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British Standard Specification for

Portable residual current devices

Dispositifs (de protection) portatifs à courant différentiel-résiduel — Spécifications

Tragbare Nullstromgeräte

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Foreword

This British Standard has been prepared under the direction of the Power Electrical Engineering Standards Committee.

This British Standard includes requirements for single-pole with switched neutral, double-pole and single-pole with solid neutral portable residual current devices (portable rcds), but it should be noted that it is intended to withdraw the requirements for single-pole with solid neutral devices on 31 December 1990 by amendment. This amendment will delete the classification of single-pole with solid neutral from clause 3(c) and also delete those requirements in 7.6.6, 7.6.7, 8.30 and 9.6 which relate to single-pole with solid neutral devices.

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

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Specification

1 Scope

This British Standard specifies requirements for portable residual current devices (portable rcds) (including devices using auxiliary sources and devices with electronic circuitry) for operation on an a.c. supply and having a rated voltage not exceeding 250 V a.c. single phase, a rated current not exceeding 16 A, a rated frequency not exceeding 400 Hz and a rated residual operating current not exceeding 30 mA. Portable rcds incorporate a plug-pin portion and/or socket-outlet portion(s) and may include terminals for external flexible cords where appropriate. Portable rcds with an intentional time delay are not covered by this standard.

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

2 Definitions and symbols

2.1 Definitions

For the purposes of this British Standard the following definitions apply.

2.1.1 residual current (I_{Δ}). The root mean square (r.m.s.) value of the vector resultant of the instantaneous values of the currents flowing in the main circuit of the residual current device.

2.1.2 portable residual current device (portable rcd). A device which incorporates an auxiliary sensing circuit that will automatically disconnect the main circuit at a predetermined value of residual current.

2.1.3 interlocked portable rcd. A portable rcd incorporating an interlock (either mechanical or electrical) which prevents the contacts of the portable rcd from being closed on-load.

2.1.4 rewirable portable rcd. A portable rcd so constructed that a cable or flexible cord can be fitted or replaced using general purpose tools.

2.1.5 non-rewirable portable rcd. A portable rcd so constructed that it forms a construction unit with the flexible cord such that the flexible cord cannot be separated from the portable rcd without making it permanently useless, and the portable rcd cannot be opened by hand or by using a general purpose tool, e.g. a screwdriver and/or pliers, without making the portable rcd permanently useless.

NOTE. A portable rcd is considered to be permanently useless when, for reassembly of the portable rcd, parts or materials other than the original need to be used.

2.1.6 tripping current ($I_{O\Delta}$). The minimum value of residual current that causes the device to open.

2.1.7 rated tripping current ($I_{O\Delta,N}$) (rated residual operating current). The value of residual current, assigned by the manufacturer, at which the device opens under specific conditions.

2.1.8 rated non-tripping current ($I_{\phi,\Delta,N}$). The value of residual current, assigned by the manufacturer, at which the device does not open under specified conditions.

2.1.9 rated current of a device (I_N). The r.m.s. value of current, assigned by the manufacturer, which the main circuit of the device is capable of carrying continuously under specified conditions of use and behaviour.

2.1.10 prospective current. The current (r.m.s. value of the a.c. component) that would flow in the circuit due to the applied voltage if each main current path of the device were replaced by a link of negligible impedance but without any other circuit change.

NOTE. For the purpose of this definition the term 'device' includes the short length of cable or cord used to connect the device to the test circuit.

2.1.11 rated voltage (U_N). The r.m.s. value of voltage, assigned by the manufacturer, to which the performance of the device is referred.

2.1.12 pole. The portion of a switching device associated exclusively with one electrically separated conducting path of its main circuit and excluding those portions which provide a means for mounting and operating all poles together.

NOTE. All the conducting parts of a switching device included in the circuit which it is designed to close or open are considered to be the main circuit.

2.1.13 switched pole. A pole containing contacts for opening and closing the current path.

2.1.14 switched neutral. A switched pole, in the neutral current path, with contacts not intended to make or break current but arranged to open after and to close before the contacts in any other switched pole of the main current path.

2.1.15 main contacts. The fixed and moving contacts in the main current carrying paths.

2.1.16 test circuit. an integral circuit to enable the protective function of the device to be checked.

2.1.17 integral auxiliary source. An auxiliary source intended to supply the auxiliary circuit(s), which is derived from the same mains supply within the device as the load being protected.

2.1.18 portable rcd with integral overcurrent protection. A portable rcd designed to perform the additional function of overload and/or short circuit protection.

NOTE. This includes a portable rcd with a socket-outlet and/or plug-pin portions as an integral part of its construction, which can supply a local load only through either a fused plug or its integral overcurrent protection.

2.1.19 termination. A means by which an electrical connection can be made between the appropriate cable or flexible cord and the conducting part of the portable rcd using special purpose tools, e.g. soldering, welding and crimping.

2.1.20 terminal. A means by which the user can make an electrical connection between the appropriate cable or flexible cord and the conducting parts of the portable rcd without the use of special tools.

2.1.21 pillar terminal. A terminal in which the conductor is inserted into a hole or cavity where it is clamped under the end of the screw or screws or through an intermediate clamping member to which pressure is applied by the end of the screw.

2.1.22 screw terminal. A terminal in which the conductor is clamped under the head of the screw, the clamping pressure being applied either directly by the head of the screw or through an intermediate metallic part in direct contact with the screw, such as a washer, clamping plate or antispread device.

2.1.23 stud terminal. A terminal in which the conductor is clamped under a nut, the clamping pressure being applied either directly by a suitably shaped nut or through an intermediate part, such as a washer, clamping plate or antispread device.

2.1.24 rcd adaptor. A portable rcd comprising a plug-pin portion and socket-outlet(s) as integral parts of the portable rcd's construction, the plug-pins being of the same rating and to the same standard as the socket-outlet portion.

2.1.25 rcd plug. A portable rcd comprising a plug-pin portion and terminals for connection of a flexible cord as integral parts of the rcd plug's construction or with a flexible cord connected.

2.1.26 portable rcd socket-outlet. A portable rcd comprising socket-outlet(s) portions as integral parts of the device with terminals for connection of a flexible cord or with a flexible cord connected.

2.1.27 accessible external surface of a portable rcd. All surfaces which can be touched by test finger I of BS 3042 : 1971 when the portable rcd is in normal use or, in the case of a portable rcd with plug pins, when it is in full engagement with a corresponding socket-outlet.

2.2 Symbols

For the purposes of this British Standard the following symbols apply:

I = current
 U = voltage

qualified by the following subscripts:

N = rated
 O = open
 ϕ = non-opening
 Δ = residual (out-of-balance)
 a = auxiliary

3 Classification

A portable rcd shall be classified according to the following:

- (a) the type of portable rcd, as follows:
 - (1) portable rcd adaptor; or
 - (2) portable rcd plug; or
 - (3) portable rcd socket-outlet;
- (b) whether it is rewirable or non-rewirable;
- (c) the number of poles, as follows:
 - (1) single-pole with switched neutral; or
 - (2) double-pole; or
 - (3) single-pole with solid neutral (see foreword);
- (d) the type of switching, as follows:
 - (1) on-load closing; or
 - (2) on-load closing prevented (interlocked portable rcd).

4 Rating

A portable rcd shall be rated in terms of the following:

- (a) voltage;
- (b) current;
- (c) frequency;
- (d) tripping current.

5 Marking and labelling

5.1 The portable rcd shall be marked legibly and in a durable manner with the following details:

- (a) the rated voltage (U_N);
 - (b) the rated current (I_N);
 - (c) the rated tripping current ($I_{O,\Delta,N}$);
 - (d) the symbol for nature of supply;
 - (e) the frequency of supply if other than 50 Hz;
 - (f) the manufacturer's or responsible vendor's name or distinguishing mark;
 - (g) the type reference (which may be a catalogue number);
 - (h) the number and date of this British Standard, i.e. BS 7071 : 1989;
 - (i) the details concerning the operation of the test circuit including such words as 'Test each time before use';
 - (j) the closed and open positions of the portable rcd;
- NOTE. The symbols given in 5.4 may be used.

(k) a diagram of connections, if a diagram of connections is not separately supplied with the device;

(l) the words 'Supply Fault' adjacent to the reverse polarity indicator, if fitted.

The test details in items (i), (j) and (l) shall be visible when the portable rcd is in normal use. All other marking shall be on the external surface.

5.2 The terminals for the connection of the neutral and line conductors shall be identified by the symbols N and L respectively. Where it is necessary to distinguish between supply and load terminals, they shall be clearly identified by suitable marking.

5.3 Terminals for the connection of protective conductors shall be marked with the symbol for earth.

5.4 If symbols are used they shall be as follows:

amperes	A
volts	V
frequency	Hz
alternating current	~ *
line	L
neutral	N
earth	 * preferred or $\perp$ *
fuse	 *
ON	I *
OFF	O *

NOTE. For the marking of the rated current and rated voltage of the portable rcd figures may be used alone, the figures for the current rating being placed before or above those for the rated voltage and separated by a line. If a symbol for nature of supply is used, it is placed next to the marking for rated current and rated voltage. Examples are as follows:

13 A 250 V ~

13/250 ~

$\frac{13}{250}$ ~

5.5 Compliance with 5.1 to 5.4 shall be checked by inspection and by the tests described in 8.7.

5.6 When a rewirable portable rcd is fitted with a fuse link, the rating of the fuse link shall be indicated, e.g. 'Fitted with X ampere fuse' (where X denotes the rating of the fuse link).

NOTE. This information may be provided on a removable tag or label or it may be given in accompanying literature or on a card such as a retail blister card, to which the portable rcd is fixed.

Compliance shall be checked by inspection.

5.7 A portable rcd fitted with a flexible cord shall be supplied with a label or instruction indicating the colour coding of the cores of the flexible cord as follows, unless supplied direct to a manufacturer for incorporation in other equipment:

'IMPORTANT. Wires in the mains lead are coloured in accordance with the following code:

Green/Yellow	Earth (if any)
Blue	Neutral
Brown	Live

Compliance shall be checked by inspection.

5.8 A portable rcd shall be provided with an instruction sheet for its use. The following text shall be included:

(a) a detailed procedure for testing before use arranged as a logical sequence of actions;

(b) a statement that the device shall not be used if it fails to operate correctly in accordance with the instructions;

(c) adequate instructions on the safe connection of any appropriate flexible cords including reference to BS 6500, the number and colour of cores, the correct cross-sectional area of the conductors and, in the case of portable rcd socket-outlets, an instruction that a maximum length of 2 m of flexible cord should be connected between the device and the corresponding plug;

(d) a statement detailing the appropriate British Standards and ratings of any integral or associated overcurrent protective devices necessary for the safe operation of the portable rcd and any associated cables;

(e) a statement warning against storage or use outside the service conditions (see clause 6) and misuse such as dropping, immersion, etc.

(f) a statement that electricity can be dangerous and that the use of a portable rcd should not be regarded as a substitute for basic electrical safety precautions, and specific mention of the need to unplug equipment to achieve isolation before any inspection or repair of that equipment is attempted;

(g) a statement warning the user to seek advice from the manufacturer, responsible vendor or a competent electrician if the portable rcd repeatedly trips with an appliance connected or if it fails to trip when tested in accordance with the instructions.

Compliance shall be checked by inspection.

6 Service conditions

A portable rcd complying with this standard shall be suitable for use under the following conditions of service:

(a) an ambient temperature range of -5°C to $+40^{\circ}\text{C}$, with an average value not exceeding $+35^{\circ}\text{C}$ measured over any 24 h period;

*BS 6217 gives guidance on these symbols.

- (b) an altitude not exceeding 2000 m above sea level;
- (c) an atmosphere not subject to abnormal pollution by smoke, chemical or flammable fumes, salt-laden spray, prolonged periods of high humidity or other abnormal conditions.

NOTE 1. Portable rcds complying with this standard may not be suitable for exposure to direct radiation from the sun or to other sources of heat likely to raise the temperature above the designated ambient temperature, nor for subjection to excessive vibration.

NOTE 2. Where service conditions differ from those prescribed above the advice of the manufacturer or responsible vendor should be sought.

7 Design and construction

7.1 General

7.1.1 The portable rcd shall be so designed and constructed that in normal use it performs reliably and without danger to the user or to the surroundings.

7.1.2 The portable rcd shall be capable of meeting all the relevant requirements of this standard and the tests specified in clauses 8 and 9.

7.1.3 Where tolerances are not specified the values given shall be regarded as nominal.

7.1.4 For a portable rcd incorporating overcurrent protection as an integral part of its construction, such overcurrent protection shall comply with the appropriate British Standard, as declared by the manufacturer (e.g. fuse links shall comply with BS 1362 and circuit-breakers shall comply with BS 3871 : Part 1).

Compliance shall be checked by inspection of the marking or by testing to the appropriate standard.

7.1.5 A portable rcd incorporating plug pins and/or socket contacts, intended to engage with socket-outlets or plugs complying with other British Standards, shall be so designed and constructed that such plug pins and/or socket contacts comply with the appropriate requirements specified in those British Standards.

NOTE. For BS 1363 configurations the relevant tests are referred to in appendix A.

Compliance shall be checked by the tests referred to in 8.28.

7.2 Temperature rise

A portable rcd and its surroundings shall not attain temperatures in excess of those specified in the appropriate British Standard for the appropriate plugs and socket-outlets.

Compliance shall be checked by the test described in 8.4.

7.3 Provision for testing residual current operation

Provision shall be made for testing the automatic opening of the portable rcd main contacts by an integral test circuit.

Operation of the test circuit shall excite the current-balance transformer(s) and the exciting ampere-turns produced by the test circuit shall not exceed 2.5 times the exciting ampere-turns produced by the rated tripping current flowing in one pole of the portable rcd.

The test circuit shall be arranged for external operation in such a way that the protection afforded by the cover or enclosure is not impaired. To safeguard against loss, the push button or the operating handle of the test circuit shall not be removable without the use of tools nor until the cover has been removed from the portable rcd.

NOTE. Appendix B gives information on the function of the test circuit.

Compliance shall be checked by the tests described in 8.29.

7.4 Voltage limits for auxiliary source supplies

A portable rcd that depends on an integral auxiliary source for operation shall perform its protective function at any value of the source voltage between 0.70 and 1.1 times its rated voltage.

Compliance shall be checked by the tests described in 8.10.2.

7.5 Construction

7.5.1 A portable rcd shall have adequate mechanical strength and be so constructed as to withstand such handling as may be expected in normal use.

Compliance shall be checked by the tests described in 8.11.

7.5.2 The enclosure of the portable rcd shall be sealed by the manufacturer to prevent any access other than to replaceable fuses and rewirable terminals.

NOTE. This means that the enclosure cannot be opened by hand or by using general purpose tools, e.g. a screwdriver and/or pliers, without rendering the portable rcd permanently useless. A portable rcd is considered to be permanently useless when, for reassembly, parts or materials other than the original need to be used. This does not apply to the replacement of a fuse link.

Compliance shall be checked by inspection, the appropriate mechanical strength tests of this standard and manipulation by hand and/or the use of general purpose tools.

7.5.3 Current-carrying parts and earthing contacts shall be of brass, copper, phosphor-bronze or other metal at least equivalent with regard to its conductivity, resistance to abrasion and resistance to corrosion.

NOTE. This requirement does not apply to screws, nuts, washers, clamping plates and similar parts of terminals, nor to parts of portable rcd socket-outlets used for earth continuity purposes other than the earthing contacts.

Compliance shall be checked by the tests of 8.13.2 and the relevant tests referred to in 8.2.8.

7.5.4 Ferrous parts shall be adequately protected against rusting.

Compliance shall be checked by the test described in 8.13.1.

7.6 Operating mechanism

7.6.1 The portable rcd shall be arranged for automatic opening under earth fault conditions.

Compliance shall be checked by the tests described in **8.9** and **8.10**.

7.6.2 It shall be impossible to hold the portable rcd contacts closed by the operating mechanism under fault conditions in which tripping should occur.

Compliance shall be checked by the tests described in **8.10.2**.

7.6.3 The position of the contacts shall be reliably indicated. Neon or other electroluminescent parts shall not be used for this purpose.

It shall be impossible for the indicating device to assume the open position unless all moving contacts are also in the open position.

Compliance shall be checked by inspection and the test described in **8.31**.

7.6.4 The portable rcd contacts shall be incapable of unintentional reclosure as a result of mechanical shock or vibration.

Compliance shall be checked by the test described in **8.11.2**.

7.6.5 The portable rcd shall be capable of withstanding without excessive wear or other harmful effects, the electrical and mechanical stresses occurring in use.

Compliance shall be checked by the tests described in **8.12**.

7.6.6 Where the plug and socket system of the portable rcd is not polarized, double-pole switching shall be used. A portable rcd with single-pole with solid neutral shall have reverse polarity indication (see foreword).

Compliance shall be checked by inspection and the tests described in **8.30**.

7.6.7 The portable rcd shall operate in one of the following ways when connected to supply terminals with reversed polarity (L and N).

(a) A portable rcd with switched neutral or double-pole switching shall either function as normal or trip automatically on connection to the supply.

(b) A portable rcd with a solid neutral shall trip automatically on connection of the supply and provide a continuous visual indication of the supply fault.

Compliance shall be checked by the tests described in **8.30**.

7.6.8 The portable rcd shall not be fitted with an intentional time delay.

Compliance shall be checked by the test described in **8.10.3**.

7.7 Connection arrangements

7.7.1 Terminals in a rewirable portable rcd shall permit the connection, without special preparation, of flexible cords having nominal conductor cross-sectional areas of 0.5 mm^2 to 1.5 mm^2 .

Compliance shall be checked by inspection, by a manual test and by the tests described in **8.18**.

7.7.2 Where pillar terminals are used they shall have clamping screws of sufficient length to extend to the far side of the conductor hole. The end of the screw shall be slightly rounded so as to minimize damage to the conductors.

The sizes of the conductor hole and the clamping screw shall be such that the clearance between the sides of the major diameter of the clamping screw and the conductor hole does not exceed 0.4 mm .

Compliance shall be checked by inspection and measurement.

7.7.3 Terminal screws shall have a nominal (outside) diameter as given in table 3.

Compliance shall be checked by inspection and measurement.

7.7.4 Terminals of a portable rcd shall be so located or shielded that should a wire of a stranded conductor escape when the conductors are fitted, there is no risk of accidental connection between live parts and accessible external surfaces.

Compliance shall be checked by the test described in **8.17**.

7.7.5 A non-rewirable portable rcd fitted with a flexible cord shall be provided with soldered, welded, crimped or similar terminations; screw-type and 'snap-on' terminals shall not be used.

Crimped connections shall not be made on to presoldered ends of flexible cords.

For all these methods of termination, not more than one strand, or 5 % of the total number of strands of the conductor, whichever is the greater, shall be fractured during connection.

Compliance shall be checked by inspection and measurement.

7.8 Screws, current carrying parts and connections

7.8.1 Screwed connections, electrical and otherwise, shall withstand the mechanical stresses occurring in normal use. Screws transmitting electrical contact pressure shall screw into metal and shall be of metal which is not soft nor liable to creep.

Compliance shall be checked by inspection and by the tests described in **8.18**.

7.8.2 Screws accessible to the user shall not be of insulating material if their replacement by a metal screw would affect the safety or performance requirements of the portable rcd.

Compliance shall be checked by inspection.

7.8.3 Contact pressure in electrical connections shall not depend on the dimensional stability of insulating materials other than ceramic or mica.

Compliance shall be checked by inspection.



7.8.4 Thread-forming or thread-cutting screws for the connection of current-carrying parts and parts of the earthing circuit shall be used only when screwed into metal parts. Such screws shall not be accessible during installation or in normal use.

Compliance shall be checked by inspection.

7.8.5 Screws which make a mechanical connection between different parts of the device shall be locked against loosening, if the connection carries current, including earth fault currents.

Compliance shall be checked by inspection and manual test.

7.9 Cord anchorage and the connection of flexible cords

7.9.1 Cord anchorages in the portable rcd shall anchor the cord securely.

Compliance shall be checked by the tests referred to in 8.5.

7.9.2 The cord entry to the portable rcd shall be so shaped as to prevent damage to the cord which could be caused by excessive bending.

Compliance shall be checked by inspection.

7.9.3 Flexible cords supplied with a portable rcd shall be coloured as indicated on the instructions described in 5.7.

Compliance shall be checked by inspection.

7.9.4 A portable rcd supplied fitted with a flexible cord shall be so designed that the flexible cord is not subjected to excessive bending where it enters the portable rcd.

Compliance shall be checked by the test described in 8.19.

7.9.5 Flexible cords fitted to a portable rcd socket-outlet shall comply with BS 6500. The maximum length of flexible cord fitted shall not exceed 2 m.

Compliance shall be checked by inspection and measurement.

7.10 Accessibility of live parts

7.10.1 The portable rcd shall be so designed that when installed in normal use, live parts are not accessible.

Compliance shall be checked by the tests referred to in 8.20.

7.10.2 Where a portable rcd has a resilient enclosure it shall be so designed and constructed that when assembled and wired as in normal use there is no risk that, as a result of undue pressure, live parts could penetrate the cover or become so disposed as to reduce creepage distances and clearances to values below those specified in 7.12.

Compliance shall be checked by the tests described in 8.21.

7.11 Provision for earthing

All accessible metal parts of a portable rcd shall be in effective electrical contact with the earth socket contacts and/or earthing plug pin, except for metal parts on, or screws in or through, non-conducting material,

and separated by such material from current-carrying parts in such a way that in normal use they can not become live, which need not be in effective electrical contact with the earthing socket contact or earthing plug pin.

NOTE. Metal parts having an accessible surface coating of lacquer or enamel are taken to be accessible metal parts for the purposes of this requirement.

Compliance shall be checked by the following tests:

- (a) for metal parts insulated from live parts, by the test described in 8.3;
- (b) for metal parts connected to an earthing terminal or earthing plug pin, by the test described in 8.22.

7.12 Creepage distances, clearances and distances through insulation

7.12.1 The minimum clearance through air and the minimum creepage distances on main current carrying circuits shall be 2.5 mm for the following cases:

- (a) between live parts and any other metal parts;
- (b) between live parts and the accessible external surface of the portable rcd;
- (c) between component parts in any fused line circuit that is separated by the removal of the fuse link.

Where printed circuit boards are used the guidance given in BS 6221 : Part 3 shall be followed.

NOTE. These requirements do not apply to any flexible cord connected to the portable rcd.

Compliance shall be checked by the tests described in 8.25.

7.12.2 The isolation distance between contacts in the same conductive path shall be at least 3 mm.

Compliance shall be checked by inspection and measurement.

7.12.3 The portable rcd shall have either a minimum distance of 2 mm through insulation between live parts and the accessible external surface or the minimum distance shall be made up of 2 mm through air and 1 mm insulation provided the parts are so located that there is no likelihood of the distance through air being reduced by distortion or movement of the parts.

NOTE. These requirements do not apply to any flexible cord connected to a portable rcd.

Compliance shall be checked by the tests described in 8.21.

7.13 Resistance to humidity

The portable rcd shall be proof against humid conditions which may occur in normal use.

Compliance shall be checked by the test described in 8.14.

7.14 Ability to withstand through fault current

The portable rcd shall be capable of withstanding the thermal and electromagnetic stresses which may occur under through fault conditions before the back-up protection clears.

Compliance shall be checked by the tests described in 8.16.

7.15 Resistance to heat

The portable rcd shall be resistant to heat.

Compliance shall be checked by the tests described in **8.26**.

7.16 Resistance to abnormal heat, fire and tracking

The portable rcd shall be proof against abnormal heat, fire and tracking.

Compliance shall be checked by the tests described in **8.27**.

The tests shall not be made on parts of ceramic material or metal.

7.17 Insulation resistance and electric strength

The insulation resistance and electric strength of a portable rcd shall be adequate.

Compliance shall be checked by the tests described in **8.3** and **8.8**.

7.18 Core balance requirement

The portable rcd shall not be subject to nuisance tripping due to an inherent unbalance in the transformer when subject to moderate current surges.

Compliance shall be checked by the test described in **8.6**.

7.19 Loss of supply neutral

The portable rcd shall automatically trip or shall continue to give protection in the event of a loss of the supply neutral.

Compliance shall be checked by the test described in **8.23**.

8 Type tests**8.1 General**

Type tests as specified in **8.2** to **8.31** shall be made on samples representing each type of portable rcd.

NOTE 1. A test for electronic component reliability is under consideration.

NOTE 2. Routine tests are given in clause **9**.

8.2 Conditions

8.2.1 Tests shall be made at rated voltage $\pm 5\%$, at rated frequency $\pm 10\%$ and at an ambient temperature of $20 \pm 5^\circ\text{C}$ unless otherwise stated in this standard.

8.2.2 The specified sequences shall be completed without any adjustment being made to the samples.

8.2.3 The portable rcd shall be positioned and wired as in normal use unless otherwise stated and in compliance with any requirements specified by the manufacturer.

8.2.4 Flexible cords used for the tests shall comply with BS 6500 and be of the appropriate size according to the rating of the portable rcd unless otherwise specified in the appropriate clause.

8.2.5 A separate sample shall be used for each of the test sequences given in **8.2.8** except for test sequence **8**, which may require more than one sample (see appendix A). Each sample shall be in a clean, new condition.

8.2.6 The tests shall be performed in the order given for each test sequence.

8.2.7 When routine tests as described in clause **9** are carried out as part of the type test sequences of **8.2.8** all of **8.2** shall be complied with.

8.2.8 The portable rcd shall be deemed to comply with this standard provided that there are no failures during the following test sequences.

NOTE. The type testing sequences may be modified by the requirements referred to in appendix A.

Test sequence 1

- | | |
|----------------------------------|-----------------|
| (a) Routine tests | clause 9 |
| (b) Verification of construction | 8.24 |

Test sequence 2

- | | |
|--|-----------------|
| (a) Routine tests | clause 9 |
| (b) High impulse voltage | * |
| (c) Temperature rise | 8.4 |
| (d) Transformer balance | 8.6 |
| (e) Tests for reverse polarity | 8.30 |
| (f) Portable rcd performance | 8.10 |
| (g) Insulation resistance | 8.8 |
| (h) Resistance to excessive residual stresses and to rusting | 8.13 |

Test sequence 3

- | | |
|---|-----------------|
| (a) Routine tests | clause 9 |
| (b) Loss of supply neutral | 8.23 |
| (c) Endurance | 8.12 |
| (d) Condition of tested sample | 8.15 |
| (e) Portable rcd performance | 8.10 |
| (f) Reliability of contact position indicator | 8.31 |

Test sequence 4

- | | |
|--------------------------------|-----------------|
| (a) Routine tests | clause 9 |
| (b) Circuit fault current | 8.16 |
| (c) Condition of tested sample | 8.15 |
| (d) Portable rcd performance | 8.10 |

Test sequence 5

- | | |
|----------------------------|-----------------|
| (a) Routine tests | clause 9 |
| (b) Resistance to humidity | 8.14 |
| (c) Insulation resistance | 8.8 |
| (d) High voltage | 8.3 |
| (e) Durability of marking | 8.7 |

* This test is under consideration and will be added by amendment.

Test sequence 6

- | | |
|--------------------------------------|----------|
| (a) Routine tests | clause 9 |
| (b) Earth fault breaking current | 8.9 |
| (c) Portable rcd performance | 8.10 |
| (d) Condition of tested sample | 8.15 |
| (e) Electronic component reliability | * |

Test sequence 7

- | | |
|--|----------|
| (a) Routine tests | clause 9 |
| (b) Stray conductor strand | 8.17 |
| (c) Screwed connections | 8.18 |
| (d) Accessibility of live parts | 8.20 |
| (e) Durability of marking | 8.7 |
| (f) Cord anchorage | 8.5 |
| (g) Mechanical strength | 8.11 |
| (h) Tripping current | 8.10.4 |
| (i) Effective earthing | 8.22 |
| (j) Resistance to heat | 8.26 |
| (k) Accessibility of live parts | 8.20 |
| (l) Routine high voltage | 9.2 |
| (m) Flexing test for flexible cords | 8.19 |
| (n) Test circuit operation | 8.29 |
| (o) Verification of creepage and clearances | 8.25 |
| (p) Distance through insulation | 8.21 |
| (q) Resistance to abnormal heat, fire and tracking | 8.27 |

Test sequence 8

- | | |
|--|----------|
| (a) Routine tests | clause 9 |
| (b) Verification of plug and/or socket-outlet(s) portion | 8.28 |

8.3 High voltage

The portable rcd shall withstand the test voltage given in table 1 applied for 1 min as follows.

- Between all incoming terminals of poles in turn with the portable rcd contacts closed. If an auxiliary source or electronic control circuit is required to close the contacts, this may be disconnected and the test shall be carried out with the contacts open followed by a second test between all outgoing terminals of poles in turn, excluding the earth terminal.
- Between all incoming terminals of switched poles and the corresponding outgoing terminals of switched poles in turn with the contacts open.
- Between the terminals of all main poles connected together, excluding the earth terminal, and any earthed metal.
- Between the terminals of all main poles connected together, excluding the earth terminal, and a metal foil in contact with the entire accessible external surface.

Where terminals are not directly accessible, these tests shall be made using accessible parts, e.g. pins or socket-outlet contacts, known to be connected to the terminals.

Table 1. High voltage test values

Rated voltage, U_N	a.c. test voltage (r.m.s.)
V	V
$U_N \leq 60$	$1000 \begin{smallmatrix} -0 \\ +30 \end{smallmatrix}$
$60 < U_N \leq 300$	$2000 \begin{smallmatrix} -0 \\ +60 \end{smallmatrix}$

A voltage of substantially sinusoidal waveform at the rated frequency of the device is applied. Initially, not more than half the test voltage is applied, the voltage then being increased to full value. The high voltage source used shall be such that when the output is adjusted to 2000 ± 60 V for 1 min and is then short-circuited, the output current is $200 \begin{smallmatrix} +20 \\ -0 \end{smallmatrix}$ mA.

Any overcurrent protection shall not operate at a current less than 100 mA.

During the test, no flashover or breakdown shall occur. Glow discharges without drop in voltage are neglected.

NOTE 1. Attention is drawn to the need for special precautions to be taken in the use of test sets with outputs greater than 10 mA.

NOTE 2. Connections to under-voltage releases or electronic devices may be removed or disconnected for this test.

8.4 Temperature rise

The temperature-rise test shall be carried out in accordance with the tests for the requirements specified in the standard appropriate to the associated plug/socket-outlet.

After the test there shall be no damage to adjacent parts and the operation of the portable rcd shall not be impaired.

NOTE. The term 'no damage' implies that the essential characteristics remain such that the mechanical, dielectric and operating functions comply with the appropriate requirements of this standard. These are checked when carrying out the remaining tests in the sequence.

8.5 Cord anchorage

The tests for the requirements specified in the standard appropriate to the associated plug/socket-outlet shall be carried out.

8.6 Transformer balance

The portable rcd shall be closed three times on to a circuit such that each pole carries twice the rated current (I_N) at the rated voltage of the device. The portable rcd shall not trip. The test current shall be maintained for 5 s.

NOTE. Appendix C of BS 4293 : 1983 gives information on the purpose of the transformer balance test.

8.7 Durability of marking

The durability of marking shall be checked by rubbing the marking by hand for 15 s with a piece of cloth soaked in water and again for 15 s with a piece of cloth soaked in petroleum spirit.

*This test is under consideration and will be added by amendment.