 to 9 999	3
10 000 to 99 999	10
100 000 and higher	25

The accuracy of the measuring equipment shall be such that the error does not exceed 10 % of the tolerance or the appropriate ohmic tolerance stated in the detail specification.

Where the measurement forms part of a test sequence, any error shall not exceed 10 % of the maximum change permitted for that test or the appropriate ohmic tolerance stated in the detail specification.

For potentiometers having continuous rotation and an angle of effective rotation less than but very close to 360° , care should be taken not to bridge the beginning and end of the resistance element by the moving contact.

For potentiometers having continuous rotation, where each end of the resistance element is not brought out to separate terminations, the rated resistance shall be that resistance measured between terminations spaced 180° apart electrically, with the moving contact positioned at one of these terminations.

1.2.4.3.2 Terminations *a* to *c*. Unless otherwise specified in the relevant detail specification the resistance, measured in accordance with **1.2.4.3.1** at 20°C between terminations *a* and *c*, with the moving contact set at the end of its travel by anti-clockwise rotation of the actuating device shall be equal to the rated resistance taking into account the tolerance specified in the relevant detail specification.

NOTE 1 For potentiometers fitted with end stops the position of the moving contact will normally be against the end stop at either end.

NOTE 2 For devices fitted with slipping clutch the spindle should be turned through the specified maximum operating turns in one direction to ensure that the moving contact is at the end of the resistance element.

1.2.4.3.3 Terminations *a* to *b*. The resistance between terminations *a* and *b* shall be measured taking care not to overload the small portion of the element, with the actuating device rotated in an anti-clockwise direction until a minimum resistance is obtained.

The measuring method shall give an accuracy of $\pm 5\%$ and the voltage applied to the potentiometer shall be so chosen that the limiting slider current is not exceeded.