



BS 3456 : Part 3 : Section 3.14 :1980

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Specification for
**Safety of household and similar
electrical appliances**

Part 3. Complete particular specifications
Section 3.14 Projectors

Spécification relative à la sécurité des appareils électrodomestiques
Partie 3. Spécifications particulières complètes
Section 3.14 Projecteurs

Spezifikation bezüglich der Sicherheit von elektrischen Haushaltsgeräten
Teil 3. Volle einzelne Spezifikationen
Abschnitt 3.14 Projektoren

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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, which 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, 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, the no-load voltage not exceeding 50 V.

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, the input 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 hand-held appliance. A portable appliance intended to be held in the hand during normal use, the motor, if any, forming an integral part of the appliance.

2.26 stationary appliance. Either a fixed appliance or an appliance having a mass exceeding 18 kg and not provided with a carrying handle.

2.27 fixed appliance. An appliance that is fastened to a support or otherwise secured in a specific situation.

2.28 No requirement.

2.29 conditions of adequate heat discharge. The conditions that apply when the appliance is operated under normal conditions of use.

2.30 normal load. The load obtained when the appliance is operated under the following conditions.

Manually-operated slide projectors are operated with a standard slide in position, until steady conditions are established.

Semi-automatic slide projectors are operated with the slide carrier filled with standard slides and with the slide changing mechanism operating every 10 s, until steady conditions are established.

Fully automatic slide projectors are operated with the slide carrier filled with standard slides and with the slide changing mechanism operating at the rate imposed by the appliance, until steady conditions are established or according to the most unfavourable setting of the timer or similar device, whichever is the shorter period.

For fully automatic slide projectors not delivered with a timer or similar device, the slide changing mechanism is operated every 10 s, until steady conditions are established.

Motors for manually initiated adjustment of the lens of a slide projector are operated for the time necessary to carry the lens from one extreme position into the other, this operation being performed once every 4 min for manually-operated projectors and each time after 18 standard slides have been projected for other projectors.

Viewers are operated as specified for slide projectors with a standard slide or film strip in position, as appropriate.

Film projectors are operated with a film in position and with the lamp control set to the highest position indicated on the projector for four cycles, each cycle comprising a period of operation of the time allowed by the maximum size of reel that can be accommodated, and a rest period of 5 min.

During the rest periods, any rewinding device is operated and fans are not deliberately switched off.

NOTE. Details with regard to the standard slide and the standard film strip are under consideration.

2.31 rated operating time. The operating time assigned to the appliance by the manufacturer.

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. For single-phase a.c. appliances and for d.c. appliances, disconnection of both supply conductors by a single switching action or, for appliances to be connected to more than two supply conductors, disconnection of all supply conductors, except the earthed (neutral) conductor, 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 slide. An assembly comprising:

- (a) a transparency for projection by transmitted light;
- (b) an appropriate mask;
- (c) a holder with or without a transparent protecting cover.

2.102 slide carrier. A device by which slides are placed in position for projection.

2.103 film strip. A strip of film carrying photographic images suitable for still projection, but not cine projection.

2.104 manually-operated slide (film strip) projector. An appliance in which the energy required for changing the slides (film strip frames) is supplied by the operator.

2.105 semi-automatic slide (film strip) projector. An appliance in which the energy for changing the slides (film strip frames) is supplied by a coil, a motor or a similar device, but which is initiated by the operator.

2.106 fully automatic slide (film strip) projector. An appliance in which the energy for changing the slides (film strip frames) is supplied by a coil, a motor or a similar device, and which can be initiated by a timer or similar device, such as a tape recorder.

2.107 gate. That part of an appliance which holds the film or slide in the correct optical position.

2.108 combined still projector for slides and film strips. An optical instrument capable of projecting the image from slides and alternatively from film strip.

2.109 still film strip projector. An optical instrument capable of projecting the images from film strip.

2.110 viewer. An appliance for directly viewing a magnified image from a slide or film strip.

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.

3.101 Audio amplifiers of sound film projectors shall comply with the requirements of BS 415.

3.102 Electronic circuits, excluding audio amplifiers, shall comply with the requirements of appendix A.

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.

NOTE 2. If the appliance is designed for different supply voltages, for both a.c. and d.c., for different speeds, etc., more than one sample may be required.

NOTE 3. If it is necessary to dismantle a class II appliance for the relevant tests, one additional sample is required.

NOTE 4. 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 for a.c. only shall be tested with a.c., at rated frequency, if marked; those for d.c. only shall be tested with d.c. and those for a.c./d.c. shall be tested at the more unfavourable supply.

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

Appliances for a.c. 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 motor-operated appliances 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. 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.

When testing appliances for d.c. only, the possible influence of polarity on the operation of the appliance shall be taken into consideration.

4.7 Appliances for which alternative lamps or accessories are available shall be tested with those lamps or accessories that give the most unfavourable results, provided that the lamps or accessories used are within the appliance manufacturer's specification.

4.8 If, in normal use, the lamps cannot be operated unless the motor is running, the lamp circuits shall be tested with the motor running. If the lamp can be operated without the motor running, the lamp circuits shall be tested with or without the motor running, whichever is the more unfavourable.

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 Appliances incorporating a motor shall be loaded according to the specified conditions of normal load, unless it is evident from the design of the appliance that these conditions will not occur in normal use.

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 3.101, 3.102 and appendix A.

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 Single-phase 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 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.

7. Marking

7.1 Appliances shall be marked with:

(a) rated voltage(s) or rated voltage range(s), in volts. The rated voltage of projector lamps or similar lamps shall be marked separately if different from the rated voltage of the appliance and shall be indicated by 'lamp ...V';

(b) symbol for nature of supply, if applicable;

(c) rated frequency or rated frequency range, in hertz, unless the appliance is designed for d.c. only or for a.c. of both 50 Hz and 60 Hz;

(d) rated input in watts or kilowatts, if greater than 25 W;

This input shall include the power taken by the most powerful lamp for which the projector is designed. The maximum marked input of the lamps shall be separately stated, e.g. 'max. lamp 300 W'.

(e) rated current of the appropriate fuse-link in amperes for motor-operated appliances where the inrush current requires a fuse of a current rating higher than that appropriate to the marked rating (see 9.2);

If the rated current of the appropriate fuse-link is marked and if the fuse-link is of the time-lag type, information about the time/current characteristics rating shall be included in the relevant marking;

If a high breaking capacity fuse-link is specified for the projection lamp, this shall be stated in the relevant marking;

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

(g) manufacturer's model or type reference;

(h) symbol for class II construction, for class II appliances only.

In addition, motors with windings insulated with class B, class F or class H material only shall be marked with the class designation of their winding insulation.

NOTE 1. The rated input or rated current is the total maximum input or current of the circuits that can be in operation simultaneously.

NOTE 2. If an appliance has alternative components that can be selected by a control device, the rated input is that corresponding to the highest loading possible.

NOTE 3. If the motor of an appliance is marked separately, it is essential that the marking of the appliance and that of the motor be such that there can be no doubt with regard to the rating and manufacturer of the appliance itself.

NOTE 4. Additional markings are allowed, provided they do not give rise to misunderstanding.

7.2 No requirement.

7.3 No requirement.

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

NOTE. For appliances for which frequent changes in voltage setting are not required, this requirement is considered to be complied with if the rated voltage or the rated input 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.

7.5 For appliances marked with more than one rated voltage or rated 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 marked on the appliance so 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
Hz	hertz
W	watts
kW	kilowatts
µF	microfarads
kg	kilograms
h	hours
min	minutes
s	seconds
	alternating current
	direct current
 A	rated current of the appropriate fuse-link
	time-lag D-type fuse-link
 X	time-lag miniature fuse-link where X is the symbol for time/current characteristic as given in BS 4265
	Class II construction

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, speed, cooling effect, etc., shall be indicated by a higher figure.

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

7.11 Thermostats, regulating devices, lamp controls and the like, intended to be adjusted during installation or in normal use, shall be provided with an indication for the direction of adjustment to increase or to decrease the value of the characteristic being adjusted.

NOTE. An indication of + and - is considered to be sufficient.

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. Lamp manufacturer's instructions and recommendations should be strictly adhered to when installing, running, removing or disposing of the lamp.

If the supply wires of an appliance can come into contact with parts of a terminal block or compartment for fixed wiring and these parts have, under conditions of normal use, a temperature such that the insulation of the wire is subjected to a temperature rise exceeding that specified in table 3, the instruction sheet shall also state that the appliance must be connected by means of wires having appropriate T-marking or T-rating.

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.'

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 provided they do not give rise to misunderstanding.

TEST. Compliance with the requirements of 7.1 to 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** to **7.5** shall be on a main part of the appliance.

The marking of fixed appliances shall be clearly discernible from the outside after the appliance has been fixed as in normal use but, if necessary, after removal of a cover.

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

For stationary appliances, the marking shall be beneath a cover only if it is near to the terminals for external conductors.

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 $\perp$ or coloured green or green-and-yellow.

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

The wire that 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.

7.11 For portable 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'

For all class I appliances the warning shall be included in the user instructions.

NOTE. The label specified in **7.1** may be used for this purpose: a separate label is not required.

TEST. Compliance shall be checked by inspection.

NOTE. For appliances intended for export, labelling other than that specified in **7.1** and **7.11** may be required.

7.101 The instruction sheet shall include information with regard to rated voltage, rated input and lamp type or designation of the projector or similar lamp and the substance of the following warning.

'The appliance shall be operated so that the air flow through the ventilation holes is not impeded.'

The instruction sheet shall include the manufacturer's recommendations for the safe use of the lamp.

TEST. Compliance shall be checked by inspection.

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, except that appliances normally used on the floor and having a mass exceeding 40 kg are not tilted.

For appliances provided with movable devices, such as those intended for varying the heat distribution or the tension of belts, the test shall be carried out with the devices adjusted to their most unfavourable position within their range of adjustment.

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 which 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 the test pin I specified in BS 3042 or to touch metal parts separated from live parts by basic insulation only with test finger I specified in BS 3042.

The test pin is not applied to lamp caps.

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 For appliances other than those of class III, flexible shafts that are handled in normal use shall be insulated from the motor shafts by suitable couplings of insulating material.

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

8.4 No requirement.

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

TEST. Compliance with the requirements of 8.5 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.

For stationary appliances, this requirement does not apply to handles, levers and knobs, other than those of electrical components, provided they are either reliably connected to

an earthing terminal or earthing contact, or separated from live parts by earthed metal.

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 which 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 µF are not considered to entail a risk of electric shock.

9. Starting of motor-operated appliances

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 source is such that, during the test, the voltage does not exceed 1%.

9.2 The starting current shall not blow a quick-acting fuse-link having a rated current:

- (a) according to the marking, if the rated current of the appropriate fuse-link is marked on the appliance;
- (b) equal to the rated current of the appliance, with a minimum of 10 A for appliances having a rated voltage exceeding 130 V, and 16 A for appliances having a rated voltage of 130 V and less, if the rated current of the appropriate fuse is not marked on the appliance.

TEST. Compliance shall be checked by the following test.

The appliance is connected in series with a silver wire having a length of 85 mm and a diameter as shown in table 1.

Table 1. Diameter of silver wire for fuse test

Rated current	Diameter of silver wire	
	starting time not exceeding 1 s	starting time exceeding 1 s
A	mm	mm
10	0.29	0.39
16	0.39	0.52
20	0.46	0.60
25	0.53	0.66

The wire has a silver content not less than 99.9 %, and it is stretched horizontally along the centre line of a box with inside dimensions of 80 mm x 80 mm x 150 mm.

The appliance is so loaded that the conditions for starting are the most unfavourable encountered in normal use. Lamps incorporated in the appliance are operated, but are not connected to a separate supply.

The appliance is then started ten times at a voltage equal to 0.9 times rated voltage and ten times at a voltage equal to 1.1 times rated voltage. The interval between consecutive starts is made sufficiently long to prevent undue heating, and not less than 5 min.

During the test, the silver wire shall not melt and neither shall any overload protection device operate.

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

NOTE 2. A revision of this test is under consideration.

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

TEST. Compliance shall be checked during the test specified in 9.2.

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.

TEST. Compliance shall be checked by measuring the input of the appliance operated at rated voltage and under normal load, when the input has stabilized. If the motor load varies throughout the operating cycle, the input shall be measured by means of a watt-hour meter, and determined as the mean value of the input occurring during a representative period.

10.2 If a motor-operated appliance is marked with rated current, the current taken by the appliance shall not exceed the rated 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.

10.3 No requirement.

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 to 11.7.

11.2 Hand-held appliances shall be suspended in their normal position, in still air.

Other appliances without motors 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 positioned in the test corner as near to the walls as possible with the beam pointing away from the test corner.

Other motor-operated appliances shall be placed on, or fixed to, a horizontal support of dull black-painted plywood having a thickness of 20 mm.

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.

Table 2. Permissible variations in rated input

Type	Rated input	Deviation
Appliances without motors	W	
	Not exceeding 100 Exceeding 100	$\pm 10 \%$ $+ 5 \%$ or $- 10 \%$, or 10 W, whichever is the greater
Motor-operated appliance	Up to and including 33.3	$+ 10 \text{ W}^*$
	Over 33.3 up to and including 150	$+ 30 \%$
	Over 150 up to and including 300	$+ 45 \text{ W}^*$
	Over 300	$+ 15 \%$

*The negative deviation is not limited.

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.

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 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 1. 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.

NOTE 2. The point of separation of the cores of a multicore cable or cord and where insulated wires enter lampholders are examples of places where thermocouples are positioned.

11.4 Appliances without motors shall be operated under normal load with all lamps in circuit, the supply voltage being such that the input is 1.1 times the maximum rated input. Lamps that fail during the test shall be replaced immediately.

11.5 No requirement.

11.6 For appliances incorporating both lamps and motors, when the motors are operated at a voltage equal to 1.06 times the maximum rated voltage, the input to the lamps shall be as specified in 11.4. When the motors are operated at a voltage equal to 0.94 times the minimum rated voltage, the input to the lamps shall be reduced to 0.90 times the minimum rated input.

NOTE. If it is necessary to carry out the test at an intermediate voltage, the input of the lamps is adjusted proportionately.

11.7 The appliance 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 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:

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

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 For appliances provided with an automatic cord reel, one-third of the total length of the cable or cord shall be unreeled. The temperature rise of the rubber or polyvinyl chloride insulation shall then be determined as near as possible to the hub of the reel and between the two outermost layers of the cable or cord on the reel.

The temperature rise of the insulation shall not exceed the relevant value specified in table 3 and the temperature rise of the sliding contacts of the reel shall not exceed 65 °C (65 K).

12. Operation under overload conditions

12.1 Appliances shall be so designed and constructed that they withstand overloads that are liable to occur in normal use.

TEST. Compliance shall be checked by the test specified in 12.2.

After the test, the appliance shall show no damage within the meaning of this standard.

In particular, internal wiring and the general assembly shall not show such deformation that creepage distances and clearances are reduced below the values specified in 29.1. Contacts and connections shall not have worked loose.

12.2 TEST. Hand-held appliances shall be suspended in their normal position, in still air.

Appliances normally used on the floor or a table shall be placed on a horizontal support, away from walls.

The appliance shall be subjected to 15 cycles or until two lamps rupture, each cycle comprising an operating period as specified in 11.7, in accordance with conditions of normal use and a cooling period sufficient to allow the appliance to cool down to or approximately room temperature.

Table 3. Permissible temperature rises

Part	Temperature rise	Part	Temperature rise
Windings ¹ , if the winding insulation is:	°C or K		°C or K
of class A material ²	75 (65)	melamine-formaldehyde	75 (150)
of class E material ²	90 (80)	urea-formaldehyde	65 (150)
of class B material ²	95 (85)	polyester with glass-fibre reinforcement	110
of class F material ²	115	silicone rubber	145
of class H material ²	140	polytetrafluoroethylene	265
Pins of appliance inlets:		pure mica and tightly sintered ceramic material, when such materials are used as supplementary insulation or reinforced insulation	400
for very hot conditions	130	thermoplastic material ⁷	—
for hot conditions	95	Wood, in general ⁸ , including wooden supports, walls and floor of the test corner	65
for cold conditions	40	Outer surface of capacitors:	
Ambient of switches and thermostats ³ :		with marking of maximum operating temperature (<i>T</i>)	<i>T</i> -35
without <i>T</i> -marking or temperature rating	30	without marking of maximum operating temperature:	
with <i>T</i> -marking or temperature rating	<i>T</i> -25	small ceramic capacitors for radio and television interference suppression	50
Rubber or polyvinyl chloride insulation of internal and external wiring including power supply cords:		other capacitors	20
without <i>T</i> -marking or temperature rating	50 ⁴	External enclosure, except handles held in normal use	60
with <i>T</i> -marking or temperature rating	<i>T</i> -25 ⁵	External ventilation grilles ⁹	110
Cord sheaths used as supplementary insulation	35	of metal	80
Rubber, other than synthetic, used for gaskets or other parts, the deterioration of which could affect safety:		of suitable plastics	
when used as supplementary insulation or as reinforced insulation	40	Handles, knobs, grips and the like which, in normal use, are continuously held (e.g. of soldering irons):	
in other cases	50	of metal	30
Lampholders E26 and E27:		of porcelain or vitreous material	40
metal or ceramic type	160	of moulded material, rubber or wood	50
insulated type, other than ceramic	120	Handles, knobs, grips and the like which, in normal use, are held for short periods only (e.g. of switches):	
Lampholders E14, B15 and B22:		of metal	35
metal or ceramic type	130	of porcelain or vitreous material	45
insulated type, other than ceramic	90	of moulded material, rubber or wood	60
with <i>T</i> -marking	<i>T</i> -25	Any point where the insulation of wires can come into contact with parts of a terminal block or compartment for fixed wiring of a stationary appliance not provided with a power supply cord:	
Material used as insulation other than that specified for wires and windings ⁶ :		where the instructions require <i>T</i> -marked or temperature rated wires	<i>T</i> -25 ⁵
impregnated or varnished textile, paper or press board	70	in other cases	50 ⁴
laminates bonded with:			
melamine-formaldehyde, phenol-formaldehyde or phenol-furfural resins	85 (175)		
urea-formaldehyde resin	65 (150)		
mouldings of:			
phenol-formaldehyde with cellulose fillers	85 (175)		
phenol-formaldehyde with mineral fillers	100 (200)		

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 vibrator coils and 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 (5 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 must be determined.

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

⁹ These values are permitted if the materials used are not exposed to temperatures in excess of those which have proved permissible for these materials.

Throughout the operating period, all lamps that can be operated at the same time shall be in circuit, the supply voltage being such that the input is:

- (a) 1.33 times rated input for appliances having a rated input not exceeding 100 W;
- (b) 1.27 times rated input or 1.21 times rated input plus 12 W, whichever is the greater, for appliances having a rated input exceeding 100 W.

If any of the lamps fail, the operating period shall be considered to have ended. The lamp shall be replaced for the next cycle.

If a self-resetting thermal cut-out or a non-self-resetting thermal cut-out that is accessible and can be reset without the aid of a tool operates, the operating period is considered to be ended. The appliance is then allowed to cool down and the cut-out is reset for the next cycle.

During the test, non-self-resetting thermal cut-outs that are accessible only with the aid of a tool or which require the replacement of a part shall not operate and no vapour or ignitable gas shall accumulate in the appliance.

NOTE 1. Forced cooling may be used for the purpose of shortening the cooling period.

NOTE 2. For appliances incorporating a motor, the operation of which may affect the conditions of the heating elements, the motor is operated from a separate supply at rated voltage and under normal load.

12.3 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 and 13.3, the appliance being operated under normal load for the time specified in 11.7.

Appliances with motors shall be operated at a supply voltage equal to 1.06 times rated voltage.

Appliances without motors shall be operated at a voltage such that the input is 1.1 times maximum rated input.

The tests shall be carried out while the appliance is connected to the supply.

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 x 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 figure 4 for class II appliances and as shown in figure 5 for other than class II appliances.

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 test shall be carried out with a.c., unless the appliance is for d.c. only, in which case the test shall be carried out with d.c. except that motor-operated appliances for d.c. only are not tested.

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 portable class I appliances | 0.75 mA |
| (2) for class II appliances | 0.25 mA |
| (3) for class III appliances | 0.5 mA |
| (4) for stationary class I appliances incorporating motors | 3.5 mA |
| (5) for stationary class I appliances without motors | 0.75 mA or 0.75 mA per kW rated input, whichever is the greater, with a maximum of 5 mA |

(b) to metal parts of class II appliances separated from live parts by basic insulation only 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 The insulation other than that of motors shall be subjected for 1 min to a voltage of substantially sine-wave form, having a frequency of 50 Hz or 60 Hz. The connections shall be as shown in figure 8.

The test voltage shall be applied between live parts and the body and, for class II appliances, between live parts and parts separated from live parts by basic insulation only. In addition, for class II appliances, the test voltage shall be applied between metal parts separated from live parts by basic insulation only and the body.

The value of the test voltage shall be:

- 500 V for basic insulation subjected in normal use to a safety extra-low voltage;
- 1000 V for other basic insulation;
- 2750 V for supplementary insulation;
- 3750 V for reinforced insulation.

Initially, not more than half the prescribed voltage shall be applied; then it is raised rapidly to the full value.

No flashover or breakdown shall occur during the test.

NOTE 1. Glow discharges without drop in voltage are ignored.

NOTE 2. The high voltage transformer used for the test should have a rating of at least 500 V A.

NOTE 3. If the secondary winding of the isolating transformer is not provided with a tap at the midpoint, the output winding of the high-voltage transformer can be connected to the midpoint of a potentiometer having a total resistance not exceeding 2000 Ω and connected across the output winding of the isolating transformer.

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 No requirement.

15.2 No requirement.

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 $93 \pm 2\%$. The temperature of the air, at all places where samples can be located, is maintained within 1°C (1 K) of any convenient value t between 20°C and 30°C .

Before being placed in the humidity cabinet, the sample shall be brought to a temperature of between t and $t + 4^\circ\text{C}$.

The sample shall be kept in the cabinet for 2 days (48 h).

NOTE 1. In most cases, the sample may be brought to the specified temperature by keeping it at this temperature for at least 4 h before the humidity treatment.

NOTE 2. A relative humidity of $93 \pm 2\%$ can be obtained by placing in the humidity cabinet a saturated solution of sodium sulphate (Na_2SO_4) or potassium nitrate (KNO_3) in water, having a sufficiently large contact surface with the air.

NOTE 3. In order to achieve the specified conditions within the cabinet, it is necessary to ensure constant circulation of the air within and, in general, to use a cabinet which is thermally insulated.

After this treatment, the appliance shall show no damage within the meaning of this standard.

16. Insulation resistance and electric strength

16.1 The insulation and electric strength of appliances shall be adequate.

TEST. Compliance shall be checked, by the tests specified in **16.3** and **16.4**, which are made on the cold appliance, not connected to the supply, immediately after the test specified in **15.4**, in the humidity cabinet or in the room in which the sample was brought to the prescribed temperature, after reassembly of those parts which may have been removed.

16.2 No requirement.

16.3 The insulation resistance shall be measured with a d.c. voltage of approximately 500 V applied, the measurement being made 1 min after application of the voltage.

The insulation resistance shall be not less than that shown in table 4.

Table 4. Insulation resistance

Insulation to be tested	Insulation resistance
	M Ω
Between live parts and the body:	
for basic insulation	2
for reinforced insulation	7
Between live parts and metal parts of class II appliances that are separated from live parts by basic insulation only	2
Between metal parts of class II appliances that are separated from live parts by basic insulation only and the body	5

16.4 Immediately after the test specified in 16.3 the insulation shall be subjected for 1 min to a voltage of substantially sine-wave form, having a frequency of 50 Hz. The value of the test voltage and the points of application are shown in table 5.

The test between the live parts of different polarity is carried out only where the necessary disconnections can be made without damaging the appliance.

The test between the point where a winding and a capacitor are connected together, and the body or metal parts, is carried out only where the insulation is subjected to the resonance voltage under normal running conditions. Other parts are disconnected and the capacitor is short-circuited.

The test is not carried out between the contacts of switches of micro-gap construction, motor-starting switches, relays, thermostats, thermal cut-outs and the like, or on the insulation of capacitors connected between live parts of different polarity.

Initially, not more than half the prescribed voltage shall be applied; then it is raised rapidly to the full value.

No flashover or breakdown shall occur during the test.

NOTE 1. Care is necessary to ensure that the metal foil is so placed that no flashover occurs at the edges of the insulation.

NOTE 2. For class II appliances incorporating both reinforced insulation and double insulation, care is necessary to ensure that the voltage applied to the reinforced insulation does not overstress the basic insulation or the supplementary insulation.

NOTE 3. When testing insulating coatings, the metal foil may be pressed against the insulation by means of a sandbag of such a size that the pressure is about 0.5 N/cm² (5 kPa). The test may be limited to places where the insulation is likely to be weak, for example where there are sharp metal edges under the insulation.

NOTE 4. If practicable, insulating linings are tested separately.

Table 5. Test voltages

Points of application of test voltage	Test voltage		
	Class III appliances	Class II appliances	Class I appliances
1. Between live parts and parts of the body that are separated from live parts by:	V	V	V
basic insulation only	500	—	1250
reinforced insulation	—	3750	3750
2. Between live parts of different polarity	500	1250	1250
3. For parts with double insulation, between metal parts separated from live parts by basic insulation only, and:			
live parts	—	1250	1250
the body	—	2500	2500
4. Between metal enclosures or covers lined with insulating material and metal foil in contact with the inner surface of the lining, if the distance between live parts and these metal enclosures or covers, measured through the lining, is less than the appropriate clearance as specified in 29.1	—	2500	1250
5. Between metal foil in contact with handles, knobs, grips and the like and their shafts, if these shafts can become live in the event of an insulation fault	—	2500	2500
6. Between the body and either the power supply cord wrapped with metal foil or a metal rod of the same diameter as the power supply cord, inserted in its place, fitted in inlet bushings of insulating material, cord guards, cord anchorages and the like	—	2500	1250
7. Between the point where a winding and a capacitor are connected together, if a resonance voltage, U , occurs between this point and any terminal for external conductors, and:			
the body	—		
metal parts separated from live parts by basic insulation only	—		