



Specification for

Safety of household and similar electrical appliances

Part 3. Complete particular specifications
Section 3.25 Battery chargers

Spécification relative à la sécurité des appareils électrodomestiques et appareils analogues
Partie 3. Spécifications particulières complètes
Section 3.25 Chargeurs d'accumulateur

Spezifikation bezüglich der Sicherheit von elektrischen Haushaltsgeräten und ähnliche Zwecke
Teil 3. Volle einzelne Spezifikationen
Abschnitt 3.25 Batterieladegeräte

BS 3456 : Part 3 : Section 3.25 : 1981

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Foreword

This revised specification for battery chargers has been prepared under the direction of the Light Electrical Engineering Standards Committee and is one of the new series of stand-alone specifications that will replace the existing sections of Part 2 of BS 3456.

A need for revision of the whole of the BS 3456 series has arisen from the harmonization programme of the European Committee for Electrotechnical Standardization (CENELEC). The general requirements of this standard are technically identical with HD 251 S2, the CENELEC harmonization document (HD) for household and similar electrical appliances. Particular requirements for battery chargers are technically aligned with the International Electrotechnical Commission (IEC) Publication IEC 335-2-29, which will be adopted by CENELEC as the basis of the HD for battery chargers. Any minor changes that may be required as a result of the subsequent publication of the HD for battery chargers will be introduced by amendment action as soon as this HD has been agreed by CENELEC.

CENELEC harmonization documents recognize certain national deviations that cannot, for the moment, be removed. Such United Kingdom departures, in accordance with CENELEC regulations, are denoted in the text by a marginal marking as shown below*. Deviations for other countries may be ascertained by reference to the relevant CENELEC harmonization documents.

For ease of cross-referencing between this standard, the CENELEC HDs and the IEC standards on which the HDs are based, the clause and subclause numbers have been kept in line with those of the second edition of International Electrotechnical Commission Publication 335-1 : 1976, which is the reference document for HD 251 S2. Where a clause of the IEC standard does not

apply to the appliances covered by this standard the clause number has been retained marked 'No requirement'. Additional subclauses introduced by either the CENELEC HDs or by UK deviations from the HDs are numbered with the main clause number, followed by **I, II** etc., for additional clauses for general requirements and **.101, .102** etc., for additional clauses for requirements particular to battery chargers.

Appliances complying with the requirements of British Standards in the BS 3456 series of specifications are not necessarily suitable for use in premises to which the Offices, Shops and Railway Premises Act of 1963 and the Factories Act apply.

Compliance with the Electrical Equipment (Safety) Regulations : 1975, will generally be assured if appliances comply with the requirements of BS 3456. For more precise details regarding the relevance of BS 3456 to the regulations, reference should be made to the 'Administrative Guidance on the Electrical Equipment (Safety) Regulations : 1975 and the Electrical Equipment (Safety) (Amendment) Regulations 1976', available from HMSO (ISBN 0 11 511831 4).

Certification. The British Electrotechnical Approvals Board (BEAB) uses the series of specifications in BS 3456 as the requirements for granting its certification mark (see the inside back cover for details).

This British Standard supersedes BS 3456 : Part 2: Section 2.36 which will be withdrawn on the date agreed by the CENELEC General Assembly for standards conflicting with the HD for battery chargers to be withdrawn. Until this date BEAB will accept for approval appliances complying either with this standard or with BS 3456 : Part 2 : Section 2.36.

* The marginal marking used in the text to indicate national deviations from CENELEC harmonization documents is as follows:

British Standard Specification for Safety of household and similar electrical appliances

Part 3. Complete particular specifications Section 3.25 Battery chargers

1. Scope

1.1 BS 3456 : Part 3 : Section 3.25 specifies requirements for mains-operated, self-contained battery chargers incorporating static rectifiers, having an output at safety extra-low voltage for household and similar purposes and suitable for recharging batteries for automobiles, appliances and the like.

Battery chargers not intended for normal household use, but which nevertheless may be a source of danger to the public, such as battery chargers intended to be used by lay people in shops, in light industry and on farms, are within the scope of this standard. Examples of such battery chargers are those for gardening appliances and for use in garages and the like.

Battery chargers which are intended to be built into caravans and which may incorporate a d.c. distribution board are within the scope of this standard.

This standard does not take into account the special hazards that exist in nurseries and other places where there are young children or aged or infirm persons without supervision; in such cases additional requirements may be necessary.

This standard does not apply to:

- battery chargers designed exclusively for industrial purposes;
- battery chargers intended to be used in locations where special conditions prevail, such as the presence of a corrosive, explosive atmosphere (dust, vapour or gas);
- charging assemblies for battery-powered appliances having a low input;
- charging assemblies for toys;
- charging assemblies for electronic equipment;

For battery chargers intended to be used in vehicles or on board ships or aircraft, additional requirements may be necessary.

For battery chargers intended to be used in tropical countries, special requirements may be necessary.

Additional requirements for battery chargers provided with an engine cranking switch are under consideration.

1.2 This standard is concerned with safety and takes into account the influence on safety of components necessary to achieve a required degree of radio and television interference suppression.

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

2. Definitions

Where the terms 'voltage' and 'current' are used, they imply the r.m.s values unless otherwise specified.

For the purposes of this British Standard the following definitions, with the exception of definitions **2.16**

and **2.17**, apply. Definitions **2.16** and **2.17** have been included because, although these classes of appliance are not permitted in the United Kingdom, they are referred to in corresponding international standards.

2.1 d.c. distribution board. A means whereby d.c. power can be distributed to various points by means of a number of switched outlets each protected by a separate fuse-link.

NOTE. The d.c. power source to a distribution board need not be derived from the battery charger circuit.

2.11 caravan. A structure designed or adapted for human habitation and capable of being moved from one place to another (whether towed or transported on a motor vehicle or trailer), or any other motor vehicle so designed or adapted but not including:

- (a) railway rolling stock which is on rails forming part of a railway system; or
- (b) tents.

2.1 rated voltage. The voltage (for three-phase supply, the voltage between phases) assigned to the appliance by the manufacturer.

2.2 rated voltage range. The voltage range assigned to the appliance by the manufacturer, expressed by its lower and upper limits.

2.3 working voltage. The maximum voltage to which the part under consideration can be subjected when the appliance is operating at its rated voltage and under normal conditions of use

NOTE 1. Normal conditions of use include changes of voltage within the appliance imposed by likely occurrences such as the operation of a circuit breaker or the failure of a lamp.

NOTE 2. When deducing the working voltage, the effect of possible transient voltages on the supply mains is ignored.

2.4 rated input. The input under conditions of adequate heat discharge or under normal load and at normal operating temperature assigned to the appliance by the manufacturer.

2.5 rated input current. The input current assigned to the appliance by the manufacturer.

NOTE. If no current is assigned to the appliance, the rated input current for the purposes of this standard is determined by calculation from the rated input and the rated voltage and/or by measuring the input current when the appliance is operating at rated voltage under normal load and at normal operating temperature.

2.6 rated frequency. The frequency assigned to the appliance by the manufacturer.

2.7 rated frequency range. The frequency range assigned to the appliance by the manufacturer expressed by its lower and upper limits.

2.8 No requirement.

2.9 detachable flexible cable or cord. A flexible cable or cord, for supply or other purposes, intended to be connected to the appliance by means of a suitable appliance coupler.

2.10 power supply cord. A flexible cable or cord, for supply purposes, fixed to, or assembled with the appliance according to one of the following methods:

type X attachment. A method of attachment such that the flexible cable or cord can easily be replaced, without the aid of special purpose tools, by a flexible cable or cord not requiring any special preparation.

type M attachment. A method of attachment such that the flexible cable or cord can easily be replaced, without

the aid of special purpose tools, by a special cable or cord with, for example, a moulded-on cord guard or crimped terminations.

type Y attachment. A method of attachment such that the flexible cable or cord can be replaced only with the aid of special purpose tools normally available only to the manufacturer or his agents.

NOTE. Type M and type Y attachments may be used either with common flexible cables or cords or with special cables or cords.

type Z attachment. A method of attachment such that the flexible cable or cord cannot be replaced without breaking or destroying a part of the appliance.

2.11 No requirement.

2.12 basic insulation. Insulation applied to live parts to provide basic protection against electric shock.

NOTE. Basic insulation does not necessarily include insulation used exclusively for functional purposes.

2.13 supplementary insulation. Independent insulation applied in addition to basic insulation, in order to ensure protection against electric shock in the event of a failure of the basic insulation.

2.14 double insulation. Insulation comprising both basic insulation and supplementary insulation.

2.15 reinforced insulation. A single insulation system applied to live parts that provides a degree of protection against electric shock equivalent to double insulation under the conditions specified in this standard.

NOTE. The term 'insulation system' does not imply that the insulation is one homogeneous piece. It may comprise several layers that cannot be tested singly as supplementary or basic insulation.

2.16 class 0 appliance. An appliance in which protection against electric shock relies upon basic insulation; this implies that there are no means for the connection of accessible conductive parts, if any, to the protective (earthing) conductor in the fixed wiring of the installation, reliance in the event of a failure of the basic insulation being placed upon the environment.

NOTE 1. Class 0 appliances have either an enclosure of insulating material which may form a part or the whole of the basic insulation, or a metal enclosure which is separated from live parts by an appropriate insulation. If an appliance with an enclosure of insulating material has provision for earthing internal parts, it is considered to be of class I or class OI construction.

NOTE 2. Class 0 appliances may have parts with double insulation or reinforced insulation, or parts operating at safety extra-low voltage.

2.17 class OI appliance. An appliance having at least basic insulation throughout and provided with an earthing terminal, but with a power supply cord without an earthing conductor and a plug without an earthing contact and which cannot be introduced into a socket-outlet with an earthing contact.

NOTE. Class OI appliances may have parts with double insulation or reinforced insulation, or parts operating at safety extra-low voltage.

2.18 class I appliance. An appliance in which protection against electric shock does not rely on basic insulation only, but which includes an additional safety precaution in such a way that means are provided for the connection of accessible conductive parts to the protective (earthing) conductor in the fixed wiring of the installation so that accessible conductive parts cannot become live in the event of a failure of the basic insulation.

NOTE 1. Class I appliances may have parts with double insulation, or parts operating at safety extra-low voltage.

NOTE 2. For appliances intended for use with a flexible cord or cable, this provision includes a protective (earthing) conductor as part of the flexible cord or cable.

2.19 class II appliance. An appliance in which protection against electric shock does not rely on basic insulation only, but in which additional safety precautions, such as double insulation or reinforced insulation, are provided, there being no provision for protective earthing or reliance upon installation conditions.

Such an appliance may be of one of the following types:

(a) an appliance having a durable and substantially continuous enclosure of insulating material that envelops all metal parts, with the exception of small parts, such as nameplates, screws and rivets, which are isolated from live parts by insulation at least equivalent to reinforced insulation; such an appliance is called an 'insulation-encased class II appliance';

(b) an appliance having a substantially continuous metal enclosure, in which double insulation is used throughout, except for those parts where reinforced insulation is used, because the application of double insulation is manifestly impracticable; such an appliance is called a 'metal-encased class II appliance';

(c) an appliance which is a combination of the types (a) and (b).

NOTE 1. The enclosure of an insulation-encased class II appliance may form a part or the whole of the supplementary insulation or of the reinforced insulation.

NOTE 2. If an appliance with double insulation and/or reinforced insulation throughout has an earthing terminal or earthing contact, it is considered to be of class I or class OI construction. Class II appliances may be provided with means for maintaining the continuity of protective circuits, provided that such means are within the appliance and are insulated from accessible conductive parts by double insulation or reinforced insulation.

NOTE 3. Class II appliances may have parts operating at safety extra-low voltage.

2.20 class III appliance. An appliance in which protection against electric shock relies on supply at safety extra-low voltage and in which voltages higher than these are not generated.

NOTE. Appliances intended to be operated at safety extra-low voltage and having internal circuits that operate at a voltage other than safety extra-low voltage are not included in the classification and are subject to additional requirements.

2.21 extra-low voltage. A voltage supplied from a source within the appliance and, when the appliance is operated at its rated voltage, not exceeding 42 V between conductors and between conductors and earth or, for three-phase supply, not exceeding 24 V between conductors and neutral, the extra-low voltage circuit being separated from other circuits by basic insulation only.

2.22 safety extra-low voltage. A nominal voltage not exceeding 42 V between conductors and between conductors and earth or, for three-phase supply, not exceeding 24 V between conductors and neutral, the no-load voltage not exceeding 50 V and 29 V respectively.

NOTE 1. When safety extra-low voltage is obtained from the supply mains, it is essential that it be through a safety isolating transformer or a converter with separate windings.

NOTE 2. The voltage limits specified are based on the assumption that the safety isolating transformer is operated at its rated supply voltage.

2.23 safety isolating transformer. A transformer with a put winding of which is electrically separated from the

output windings by an insulation at least equivalent to double insulation or reinforced insulation, and which is designed to supply a distribution circuit, an appliance or other equipment at safety extra-low voltage.

NOTE. Transformers complying with the requirements of BS 3535, without provision for earthing and with the appropriate output voltages are considered to be safety isolating transformers for the purposes of this specification.

2.24 portable appliance. Either an appliance that is moved while in operation or an appliance that can easily be moved from one place to another while connected to the supply.

2.25 No requirement.

2.26 No requirement.

2.27 No requirement.

2.28 No requirement.

2.29 No requirement.

2.30 normal load. The load obtained when the battery charger operates at rated input voltage or at the upper limit of the rated input voltage range, the output circuit being adjusted to give the rated d.c. output current.

NOTE. A circuit diagram is given in figure 19.

2.31 No requirement.

2.32 continuous operation. Operation under normal load or in accordance with conditions of adequate heat discharge for an unlimited period.

2.33 No requirement.

2.34 No requirement.

2.35 non-detachable part. A part that can be removed only with the aid of a tool.

2.36 detachable part. A part that can be removed without the aid of a tool.

2.37 thermostat. A temperature-sensing device, the operating temperature of which may be either fixed or adjustable and which, during normal operation, keeps the temperature of an appliance, or of parts of it, between certain limits by automatically opening and closing a circuit.

2.38 temperature limiter. A temperature-sensing device, the operating temperature of which may be either fixed or adjustable and which, during normal operation, operates by opening or closing a circuit when the temperature of an appliance, or of parts of it, reaches a predetermined value.

NOTE. A temperature limiter does not make the reverse operation during the normal duty cycle of the appliance. It may or may not require manual resetting.

2.39 thermal cut-out. A device which, during abnormal operation, limits the temperature of an appliance, or of parts of it, by automatically opening the circuit or by reducing the current, and which is so constructed that its setting cannot be altered by the user.

2.40 self-resetting thermal cut-out. A thermal cut-out that automatically restores the current after the relevant part of the appliance has cooled down sufficiently.

2.41 non-self-resetting thermal cut-out. A thermal cut-out that requires resetting by hand, or replacement of a part, in order to restore the current.

2.42 tool. A screwdriver, a coin or any other object that may be used to operate a screw or similar fixing means.

2.43 creepage distance. The shortest path between two conductive parts, or between a conductive part and the bounding surface of the appliance, measured along the surface of the insulating material.

2.44 clearance. The shortest distance between two conductive parts, or between a conductive part and the bounding surface of the appliance, measured through air.

NOTE. The bounding surface of the appliance is the outer surface of the enclosure, considered as though metal foil were pressed into contact with accessible surfaces of insulating material.

2.45 all-pole disconnection. Disconnection of both supply conductors by a single switching action.

NOTE. The protective earthing conductor is not considered to be a supply conductor.

2.46 No requirement.

2.47 accessible part or accessible surface. A part or surface that can be touched by means of test finger I specified in BS 3042 (see figure 1).

2.48 body. All accessible metal parts, shafts of handles, knobs, grips and the like and metal foil in contact with all accessible surfaces of insulating material but excluding inaccessible metal parts.

2.101 rated mean d.c. output voltage. The mean d.c. output voltage assigned to the battery charger by the manufacturer.

NOTE. The rated mean d.c. output voltage of a battery charger equals the product of the number of cells connected in series and the nominal voltage of one cell of the battery for which the charger is intended to be used; for example, the rated mean d.c. output of a battery charger intended to be used for charging a lead-acid-cell battery with three 2 V cells in series is 6 V.

2.102 rated mean d.c. output current. The mean d.c. output current assigned to the battery charger by the manufacturer.

2.103 charging assembly. The battery charging circuit and associated components forming part of an equipment; such an assembly may be integral with the equipment or detachable.

2.104 engine cranking switch. A switch which allows the battery charger to supply a supplementary current in addition to that delivered by the battery when starting an engine.

3. General requirements

3.1 Appliances shall be so designed and constructed that, in normal use, they function safely so as to cause no danger to persons or surroundings, even in the event of such careless use as may occur in normal service.

TEST. In general, compliance shall be checked by carrying out all the relevant tests specified.

3.1 Additionally, where the standard is used for the purposes of granting nationally recognized certification marks, designs or constructions to which the tests specified do not fully apply but which give an equivalent degree of safety and durability of safety, may be regarded as complying with the requirements of this standard, subject to the findings of a special investigation by the authority granting the certification mark and pending the issue of an amendment or extension to this standard.

4. General conditions for the tests

4.1 Tests carried out according to this standard are type tests.

4.2 Unless otherwise specified, the tests shall be carried out on a single sample as delivered, which shall withstand all the relevant tests.

NOTE 1. If it is evident from the design of the appliance that a particular test is not applicable, this test is not carried out.

5. Rating

5.1 The maximum rated voltage is 250 V.

TEST. Compliance shall be checked by inspection of the marking.

NOTE. The requirements of this standard are based on the assumption that, in normal use, the voltage between the supply lines and earth does not exceed 254 V.

5.1 Appliances intended for direct connection to the UK mains supply shall have a rated voltage that covers use at 240 V and a rated frequency that covers use at 50 Hz.

TEST. Compliance shall be checked by inspection of the marking.

6. Classification

The appliances covered by this standard shall be classified:

(a) according to protection against electric shock:

- class I appliances;
- class II appliances;
- class III appliances;

NOTE 1. The class numbers are not intended to reflect the safety level of the appliances, but only the means by which the safety is obtained.

NOTE 2. If the appliance is designed for different supply voltages more than one sample may be required.

NOTE 3. If the test of 21.101 has to be carried out, two additional samples are required.

NOTE 4. If it is necessary to dismantle a class II appliance for the relevant tests, one additional sample is required.

NOTE 5. The testing of components may necessitate the submission of additional samples of these components. When the submission of such samples is necessary, they should be submitted together with the appliance.

4.3 Unless otherwise specified, the tests shall be carried out in the order of the clauses of this specification.

NOTE. Before testing is started, the appliance is operated at rated voltage in order to verify that it is in working order.

4.4 The tests shall be carried out with the appliance, or any movable part of it, placed in the most unfavourable position that may occur in normal use.

4.5 If the test results are influenced by the temperature of the ambient air, the room temperature shall be, in general, maintained at 20 ± 5 °C. If, however, the temperature attained by any part is limited by a temperature-sensitive device, or is influenced by the temperature at which a change of state occurs, the room temperature is, in case of doubt, maintained at 23 ± 2 °C.

4.6 Appliances shall be tested with a.c., at rated frequency, if marked.

Appliances that are not marked with a rated frequency shall be tested at 50 Hz.

Appliances that are marked with a rated frequency range of 50 Hz to 60 Hz shall be tested at 50 Hz or 60 Hz, whichever is the more unfavourable.

Appliances marked with a rated frequency range other than 50 Hz to 60 Hz shall be tested at the most unfavourable frequency within the range.

Appliances designed for more than one rated voltage shall be tested at the most unfavourable voltage.

Unless otherwise specified, appliances designed for one or more rated voltage ranges shall be tested at the most unfavourable voltage within the relevant range.

When it is specified, for battery chargers marked with a rated voltage range, that the supply voltage is equal to the rated voltage multiplied by a factor, the supply voltage shall be equal to:

the upper limit of the rated voltage range multiplied by this factor, if greater than 1;

the lower limit of the rated voltage range multiplied by this factor, if smaller than 1.

NOTE 1. Where reference is made to maximum or minimum rated input, the rated input related to the upper limit or lower limit respectively of the rated voltage range is meant.

NOTE 2. If the appliance is designed for more than one rated voltage or rated voltage range, it may be necessary to carry out some of the tests at the minimum, the mean and the maximum values of the rated voltage or the rated voltage range in order to establish the most unfavourable voltage.

4.7 No requirement.

4.8 No requirement.

4.9 Appliances provided with a thermostat, a regulating device or a similar control shall be tested with these controls adjusted to their most unfavourable setting, if the setting can be altered by the user.

NOTE 1. If the adjusting means of the control is accessible without the aid of a tool, this subclause applies whether the setting can be altered by hand or with the aid of a tool. If the adjusting means is not accessible without the aid of a tool, this subclause applies only if the setting can be altered by hand.

NOTE 2. Adequate sealing is regarded as preventing alteration of the setting by the user.

4.10 No requirement.

4.11 Unless otherwise specified, appliances intended to be supplied by means of a flexible cable or cord shall be tested with the appropriate flexible cable or cord connected to the appliance.

4.12 No requirement.

4.13 No requirement.

4.14 Class III appliances shall be tested together with their supply transformers if these are sold with the appliances.

4.15 For the purposes of 8.6, 8.7, 16.4, 25.11 and 27.1, parts separated from live parts by double insulation or reinforced insulation shall be regarded as not being likely to become live in the event of an insulation fault; connection of accessible metal parts to an earthing terminal or earthing contact does not remove the necessity for carrying out the relevant tests.

4.16 If class I appliances have accessible metal parts that are not connected to an earthing terminal or earthing contact and that are not separated from live parts by an intermediate metal part which is connected to an earthing terminal or earthing contact, such parts shall be checked for compliance with the appropriate requirements specified for class II appliances.

4.17 If class I or class II appliances have parts operating at safety extra-low voltage, such parts shall be checked for compliance with the appropriate requirements specified for class III appliances.

4.18 For testing appliances incorporating electronic circuits, see appendix A.

4.101 Battery chargers intended to be built into caravans shall be installed in accordance with the manufacturer's instructions, as far as these are in accordance with normal installation conditions. 

Other battery chargers shall be tested as portable appliances.

4.1 A combined battery charger and d.c. distribution board unit capable of operating separately as a charger or as a d.c. distribution board shall be tested separately in each mode, unless testing as a combined unit produces more unfavourable operating conditions. 

NOTE 2. If class III appliances are sold with a separate safety isolating transformer for their supply from the mains, their classification is not altered.

(b) according to degree of protection against moisture:

- ordinary appliances;
- drip-proof appliances;
- splash-proof appliances.

7. Marking

7.1 Appliances shall be marked with:

- (a) rated voltage(s) or rated voltage range(s), in volts;
- (b) symbol for nature of supply, if applicable;
- (c) rated frequency or rated frequency range, in hertz, unless the appliance is designed for a.c. of both 50 Hz and 60 Hz;
- (d) rated input in watts or kilowatts, if greater than 25 W;

(e) rated current, in amperes, of the appropriate battery charger output fuse-link and of each of the d.c. distribution board output circuit fuse-links, unless the fuse-link is not interchangeable with an output fuse-link having a higher rated current.

(f) the symbol for the fuse-link and the time/current characteristic, if the fuse-link is of the time-lag type.

(g) manufacturer's or responsible vendor's name, trade mark or identification mark;

(h) manufacturer's model or type reference;

(i) symbol for class II construction, for class II appliances only;

(j) symbol for degree of protection against moisture, if applicable;

(k) rated d.c. output voltage or voltages, in volts;

(l) rated d.c. output current, in amperes.

Terminals or terminations in the output circuit to which external conductors are to be connected, shall be clearly indicated by the symbol '+' or the colour red if of positive polarity, and by the symbol '-' or the colour black if of negative polarity.

Conductors of the output circuit shall be coloured red or black, as appropriate, unless the insulation of the conductor connected to the positive pole is identified in an appropriate way by stamping; the colours blue and brown shall not be used for identifying conductors of the output circuit.

Battery chargers shall also be marked with the substance of the following.

- (i) WARNING! explosive gases - prevent flames and sparks;
- (ii) before charging, study instruction sheet;
- (iii) disconnect supply before making or breaking d.c. connections.

Automobile battery chargers, other than those provided with wheels, shall be marked, if applicable, with the substance of the following additional warning:

'This battery charger incorporates parts, such as switches and relays, that are likely to produce arcs or sparks; therefore, if used in a garage, locate the battery charger in a room or enclosure provided for this purpose'.

Class I battery chargers shall be marked with the following warning:

WARNING: THIS APPLIANCE MUST BE EARTHED.

Ordinary battery chargers shall be marked with the substance of either of the following warnings.

FOR INDOOR USE ONLY

DO NOT EXPOSE TO RAIN

NOTE. Additional markings are allowed, provided they do not give rise to misunderstanding.

7.2 Battery chargers provided with an engine cranking switch shall be marked with the maximum permissible 'on' time and either the minimum permissible 'off' time or the maximum permissible value of the ratio between 'on' time and 'off' time.

7.3 No requirement.

7.4 If the appliance can be adjusted to suit different rated input voltages the voltage or input to which the appliance is adjusted shall be easily and clearly discernible.

This requirement does not apply to appliances for star-delta connection.

NOTE. For appliances for which frequent changes in input voltage setting are not required, this requirement is considered to be complied with if the rated input voltage to which the appliance is adjusted can be determined from a wiring diagram fixed to the appliance; the wiring diagram may be on the inside of a cover which has to be removed to connect the supply conductors. This diagram may be on a card riveted to the cover, or on a paper or similar label secured to the cover by an adhesive, but it must not be on a label loosely attached to the appliance.

If the battery charger can be adjusted to different output voltages, the output voltage to which the battery charger is adjusted shall be easily and clearly discernible.

7.5 For appliances marked with more than one rated input voltage or rated input voltage range, the rated input for each of these voltages or ranges shall be marked, if greater than 25 W.

The upper and lower limits of the rated input shall be so marked on the appliance that the relation between input and voltage appears distinctly unless the difference between the limits of a rated voltage range does not exceed 10 % of the mean value of the range, in which case the marking for rated input may be related to the mean value of the range.

If the input of the appliance in cold condition differs by more than 25 % from the input at operating temperature, the input in cold condition shall be marked in addition, and shall be placed in parentheses after the marking of the input at operating temperature.

7.6 When symbols are used, they shall be as follows:

V	volts
A	amperes
Ah	ampere-hours
Hz	hertz
W	watts
kW	kilowatts
μF	microfarads
kg	kilograms
h	hours
min	minutes
s	seconds
	alternating current
	direct current
	rated current of the appropriate fuse-link
	time-lag D-type fuse-link
	

	time-lag miniature fuse-link where X is the symbol for time/current characteristic as given in BS 4265
	class II construction
	drip-proof construction (one drop)
	splash-proof construction (one drop in a triangle)

The symbol for nature of supply shall be placed next to the marking for rated voltage.

The dimensions of the symbol for class II construction shall be such that the length of the sides of the outer square is about twice the length of the sides of the inner square. The length of the sides of the outer square shall be not less than 5 mm, unless the largest dimension of the appliance does not exceed 150 mm, in which case the dimensions of the symbol may be reduced, but the length of the sides of the outer square shall be not less than 3 mm.

The symbol for class II construction shall be so placed that it will be obvious that it is a part of the technical information and is unlikely to be confused with any other marking.

7.7 For class I appliances, the line terminal shall be indicated by the letter L.

Terminals intended exclusively for the neutral conductor shall be indicated by the letter N.

Earthing terminals shall be indicated by the symbol $\perp$.

These indications shall not be placed on screws, removable washers or other parts that might be removed when conductors are being connected.

7.8 No requirement.

7.9 Unless it is obviously unnecessary, switches, the operation of which might cause a hazard, shall be so marked or placed as to indicate clearly which part of the appliance they control.

Indications used for this purpose shall, wherever practicable, be comprehensible without a knowledge of languages, national standards, etc.

7.10 The different positions of regulating devices, and the different positions of switches on stationary appliances shall be indicated by figures, letters or other visual means. The 'off' position shall not be indicated by words only.

If figures are used for indicating the different positions, the 'off' position shall be indicated by the figure 0 and the position for a greater output, input, etc., shall be indicated by a higher figure.

The figure 0 shall not be used for any other indication.

7.11 No requirement.

7.12 If it is necessary to take special precautions when installing or using the appliance, details of these shall be given in an instruction sheet that accompanies the appliance.

For appliances with type Z attachment the instruction sheet shall contain the substance of the following information:

'The supply cord of this appliance cannot be replaced; if the cord is damaged, the appliance should be discarded.'

The instruction sheet shall specify the type of battery, the number of cells and the rated capacity, in ampere-hours of the smallest battery for which the battery charger is intended to be used.

If a battery charger is marked to be automatic, its automatic function shall be explained in the instruction sheet, any limitation being clearly stated.

The instruction sheet for battery chargers intended to be built into caravans shall specify the following:

- the dimensions of the space to be provided for the battery charger;
- the dimensions and position of the means of supporting and fixing the battery charger within the space specified in (a);
- the minimum clearances between the various parts of the battery charger and the surrounding parts of the enclosure;
- the minimum dimensions and recommended position for ventilation openings;
- that the connection of the battery charger to the mains supply should be in accordance with *Regulations for Electrical Installations*, 15th Edition (IEE Wiring Regulations) 1981, published by the Institution of Electrical Engineers;
- that the battery should be positioned in a compartment vented to the outside.

The user instructions for a combined battery charger and d.c. distribution board unit shall include the following warnings, the first of which shall only be given if deemed necessary by the manufacturer.

WARNING. THE BATTERY CHARGER SHOULD NOT BE OPERATED WITHOUT A BATTERY CONNECTED.

WARNING. IF THE BATTERY IS DISCHARGED, THE LOAD SWITCHED ONTO THE DISTRIBUTION BOARD SHOULD NOT EXCEED THE RATED OUTPUT OF THE BATTERY CHARGER.

7.13 Instruction sheets and other texts required by this standard shall be written in the official language(s) of the country in which the appliance is to be sold. For appliances for sale in the United Kingdom, instructions shall be in English.

Where symbols are used, they shall be those indicated in this standard, although additional symbols are permitted if they do not give rise to misunderstanding.

TEST. Compliance with the requirements of **7.1, 7.2, 7.4** to **7.7, 7.9, 7.10, 7.12** and **7.13** shall be checked by inspection.

7.14 Marking required by this standard shall be easily legible and durable.

Marking specified in **7.1, 7.2, 7.4** and **7.5** shall be on a main part of the appliance.

The rated current of the appropriate fuse-link if any, shall be marked adjacent to the relevant fuse.

For battery chargers not provided with a two-pole connector in the output circuit, the indication of the polarity of the terminals or terminations in the output circuit shall be clearly visible at the point of connection to the battery.

The marking shall be clearly discernible from the outside, if necessary after removal of a cover; the removal of this cover shall not require the use of a tool.

Marking on, and indications for, switches, thermostats, thermal cut-outs and other control devices shall be placed in the vicinity of these components; they shall not be placed on removable parts if these parts can be replaced in such a way that the marking is misleading.

TEST. Compliance shall be checked by inspection and by rubbing the marking by hand for 15 s with a piece of cloth soaked with water and again for 15 s with a piece of cloth soaked with petroleum spirit.

After all the tests specified in this standard, the marking shall be easily legible, it shall not be easily possible to remove marking plates and they shall show no curling.

NOTE 1. A revision of the test for checking the durability of the marking is under consideration.

NOTE 2. In considering the durability of the marking, the effect of normal use is taken into account. Thus, for example, marking by means of paint or enamel other than vitreous enamel on containers that are likely to be cleaned frequently is not considered to be durable.

7.1 A label shall be attached to the flexible cord of all class I appliances fitted with a flexible cable or cord having cores coloured green-and-yellow, blue and brown. This label shall state the following.

'IMPORTANT

The wires in this mains lead are coloured in accordance with the following code.

Green-and-yellow: Earth

Blue: Neutral

Brown: Live'

In addition, the user instructions and label shall include the substance of the following.

'As the colours of the wires in the mains lead of this appliance may not correspond with the coloured markings identifying the terminals in your plug, proceed as follows.

The wire that is coloured green-and-yellow must be connected to the terminal in the plug which is marked with the letter E or by the earth symbol $\equiv$ or coloured green or green-and-yellow.

The wire which is coloured blue must be connected to the terminal which is marked with the letter N or coloured black.

The wire which is coloured brown must be connected to the terminal which is marked with the letter L or coloured red.'

For class II appliances fitted with a flexible cord, instructions shall be given by the manufacturer for the correct connection of the plug. These instructions shall make it clear that neither core is to be connected to the earth terminal of a three-pin plug.

TEST. Compliance shall be checked by inspection.

7.II For class I appliances the following warning notice shall be given on a label attached to the end of the flexible cord.

WARNING - THIS APPLIANCE MUST BE EARTHED

The warning shall also be included in the user instructions.

NOTE 1. The label specified in 7.I may be used for this purpose: a separate label is not required.

NOTE 2. For appliances intended for export, alternative labelling to that specified in 7.I and 7.II may be required.

TEST. Compliance shall be checked by inspection.

7.III Battery chargers incorporating a d.c. distribution board shall be marked with the maximum output current, in amperes, for each set of output terminals.

Battery chargers incorporating a d.c. distribution board which can be powered from an alternative source shall be marked with the type of power source which it is permissible to connect.

8. Protection against electric shock

8.1 Appliances shall be so constructed and enclosed that there is adequate protection against accidental contact with live parts and, for class II appliances, with metal parts separated from live parts by basic insulation only. This requirement applies for all positions of the appliance when it is wired and operated as in normal use, even after opening of lids and doors and removal of detachable parts, except for lamps located behind a detachable cover, provided that the appliance can be isolated from the supply by means of a plug or an all-pole switch, the 'off' position of which is clearly indicated. During the insertion or removal of lamps, protection against accidental contact with live parts of the lamp cap shall also be ensured.

There shall be, in addition, adequate protection against the risk of contact with basic insulation. Such insulation may, however, be accessible after removing a cover that requires the use of tools for removal and has to be removed for user maintenance, or after removing a cover that can be removed without tools if marked 'Remove plug before removing this cover' or 'Disconnect from the mains before removing this cover'.

The insulating properties of lacquer, enamel, ordinary paper, cotton, oxide film on metal parts, beads and sealing compound shall not be relied upon to give the required protection against accidental contact with live parts.

The enclosure of the appliance shall have no openings, other than those necessary for the use and working of the appliance, giving access to live parts and, for class II appliances, to parts separated from live parts by basic insulation only.

NOTE 1. Unless otherwise specified, parts operating at safety extra-low voltage not exceeding 24 V are not considered to be live parts.

NOTE 2. If a manufacturer instructs the user to remove a part during normal operation or user maintenance, that part is regarded as a detachable part even if a tool has to be used for its removal.

NOTE 3. This requirement excludes the use of screw-type fuses, and screw-type miniature circuit-breakers if they are accessible without the aid of a tool.

NOTE 4. Self-hardening resins are not regarded as sealing compound.

TEST. Compliance shall be checked by inspection and by a test with test finger I specified in BS 3042 (see figure 1).

In addition, all apertures in class II appliances and apertures in class I appliances other than those in metal parts connected to an earthing terminal or earthing contact and those giving access to live parts in socket outlets and lamp caps, shall be tested with test pin I specified in BS 3042 (see figure 2). The test finger and the test pin are applied, without appreciable force, in every possible position.

Apertures preventing the entry of the finger shall be further tested by means of a straight unjointed test finger of the same dimensions, which is applied with a force of 20 N; if this finger enters, the test with test finger I is repeated, the finger being introduced through the aperture. If the unjointed test finger does not enter, the force applied is increased to 30 N. If then the guard is so displaced or the aperture so distorted that test finger I can be inserted without force, the test with test finger I is repeated. An electrical contact indicator shall be used to show contact.

It shall not be possible to touch bare live parts or live parts protected by lacquer, enamel, ordinary paper, cotton, oxide film, beads or sealing compound only, with test finger I specified in BS 3042.

It shall not be possible to touch basic insulation with test finger I unless it is under a detachable cover that either requires the use of a tool for removal or is marked, 'Remove plug before removing this cover' or 'Disconnect from the mains before removing this cover'.

For class II appliances it shall not be possible to touch bare live parts with test pin I of BS 3042 or to touch metal parts separated from live parts by basic insulation only with test finger I of BS 3042.

NOTE 1. When applying test finger I, either or both of the jointed sections should be turned through any angle up to 90° with respect to the axis of the finger in the same direction only.

NOTE 2. It is recommended that a lamp be used for the indication of contact and that the voltage be not less than 40 V.

8.2 No requirement.

8.3 No requirement.

8.4 No requirement.

8.5 Shafts of operating knobs, handles, levers and the like shall not be live.

TEST. Compliance shall be checked by inspection.

8.6 For appliances other than those of class III, handles, levers and knobs that are held or actuated in normal use shall not become live in the event of an insulation fault. If these handles, levers or knobs are of metal, and if their shafts or fixings are likely to become live in the event of an insulation fault, they shall either be adequately covered by insulating material or their accessible parts shall be separated from their shafts or fixings by supplementary insulation.

TEST. Compliance shall be checked by inspection and, if necessary, by the tests specified for supplementary insulation.

8.7 For appliances other than those of class III, handles which, in normal use, are continuously held in the hand shall be so constructed that, when gripped as in normal use, contact between the operator's hand and metal parts that may become live in the event of an insulation fault is unlikely.

TEST. Compliance shall be checked by inspection and by manual test.

8.8 For class II appliances, capacitors shall not be connected to accessible metal parts, and their casings, if of metal, shall be separated from accessible metal parts by supplementary insulation.

TEST. Compliance shall be checked by inspection and by the tests specified for supplementary insulation.

8.9 Appliances intended to be connected to the supply by means of a plug shall be so designed that in normal use there is no risk of electric shock from charged capacitors when touching the pins of the plug.

TEST. Compliance shall be checked by the following test, which is carried out ten times.

The appliance is operated at rated voltage or at the upper limit of the rated voltage range.

The appliance switch, if any, is then moved to the 'off' position and the appliance is disconnected from the supply by means of the plug.

One second after disconnection, the voltage between the pins of the plug is measured with an instrument that does not appreciably affect the value to be measured.

This voltage shall not exceed 34 V.

NOTE. Capacitors having a rated capacitance not exceeding 0.1 μ F are not considered to entail a risk of electric shock.

9. Starting

9.1 Motors shall start under all normal voltage conditions that may occur in use.

Centrifugal and other automatic starting switches shall operate reliably and without contact chattering.

Motors to be started by hand shall cause no danger if they are started in the wrong direction.

TEST. Compliance shall be checked by starting the appliance three times at a voltage equal to 0.85 times rated voltage, the appliance being at room temperature at the beginning of the test.

The motor shall be started each time under the conditions occurring at the beginning of normal operation or, for automatic appliances, at the beginning of the normal cycle of operation, the motor being allowed to come to rest between successive starts.

For appliances provided with motors having other than centrifugal starting switches, this test shall be repeated at a voltage equal to 1.06 times rated voltage. Motors to be started by hand are started in the correct direction and, if possible, in the wrong direction.

In all cases, the appliance shall function in such a way that safety is not affected.

NOTE. The supply shall be such that, during the test, the drop in voltage does not exceed 1 %.

9.2 No requirement.

Table 1. No requirement.

9.3 Overload protection devices shall not operate under normal starting conditions.

TEST. Compliance shall be checked during the test specified in 9.1.

10. Input and current

10.1 The input of the appliance at rated voltage and at normal operating temperature shall not deviate from the rated input by more than the deviation shown in table 2.

Table 2. Permissible variations in rated input

Rated input	Deviation
W	
Up to and including 33.3	+ 10 W
Over 33.3 up to and including 150	+ 30 %
Over 150 up to and including 300	+ 45 W
Over 300	+ 15 %

NOTE. For appliances marked with a rated voltage range having limits differing by more than 10 % of the mean value of the range, the permissible deviations apply for both limits of the range.

TEST. Compliance shall be checked by measuring the input of the appliance, operated at rated voltage under normal load, when the input has stabilized.

10.2 If a battery charger is marked with rated input current, the input current taken by the appliance shall not exceed the rated input current by more than 10 %.

TEST. Compliance shall be checked by measuring the current taken by the appliance operating under normal load, rated voltage and rated frequency.

NOTE. For appliances marked with one or more rated voltage ranges, the tests specified in 10.1 and 10.2 are carried out at both the upper and lower limits of the ranges, unless the marking of the rated input is related to the mean value of the relevant voltage range, in which case the tests are carried out at a voltage equal to the mean value of that range.

10.3 No requirement.

10.101 When the battery charger is supplied at rated input voltage, the output current at rated d.c. output voltage and at normal operating temperature shall not deviate from the rated d.c. output current by more than 10 %.

TEST. Compliance is checked by measuring the output current at rated d.c. output voltage in a circuit as shown in figure 19, when the battery charger is supplied at rated input voltage.

10.102 The no-load d.c. output voltage shall not exceed 50 V.

TEST. Compliance shall be checked by measuring the no-load d.c. output voltage when the battery charger is supplied at rated input voltage after the battery charger has been allowed to cool to approximately room temperature.

10.1 The input of a combined battery charger and d.c. distribution board unit shall be taken as the input to the appliance when the output is under the operating conditions of rated mean d.c. output voltage and total mean rated d.c. output current.



11. Heating

11.1 Appliances and their surroundings shall not attain excessive temperatures in normal use.

TEST. Compliance shall be checked by determining the temperature rise of the various parts under the conditions specified in **11.2**, **11.3**, **11.5** and **11.7**.

 **11.2** Battery chargers, except battery chargers for building into caravans, shall be placed in a test corner. The

test corner consists of two walls at right angles, a floor and, if necessary, a ceiling, all of dull black-painted plywood having a thickness of 20 mm. The appliance shall be placed on the floor as near to the walls as possible.

 Battery chargers for building into caravans shall be built-in in accordance with the manufacturer's instructions.

The walls of the test area shall be constructed of dull black-painted, 20 mm thick plywood.

11.3 Temperature rises other than those of windings shall be determined by means of fine-wire thermocouples so chosen and positioned that they have the minimum effect on the temperature of the part under test.

Thermocouples used for determining the temperature rise of the surface of walls, ceiling and floor shall be attached to the back of small blackened discs of copper or brass, 15 mm in diameter and 1 mm thick, which are flush with the surface.

As far as possible, the appliance shall be so positioned that parts likely to attain the highest temperatures touch the discs.

In determining the temperature rises of handles, knobs, grips and the like, consideration shall be given to all parts that are gripped in normal use and, if of insulating material, to parts that are in contact with hot metal.

The temperature rise of electrical insulation, other than that of windings, shall be determined on the surface of the insulation, at places where failure could cause a short circuit, contact between live parts and accessible metal parts, bridging of insulation or reduction of creepage distances or clearances below the values specified in **29.1**.

Temperature rises of windings shall be determined by the resistance method unless the windings are non-uniform or unless it involves severe complications to make the necessary connections, in which case the temperature rise shall be determined by means of thermocouples.

NOTE. If it is necessary to dismantle the appliance to position thermocouples, the input is measured again to check that the appliance has been correctly reassembled.

1.4 No requirement.

11.5 The battery charger shall be set up to operate under normal load. The supply voltage is then adjusted to 1.06 times rated input voltage or 1.06 times the upper limit of the rated input voltage range, without changing the load.

11.6 No requirement.

11.7 Battery chargers shall be operated until steady conditions are established.

11.8 During the test, thermal cut-outs shall not operate; the temperature rises shall be monitored continuously and shall not exceed the values shown in table 3; and sealing compound, if any, shall not flow out.

The measurements specified in **13.1** shall be made at the end of this test.

Table 3. Permissible temperature rises

Part	Temperature rise	Part	Temperature rise
	°C or K		°C or K
Windings ¹ , if the winding insulation is:		mouldings of:	
of class A material ²	75 (65)	phenol-formaldehyde with cellulose fillers	85 (175)
of class E material ²	90 (80)	phenol-formaldehyde with mineral fillers	100 (200)
of class B material ²	95 (85)	melamine-formaldehyde	75 (150)
of class F material ²	115	urea-formaldehyde	65 (150)
of class H material ²	140	polyester with glass-fibre reinforcement	110
Pins of appliance inlets:		silicone rubber	145
for cold conditions	40	polytetrafluoroethylene	265
Ambient switches and thermostats ³ :		pure mica and tightly sintered ceramic material, when such materials are used as supplementary insulation or reinforced insulation	400
without T-marking or temperature rating	30	thermoplastic material ⁷	—
with T-marking or temperature rating	7-25	Wood, in general ⁸	65
Rubber or polyvinyl chloride insulation of internal and external wiring including power supply cords:		wooden supports, walls, ceiling and floor of the test corner and wood cabinets:	65
without T-marking or temperature rating	50 ⁴	Outer surface of capacitors:	
with T-marking or temperature rating	7-25 ⁵	with marking of maximum operating temperature (7)	7-35
Cord sheaths used as supplementary insulation	35	without marking of maximum operating temperature:	
Rubber, other than synthetic, used for gaskets or other parts, the deterioration of which could affect safety:		small ceramic capacitors for radio and television interference suppression	50
when used as supplementary insulation	40	other capacitors	20
or as reinforced insulation	50	External enclosure of appliances	60
in other cases		Handles, knobs, grips and the like which, in normal use, are held for short periods only (e.g. of switches):	
Lampholders E26 and E27:		of metal	35
metal or ceramic type	160	or porcelain or vitreous material	45
insulated type, other than ceramic	120	of moulded material, rubber or wood	60
Lampholders E14, B15 and B22:		Selenium rectifier	50
metal or ceramic type	130	Silicon rectifier	75
insulated type, other than ceramic	90		
with T-marking	7-25		
Material used as insulation other than that specified for wires and windings ⁶ :			
impregnated or varnished textile, paper or press board	70		
laminates bonded with:			
melamine-formaldehyde, phenol-formaldehyde or phenol-furfural resins	85 (175)		
urea-formaldehyde resin	65 (150)		

NOTES TO TABLE 3

¹ To allow for the fact that the temperature of windings of universal motors, relays, solenoids, etc. is usually below the average at the points where thermocouples are placed, the figures without parentheses apply when the resistance method is used and those within parentheses apply when thermocouples are used. For windings of a.c. motors, the figures without parentheses apply in both cases.

² The classification is in accordance with the requirements of BS 2757.

Examples of class A material are:
impregnated cotton, silk, artificial silk and paper;
enamels based on oleo- or polyamide resins.

Examples of class B material are:
asbestos, glass fibre, melamine formaldehyde and phenol formaldehyde resins.

Examples of class E material are:
mouldings with cellulose fillers, cotton fabric laminates and paper laminates, bonded with melamine-formaldehyde, phenol-formaldehyde or phenol-furfural resins;
cross-linked polyester resins, cellulose triacetate films, polyethylene terephthalate films;

varnished polyethylene terephthalate textile bonded with oil-modified alkyd resin varnish;
enamels based on polyvinylformal, polyurethane or epoxy resins.

For totally enclosed motors the temperature rise limits for class A, class E and class B may be increased by 5 °C (K).

A totally enclosed motor is a motor so constructed that the circulation of the air between the inside and the outside of the case is prevented but it is not necessarily sufficiently enclosed to be called airtight.

³ T signifies the maximum operating temperature.

For the purposes of this test, switches and thermostats marked with individual ratings may be considered as having no marking for the maximum operating temperature, if requested by the appliance manufacturer.

⁴ This limit applies to cables, cords and wires complying with the requirements of BS 6500.

⁵ This limit will become applicable as soon as there are British Standards for high temperature cables, cords and wires.

⁶ The values in parentheses apply if the material is used for handles, knobs, grips and the like and is in contact with hot metal.

⁷ There is no specific limit for thermoplastic material which has to withstand the tests specified in 30.1 or 30.2, for which purpose the temperature rise has to be determined.

⁸ The limit specified concerns the deterioration of wood and it does not take into account deterioration of surface finishes.

The temperature rise limits in the table may be exceeded if it can be shown that the temperatures are not in excess of the thermal capabilities of the materials as determined by ageing tests made on the materials themselves. Other materials not listed in the table may be used under the same conditions.

The values in the table are based on an ambient temperature not normally exceeding 25 °C but occasionally reaching 35 °C. However, the temperature rise values specified are based on 25 °C.

The value of the temperature rise of a copper winding shall be calculated from the formula:

$$\Delta t = \frac{R_2 - R_1}{R_1} (234.5 + t_1) - (t_2 - t_1)$$

where:

Δt is the temperature rise (in °C or K)

R_1 is the resistance at the beginning of the test (in Ω)

R_2 is the resistance at the end of the test (in Ω)

t_1 is the room temperature at the beginning of the test (in °C)

t_2 is the room temperature at the end of the test (in °C)

At the beginning of the test, the windings shall be at room temperature.

It is recommended that the resistance of windings at the end of the test be determined by taking resistance measurements as soon as possible after switching off, and then at short intervals so that a curve of resistance against time can be plotted for ascertaining the resistance at the instant of switching off.

NOTE. The classification of handles, knobs, grips and the like according to their materials is derived from the constant:

$$b = \sqrt{\lambda \cdot c \cdot \gamma}$$

where

λ is the thermal conductivity of the material (in W/(m K))

c is the specific heat of the material (in J/(kg K))

γ is the specific mass of the material (in kg/m³)

The materials are classified as follows:

value of b greater than 3500.... metal;

value of b between 1000 and 3500.... porcelain or vitreous material;

value of b less than 1000.... moulded material, rubber or wood.

An alternative method of determining the constant, b , is as follows.

Samples of materials with known values of the constant, b , and a sample of the material to be classified, all samples having the same dimensions, are fixed to a heated metal plate.

The temperatures of the upper surfaces of the various samples are measured and the temperatures of the reference samples are plotted as a function of the constant, b .

The constant, b , of the material to be classified is derived from this curve by reading off the value, b , corresponding to the temperature attained by the sample under investigation.

11.9 No requirement.

12. No requirement.

13. Electrical insulation and leakage current at operating temperature

13.1 The electrical insulation of the appliance at operating temperature shall be adequate and the leakage current in

normal use shall not be excessive.

TEST. Compliance shall be checked by the test specified in **13.2**, the battery charger being supplied at a voltage equal to 1.06 times rated input voltage or 1.06 times the upper limit of the rated input voltage range.

13.2 The leakage current shall be measured between any pole of the supply and:

(a) accessible metal parts and metal foil with an area not exceeding 200 mm × 100 mm in contact with accessible surfaces of insulating material, connected together;

(b) metal parts of class II appliances separated from live parts by basic insulation only.

The measuring circuit shall be as shown in the following figures:

(1) if of class II, figure 4;

(2) if other than class II, figure 5.

The resistance of the measuring circuit shall be $2000 \pm 100 \Omega$, and if it is suspected that high-frequency currents are being generated in a motor-operated appliance, the measuring instrument shall have an accuracy of at least 5 % for all frequencies within the range of 20 Hz to 5000 Hz, but it shall be insensitive to higher frequencies.

The tests shall be carried out with a.c.

The leakage current shall be measured with the selector switch, shown in figures 4 and 5, in each of the positions 1 and 2.

After an operating time as specified in **11.7**, the leakage current shall not exceed the following values:

(a) to accessible metal parts and metal foil:

(1) for class I appliances 0.75 mA

(2) for class II appliances 0.25 mA

(3) for class III appliances 0.5 mA

(b) to metal parts of class II appliances separated from live parts by basic insulation only, if the appliance is classified according to degree of protection against moisture as:

(1) ordinary appliance 5.0 mA

(2) other than ordinary appliance 3.5 mA

If the appliance incorporates one or more capacitors and is provided with a single-pole switch, the measurements shall be repeated with the switch in the 'off' position.

NOTE 1. The cut-off frequency of 5000 Hz may, for example, be obtained by connecting a capacitor of 150 ± 7.5 nF in parallel with the resistive components of the measuring circuit. The measuring circuit may be partly or completely incorporated in the measuring instrument. If an instrument of the rectifier type is used, it should rectify linearly from 0.2 mA upwards within the frequency range of 20 Hz to 10 000 Hz, and should be calibrated in r.m.s. values with a current of substantially sine-wave form. If high-frequency voltages are not present, the cut-off frequency of the measuring instrument may exceed 5000 Hz.

NOTE 2. It is recommended that the appliance be supplied through an isolating transformer; otherwise, it should be insulated from earth.

NOTE 3. The metal foil has the largest area possible on the surface under test, without exceeding the dimensions specified. If its area is smaller than the surface under test, it is moved so as to test all parts of the surface. The heat dissipation of the appliance should not however, be affected by the metal foil.

NOTE 4. The test with the switch in the 'off' position is carried out to verify that capacitors connected behind a single-pole switch do not cause an excessive leakage current.

13.3 No requirement.

14. Radio and television interference suppression

The incorporation of components necessary to achieve an adequate degree of radio and television interference suppression shall not adversely affect the safety of the appliance.

TEST. Compliance shall be checked by the tests specified in this standard.

NOTE. Attention is drawn to the fact that compliance with the requirements concerning the limits for interference effects generated by the appliance, as specified in BS 800 and when measured in accordance with that standard, will in most cases ensure that the appliance has the required degree of radio and television interference suppression.

15. Moisture resistance

15.1 The enclosure of drip-proof and splash-proof appliances shall provide the degree of protection against moisture in accordance with the classification of the appliance.

TEST. Compliance shall be checked by the appropriate treatment specified in **15.2**.

Immediately after the appropriate treatment for drip-proof and splash-proof appliances, the appliance shall withstand the electric strength test specified in **16.4**, and inspection shall show that water that may have entered the appliance does not impair compliance with the requirements of this standard; in particular, there shall be no trace of water on insulation for which creepage distances are specified in **29.1**.

Appliances shall be allowed to stand in normal test-room atmosphere for 24 h before being subjected to the test specified in **15.4**.

15.2 Appliances provided with an appliance inlet shall be fitted with an appropriate connector and flexible cable or cord; appliances with type X attachment shall be fitted with the lightest permissible type of flexible cable or cord of the smallest cross-sectional area specified in **26.2**, and other appliances shall be tested as delivered.

Electrical components, including covers and other parts that can be removed without the aid of a tool shall be removed and subjected, if necessary, to the relevant treatment with the main part.

Sealing rings of glands and other sealing means, if any, shall be aged in an atmosphere having the composition and pressure of the ambient air by suspending them freely in a heating cabinet ventilated by natural circulation.

They shall be kept in the cabinet at a temperature of $70 \pm 2^\circ\text{C}$, for 10 days (240 h).

Immediately afterwards, the samples shall be taken out of the cabinet and left at room temperature, avoiding direct daylight, for at least 16 h before being reassembled. The glands and other sealing means shall then be tightened with a torque equal to two-thirds of that applied during the test specified in **21.3**.

NOTE. The use of an electrically-heated cabinet is recommended. Natural circulation may be provided by holes in the walls of the cabinet.

Drip-proof appliances shall then be subjected for 5 min to the vertical rain test.

Splash-proof appliances shall then be subjected for 10 min to the oblique rain test, followed by 5 min subjection to the splash test.

For the vertical rain test, an apparatus similar to that shown in figure 9 which delivers 3 mm of rain per minute, uniformly distributed over the sample, shall be used.

Battery chargers shall be placed in the normal position of use, so that the nozzles of the rain apparatus are 2 m above the uppermost point of the appliance.

For the oblique rain test, the spray apparatus, shown in figure 11, shall be used, the apparatus comprising a tube formed into a semicircle. The radius of the circle is 200 mm or a multiple of 200 mm and is as small as is compatible with the size and position of the sample. The tube is perforated so that jets of water are directed towards the centre of the circle, and the water pressure at the inlet to the apparatus is equivalent to a head of about 10 m.

The tube is caused to oscillate through an angle of 120° , 60° on each side of the vertical, the time for one complete oscillation ($2 \times 120^\circ$) being about 4 s.

Appliances shall be placed on a support having dimensions that are at least 50 mm in excess of those of the orthogonal projection of the appliance on the support.

The sample shall be mounted or placed at the centre of the semicircle formed by the tube so that its lowest part is level with the axis of oscillation. The sample shall be turned about its vertical axis during the test.

For the splash test, the apparatus shown in figure 10 shall be used. During the test, the water pressure shall be regulated so that the water splashes up 150 mm above the bottom of the bowl. The bowl shall be placed on the floor for appliances normally used on the floor and, for all other appliances, on a horizontal support 50 mm below the lowest edge of the appliance; the bowl shall be moved around so as to splash the appliance from all directions. Care shall be taken to ensure that the appliance is not hit by the direct jet.

Appliances normally used on a working surface other than the floor shall be placed on a supporting surface that has dimensions equal to the surface of the appliance in contact with the support.

NOTE. A revision of the splash test is under consideration.

15.3 No requirement.

15.4 Appliances shall be proof against humid conditions that may occur in normal use.

TEST. Compliance shall be checked by the humidity treatment described in this subclause, followed immediately by the tests specified in clause **16**.

Cable entries, if any, shall be left open; if knock-outs are provided, one of them shall be opened.

Electrical components, including covers and other parts that can be removed without the aid of a tool, shall be removed and subjected, if necessary, to the humidity treatment with the main part.

The humidity treatment shall be carried out in a humidity cabinet containing air with a relative humidity of