



BS 3456 : Part 3 : Section 3.1 : 1979

UDC 614.825 : 648.424 : 687.054

Specification for

Safety of household and similar electrical appliances

Part 3. Complete particular specifications

Section 3.1. Irons, ironers and pressing machines

Spécification relative à la sécurité des appareils électrodomestiques

Partie 3. Spécifications particulières complètes

Section 3.1. Fers, machines et presses à repasser

Spezifikation bezüglich der Sicherheit von elektrischen Haushaltsgeräten

Teil 3. Volle einzelne Spezifikationen

Abschnitt 3.1. Bügeleisen, Bügelmaschinen und Kleiderpressen

British Standards Institution

BS 3456 : Part 3 : Section 3.1 : 1979

Contents

	Page		Page
Foreword	Inside front cover	Tables	
Cooperating organizations	Back cover	1. Diameter of silver wire for fuse test	10
Specification		2. Permissible variations in rated input	10
1. Scope	2	3. Permissible temperature rises	12
2. Definitions	2	4. Insulation resistance	16
3. General requirements	5	5. Test voltages	17
4. General conditions for the tests	5	6. No requirement	
5. Rating	6	7. Limiting temperatures of windings under abnormal operation	18
6. Classification	6	8. Permissible temperature rises under abnormal operation	18
7. Marking	6	9. Test force for screwed glands	20
8. Protection against electric shock	8	10. No requirement	
9. Starting of motor-operated appliances	9	11. Size of flexible cord	26
10. Input and current	10	12. Test figures for flexible cord pull and torque	28
11. Heating	10	13. No requirement	
12. Operation under overload conditions of appliances with heating elements	11	14. Conductor cross-sectional areas for which terminals shall be suitable	29
13. Electrical insulation and leakage current at operating temperature	13	15. Dimensions of pillar type terminals	30
14. Radio and television interference suppression	14	16. Dimensions of screw type terminals	30
15. Moisture resistance	14	17. Dimensions of stud type terminals	30
16. Insulation resistance and electric strength	15	18. Axial pull on conductors	30
17. Overload protection	16	19. Torque values for screws and nuts	32
18. Endurance	17	20. Creepage distances and clearances	33
19. Abnormal operation	17	Figures	
20. Stability and mechanical hazards	19	1. Standard test finger	36
21. Mechanical strength	19	2. Test pin	36
22. Construction	20	3. No requirement	
23. Internal wiring	23	4. Diagram for leakage current measurement at operating temperature for single-phase connection of class II appliances	37
24. Components	24	5. Diagram for leakage current measurement at operating temperature for single-phase connection of appliances other than those of class II	37
25. Supply connection and external flexible cables and cords	25	6. No requirement	
26. Terminals for external conductors	28	7. No requirement	
27. Provision for earthing	31	8. Diagram for electric strength test at operating temperature	38
28. Screws and connections	32	9. Vertical rain apparatus	38
29. Creepage distances, clearances and distances through insulation	33	10. Splash apparatus	39
30. Resistance to heat, fire and tracking	34	11. Spray apparatus	39
31. Resistance to rusting	35	12. Impact-test apparatus	40
32. No requirement	35	13. No requirement	
Appendices		14. Ball-pressure apparatus	40
A. Electronic circuits	44	15. Hot mandrel apparatus	41
B. Measurement of creepage distances and clearances	46	16. Arrangement and dimensions of the electrodes for the tracking test	42
C. Classification of controls in accordance with the requirements of BS 3955 : Part 3 as type 1 or type 2	48	17. Apparatus for flexing test specified in 25.10	42
		18. Schematic representation of cord anchorages	43



Foreword

This revised specification for irons, ironers and pressing machines has been prepared under the direction of the Light Electrical Engineering Standards Committee and is the first in the new series of stand-alone specifications which will replace the existing sections of Part 2 of BS 3456.

The need for the revision of the whole of the BS 3456 series has arisen from the harmonization programme of the European Committee for Electrotechnical Standardization (CENELEC).

This standard is technically identical to the CENELEC harmonization document (HD) for these appliances, which comprises HD 251.S2 for the general requirements and HD 253.S2 for the particular requirements.

CENELEC harmonization documents recognize certain national deviations which 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 HD 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 IEC 335-1 : 1976, published by the International Electrotechnical Commission (IEC), 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 and marked 'No requirement'. Additional subclauses introduced by either the CENELEC HD or by UK deviations from the HD 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 irons, ironers and pressing machines.

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).

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 standard supersedes BS 3456 : Section 2.4 : 1970 which will be withdrawn on the date agreed by the CENELEC General Assembly for standards conflicting with HD 253 to be withdrawn. Until this date BEAB will accept for approval appliances complying either with the requirements of this standard or with BS 3456 : Section 2.4 : 1970.

* 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 3.1 Irons, ironers and pressing machines

1. Scope

1.1 BS 3456: Part 3 : Section 3.1 specifies requirements for electric irons, ironers and pressing machines, including appliances with steam and spray producing devices, for household and similar purposes.

Irons and ironers not intended for normal household use, but which nevertheless may be a source of danger to the public, such as irons intended to be used by laymen in shops, in light industry and on farms, 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:

- appliances designed exclusively for industrial purposes;
- appliances intended to be used in locations where special conditions prevail, such as the presence of a corrosive atmosphere (dust, vapour or gas);
- appliances for medical purposes.

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

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

1.2 This standard is concerned with safety and takes into account the influence on safety of components that are 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 rated voltage. The voltage 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 current. The current assigned to the appliance by the manufacturer.

NOTE. If no current is assigned to the appliance, the rated current for the purpose of this standard is determined by calculation from the rated input and the rated voltage and/or by measuring the 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 rated capacity. For appliances with a liquid container, the quantity of liquid for which the appliance is designed.

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 Y attachments may be used either with common flexible cables or cords or with special cables or cords.

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 must be one homogeneous piece. It may comprise several layers which 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 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 the following conditions.

Appliances with a thermostat are operated with the thermostat at the highest setting; other appliances are operated so that the temperature at the centre of the heating surface or surfaces is maintained at $250 \pm 10^\circ\text{C}$ by switching the supply on and off.

General purpose electric irons and other electric irons with stands are operated on their stand. Other electric irons without stands are suspended by their handle, in still air, with the sole plate in the horizontal position.

Ironers with an energy regulator are operated with the energy regulator adjusted so that the temperature at the centre of the heating surface or surfaces is maintained at $250 \pm 10^\circ\text{C}$ or, if this temperature cannot be attained, the highest value possible.

Flat-bed ironers and pressing machines are operated with the pressing surfaces not in contact with each other.

Rotary ironers are operated with the heating surface in the open position and with the roller moving continuously.

Appliances with steam producing devices are operated with empty containers; pressing machines designed for external steam supply are operated without steam.

NOTE 1. The centre of the heating surface of an electric iron is the point on the centre line of the sole plate surface, midway between the tip and the heel of the iron.

NOTE 2. The stand of a general purpose electric iron is the separate stand, if one is delivered with the iron; otherwise, it is the heel stand or similar incorporated device.

NOTE 3. For ironers and pressing machines with two separate heating elements, each element is, if necessary, controlled separately so that the temperature at the centre of each heating surface is within the limits specified.

NOTE 4. If the motor of a rotary ironer is automatically switched off when the heating surface is moved to the open position, the motor is so connected that it will continue to operate when the heating surface is in the open position.

2.30 normal load. The load to be applied to a motor-operated appliance so that the stress imposed corresponds to that occurring under normal conditions of use, unless otherwise specified, heating elements, if any, being operated as in normal use.

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. The 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.

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 : 1971 (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 general purpose electric iron. An electric iron intended for normal household use.

A travelling iron is considered to be a general purpose electric iron; a tailor's iron is not.

2.102 thermostatic iron. An iron fitted with a thermostat, the setting of which can be adjusted manually to obtain a range of temperature control of the sole plate.

2.103 dry iron. An iron having neither means to produce and supply steam nor means to spray water on to textile material while ironing.

2.104 steam iron. An iron having means to supply steam to the textile material while ironing.

2.105 spray iron. An electric iron provided with means to spray water on the textile material.

2.106 sole plate. That part of the iron, ironer or pressing machine that is heated and pressed against the textile material while ironing.

2.107 stand. The heel stand or similar device incorporated in the iron; other than the separate stand delivered with the iron.

2.108 ironer. An appliance in which the textile material to be ironed is supported by a padded or similar surface, and a

heated surface can be brought into contact with it. Ironers with steam-producing devices are regarded as pressing machines.

2.109 rotary ironer. An ironer in which the surface supporting the textile material is in the form of a roller rotated by means of a motor.

2.110 flat-bed ironer. An ironer in which the surface supporting the textile material and the heating surface are flat.

2.111 pressing machine. An appliance in which the textile material is flattened between two surfaces while steam is injected.

The steam-producing device may be either incorporated in the appliance or separate.

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.

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.

For thermostatic irons the test of **21.101** shall be made before that of clause **11**

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 the 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, for example, the temperature of

boiling water, the room temperature, in case of doubt, is 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.

NOTE. If a heating appliance not incorporating a motor is designed for one rated voltage range, the upper limit of the voltage range will be the most unfavourable voltage within the range. If the appliance incorporates a motor or is designed for more than one rated voltage or rated voltage range, it may be necessary to make 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 Appliances for which alternative heating elements or accessories are available shall be tested with those elements or accessories that give the most unfavourable results, provided that the elements or accessories used are within the appliance manufacturer's specification.

4.8 If, in normal use, the heating element cannot be operated unless the motor is running, the element shall be tested with the motor running. If the heating element can be operated without the motor running, the element 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

BS 3456 : Part 3 : Section 3.1 : 1979

tested with the appropriate flexible cable or cord connected to the appliance.

4.12 When it is specified that the appliance has to be supplied at a voltage such that the input is greater than rated input, this voltage shall apply only to heating elements without an appreciable positive temperature coefficient of resistance. For other heating elements, this voltage shall be determined as follows.

First, the rated voltage is supplied until the heating element reaches its operating temperature. The supply voltage is then rapidly increased to the value necessary to give the input required for the relevant test and the test is carried out as specified, the value of the supply voltage being maintained throughout the test.

NOTE. In general, the temperature coefficient is considered to be appreciable if, at rated voltage, the input of the appliance in cold condition differs by more than 25 % from the input at operating temperature.

4.13 Motor-operated appliances shall be loaded according to the specified conditions of normal load.

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 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 Unless ironers and pressing machines are designed to be fixed to a supporting surface, they shall be tested as portable appliances.

5. Rating

5.1 The maximum rated voltage is 250 V.

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

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 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 d.c. only or for a.c. of both 50 Hz and 60 Hz;
 - (d) rated input in watts or kilowatts;
 - (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 or fuse-link is of the time-lag type, information about the time/current characteristics rating shall be included 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;
 - (i) symbol for degree of protection against moisture, if applicable.

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 Separate stands delivered with electric irons shall be marked with:

- (a) manufacturer's name or trade mark;
- (b) manufacturer's model or type reference.

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.

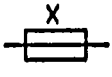
NOTE. For appliances for which frequent changes in voltage setting are not required, this requirement is considered to be complied with if the rated voltage or the rated input to which the appliance is adjusted can be determined from a wiring diagram fixed to the appliance; the wiring diagram may be on the inside of a cover which has to be removed to connect the supply conductors. This diagram may be on a card which is 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 brackets 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
μ F	microfarads
l	litres
kg	kilograms
N/cm^2	newtons per square centimetre
Pa	pascals
h	hours
min	minutes
s	seconds
	alternating current
	direct current
 A	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)
	watertight construction (two drops)

*The recommended unit of pressure is the bar and preference should be given to its use 1 bar = 10^5 N/m^2 = 10 kPa

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 15 cm, in which case the dimensions of the symbol may be reduced, but the length of the sides of the outer square shall not be 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 . 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 marked or placed so 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, etc., shall be indicated by a higher figure.

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

7.11 Thermostats, regulating devices 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 Electric irons shall be accompanied by an instruction sheet which states that the user should not leave the iron unattended while it is connected to the supply.

For steam irons and spray irons, the instruction sheet shall state that the plug of the power supply cord should be removed from the socket outlet before the container is filled with water.

If it is necessary to take special precautions when installing or using ironers or pressing machines, details shall be given in an instruction sheet.

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.

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 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 of 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 which 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  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 the 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.

7.111 No requirement.

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

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, 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: 1971 (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.

Appliances for wall-mounting shall be tested as delivered, except that reliance may be placed on the enclosure to provide protection against contact with basic insulation.

An appliance designed as a single appliance but delivered as a number of units shall be tested after assembly.

For appliances provided with movable devices, such as those intended for varying the heat distribution or the tension of belts, the test shall be made 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 the latter finger 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 of 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 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.

NOTE 3. The fact that appliances for wall-mounting are tested as delivered does not imply that such appliances must be completely enclosed; the basic insulation of wiring in appliances other than those of class II may give the required protection against electric shock, provided it is adequately protected or enclosed after installation of the appliance.

8.2 No requirement.

8.3 No requirement.

8.4 Conducting liquids that are or may become accessible in normal use shall not be in direct contact with live parts other than those operating at safety extra-low voltages not exceeding 24 V.

For class II appliances, such liquids shall not be in direct contact with basic insulation or with metal parts insulated from live parts by basic insulation only.

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

TEST. Compliance with the requirements of 8.4 and 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 is 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 1.08 times rated voltage. Motors to be started by hand are started in the correct direction and, if possible, in the wrong direction.

BS 3456 : Part 3 : Section 3.1 : 1979

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

NOTE. The supply is such that, during the test, the drop in 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 of fuse	Diameter of silver wire	
	starting time not exceeding 1 second	starting time exceeding 1 second
A	mm	mm
10	0.29	0.39
16	0.39	0.52

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.

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 in accordance with conditions of adequate heat discharge and/or 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 If a heating appliance has a marking for the input in cold condition, this shall not differ by more than 20 % from the marked value.

TEST. Compliance shall be checked by inspection and by measurement.

NOTE. For appliances marked with one or more rated voltage ranges, the tests specified in 10.1 to 10.3 are made 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 made at a voltage equal to the mean value of that range.

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 Electric irons shall be tested twice, once with the iron on its stand and once when it is supported by three pointed metallic supports so that the soleplate is in the horizontal

Table 2. Permissible variations in rated input

Type	Rated input	Deviation
Heating appliance	W	± 10 % + 5 % or - 10 %, or 10 W, whichever is the greater
	Not exceeding 100	
Motor-operated appliance	Exceeding 100	+ 10 W* + 30 %* + 45 W* + 15 %*
	Up to and including 33.3	
	Over 33.3 up to and including 150	
	Over 150 up to and including 300	
	Over 300	

* For motor-operated appliances, the negative deviation is not limited.

NOTE 1. For appliances and detachable heating elements 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.

NOTE 2. For combined appliances the input for the appliance as a whole is checked. If the deviation exceeds either that prescribed for heating appliances for that total rated input or that prescribed for motor operated appliances for that total rated input, whichever is the smaller, the inputs to the heating and motor operated parts of the appliance are measured separately for compliance with this clause.

position at least 100 mm above the base which carries the pointed supports. In both cases, the test is made in still air with the iron away from the walls of the test corner.

Other appliances shall be tested away from the walls of the test corner. The test corner consists of two walls at right angles, a floor, all 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.

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 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 The appliances shall be operated in accordance with conditions of adequate heat discharge, with all heating elements in circuit, the supply voltage being such that the input is 1.15 times the maximum rated input.

11.5 The motors of appliances incorporating motors shall be operated under normal load and at the most unfavourable voltage between 0.94 times the minimum rated voltage and 1.06 times the maximum rated voltage.

11.6 When the motors of appliances incorporating motors are operated at a voltage equal to 1.06 times the maximum rated voltage, the input to the heating elements 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 heating elements shall be reduced to 0.90 times the minimum rated input.

NOTE. If it is necessary to make the test at an intermediate voltage, the input of the heating elements is adjusted proportionately.

11.7 The appliance shall be operated for the time necessary to establish steady conditions.

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.

For the test on the pointed supports, only the temperature rise of the insulation of internal and external wiring shall be obtained.

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 nearly 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 of appliances with heating elements

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 and, if applicable, by the test specified in 12.3.

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

Table 3. Permissible temperature rises

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

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 materials claimed to be of class E, the tests specified in 11.10 are always made when the temperature rise of the windings exceeds 75 °C (75 K) and when there is doubt with regard to the classification of the winding insulation. More extensive accelerated temperature tests and, in addition, compatibility testing is required for insulation systems class B and higher temperature classes.

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.

² T signifies the maximum operating temperature.

For the purpose 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 6600.

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.

In particular, heating wires, 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.

Appliances normally fixed to a wall shall be fixed to a wall, as near as possible to the floor as is likely to occur in normal use, unless specific instructions are given by the manufacturer.

The appliance shall be subjected to 15 cycles, each cycle comprising an operating period as specified in 11.7, in accordance with conditions of adequate heat discharge, and a cooling period sufficient to allow the appliance to cool down to approximately room temperature.

Throughout the operating period, all heating elements 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 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 Appliances provided with a pressure switch shall be subjected to an additional test under the conditions specified in 12.2, but the operating and cooling periods shall be each approximately 5 min and the current is interrupted by controlling the working pressure.

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 tests specified in 13.2 and 13.3, the appliance being operated in accordance with conditions of adequate heat discharge and/or under normal load for the time specified in 11.7.

Appliances other than those incorporating motors shall be operated with all heating elements in circuit, the supply voltage being such that the input is 1.15 times the maximum rated input.

Motor-operated appliances shall be operated at a supply voltage equal to 1.06 times the rated voltage.

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 20 cm x 10 cm 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 test shall be made with a.c., unless the appliance is for d.c. only, in which case the test shall be made 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 class III appliances 0.5 mA
- (2) for portable class I appliances 0.75 mA
- (3) for stationary class I motor-operated appliances 3.5 mA
- (4) for stationary class I appliances with heating elements which can be switched off separately 0.75 mA or 0.75 mA per kW rated input for each element or group of elements, whichever is the greater, with a maximum of 5 mA for the appliance as a whole.

(5) for other stationary class I appliances 0.75 mA or 0.75 mA per kW rated input of the appliance, whichever is the greater, with a maximum of 5 mA

(6) for class II appliances 0.25 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.

For appliances with motors, the total leakage current shall be within the limits specified for heating appliances or for motor-operated appliances, whichever is the greater, but the two limits shall not be added.

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 must not, however, be affected by the metal foil.

NOTE 4. The test with the switch in the 'off' position is made 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:

(a) 500 V for basic insulation subjected in normal use to a safety extra-low voltage;

(b) 1000 V for other basic insulation;

(c) 2750 V for supplementary insulation;

(d) 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 neglected.

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

14.1 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 which 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 which are not subject to spillage of liquid in normal use 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 attachments 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, 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 ± 2 °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 be subjected for 5 min to the vertical rain test.

Splash-proof appliances shall be:

(a) if hand-held, subjected for 5 min to the vertical rain test, the appliance being turned continuously through the most unfavourable positions;

(b) If not hand-held, subject 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.

Appliances normally fixed to a wall shall be fixed in the normal position of use, to a wooden board, if necessary, this board having dimensions that are equal to those of the surface of the appliance in contact with the wall.

The wooden board itself shall be so supported that the nozzles of the rain apparatus are 2 m above the uppermost point of the appliance.

Other appliances, except hand-held appliances, 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 normally fixed to a wall shall be mounted as in normal use on a wooden board having dimensions which are 150 ± 50 mm in excess of those of the orthogonal projection of the appliance on the board.

Other 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 which 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 Steam irons, spray irons and pressing machines shall be so constructed that spillage does not affect their electrical insulation.

TEST. Compliance shall be checked by the following test.

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

The appliance shall be placed in the filling position according to the manufacturer's instructions. The liquid container shall be completely filled with cold tap water, and a further quantity of 100 cm³ of cold tap water shall be steadily poured into the filling opening over a period of 1 min.

Immediately after this treatment, the appliance shall withstand an electric strength test as specified in 16.4 and inspection shall show that water which 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. This test shall be made twice with an interval of 10 min between each test, the positions of the appliance remaining unchanged.

Steam irons and spray irons only shall then be operated at rated voltage for 1 min under conditions of adequate heat discharge, but with the container not being emptied, and immediately after this period the irons shall once again withstand an electric strength test as specified in 16.4.

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

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.

Electrical components, 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:

- (a) 2 days (48 h) for ordinary appliances;
- (b) 7 days (168 h) for drip-proof and splash-proof appliances.

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, for the heating part of appliances by the tests of 16.2 and 16.4 and for the motor-operated part of appliances 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