

# Hand-held electric motor-operated tools —

## Part 1: Specification for general requirements

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- Association of Manufacturers of Domestic Electrical Appliances
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- British Retailers' Association
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- Ministry of Defence
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- Rotating Electrical Machines Association (BEAMA)
- Small Electrical Appliances Marketing Association
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- Association of Supervisory and Executive Engineers
- British Railways Board
- Department of Trade and Industry (Mechanical Engineering)
- Electrical Contractors' Association
- Gambica (BEAMA)
- Greater London Council
- Health and Safety Executive
- Radio, Electrical and Television Retailers' Association

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# Foreword

This Part of this British Standard, which has been prepared under the direction of the Light Electrical Engineering Standards Committee, implements the European Committee for Electrotechnical Standardization (CENELEC) harmonization document HD 400.1 “*Hand-held motor-operated tools — Part 1: General requirements including amendment A1*”. A complementary Part 2 to this revision of BS 2769, issued in separately published Sections, is also to be published and it will cover the particular requirements appropriate to specific tools. Part 2 will similarly implement corresponding Parts of the CENELEC HD 400 series.

For ease of reference, the clause and subclause numbers in this standard are the same as those of the harmonization document as far as possible. Additional subclauses introduced by UK deviations from the CENELEC HDs are numbered with the main clause number followed by .I, .II etc; all UK deviations also have the marginal mark as shown below<sup>1)</sup>, in accordance with CENELEC regulations. Deviations for other countries may be ascertained by reference to the relevant CENELEC harmonization documents.

Portable electric motor-operated tools of all insulated or double insulated construction without earth connection, for use in premises or processes subject to the Factories Act 1961, are required to be type tested and certified by a body approved by the Chief Inspector of Factories referred to in Statutory Instrument 1968 No. 1575 The Electricity Regulations’ 1908 (Portable Apparatus Exemption) Order 1968.

The British Standards Institution (BSI) is one such approved body and the appropriate mark of certification is  which is clearly and indelibly marked on the outside of tools which have been certified as complying with this standard. The Statutory Instrument refers to tests in BS 2769:1964 or to tests equivalent to such tests. The tests in Appendix B of this Part of this standard are equivalent to those in the 1964 standard. The 1964 standard will be withdrawn 12 months from the publication of Sections 2.0 to 2.14 of this standard.

Users of class II tools are reminded that the safety of such tools, in most circumstances of use, depends on the maintenance of their insulation in the state as specified in this standard. It is a statutory requirement that portable tools used in premises or processes subject to the Factories Act 1961 and the Electricity (Factories Act) Special Regulations 1908 and 1944 be maintained in such condition as to prevent danger.

For tools intended to be used in locations where special conditions prevail, as in ships and vehicles, and in hazardous locations, for example, where explosions are liable to occur, requirements additional to those specified in this standard may be necessary.

This standard calls for the use of substances and test procedures that may be injurious to health if adequate precautions are not taken when conducting the tests. It refers only to technical suitability and in no way absolves either the supplier or the user from legal obligations relating to health, safety and fire hazard at any stage of manufacture or use.

**Certification.** Attention is drawn to the certification facilities offered by BSI described on the inside back cover of this standard.

<sup>1)</sup> The marginal mark used in the text to indicate national deviations from CENELEC harmonization documents is as follows: [

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

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

#### **Summary of pages**

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 38, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

## 1 Scope

**1.1** This standard specifies general requirements for hand-held electric motor-operated or magnetically driven tools<sup>2)</sup>, intended for indoor or outdoor use.

Hand-held electric motor-operated tools, hereinafter referred to as tools, that can be mounted on a support for use as fixed tools without any alteration of the tool itself, are within the scope of this standard. This standard applies to tools having any rated frequency.

This Part 1 is to be used in conjunction with the appropriate Section of Part 2, which contains clauses to supplement or modify the corresponding clauses in Part 1 to provide the complete requirements for each sort of tool.

It also applies, as far as is reasonable, to tools not mentioned in Part 2, and to those designed on basically new principles, provided they satisfy the requirements of Part 1 and do not present any hazards not specifically covered by Part 1. Tools with an electric heating element incorporated are within the scope of this standard but such tools are also required to comply with BS 3456-101 as far as the heating element is concerned (see 3.1).

**NOTE** The titles of the publications referred to in this standard are listed on page 38.

## 2 Definitions

### 2.1

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 apply

### 2.2

#### **hand-held tool**

an electric motor-operated or magnetically driven machine intended to do mechanical work and so designed that the motor and the machine form an assembly that can easily be brought to its place of operation and that is held by hand

**NOTE** Hand-held tools may be provided with a flexible shaft, the motor being fixed or portable. Hand-held tools may also have provision for mounting on a support.

### 2.3

#### **rated voltage**

the voltage (for three-phase supply, the line voltage) assigned to the tool by the manufacturer

### 2.4

#### **rated voltage range**

the voltage range assigned to the tool by the manufacturer, expressed by its lower and upper limits

### 2.5

#### **rated input**

the input in watts, assigned to the tool by the manufacturer

### 2.6

#### **rated current**

the current at rated voltage or at the lower limit of the rated voltage range, assigned to the tool by the manufacturer

if no current is assigned to the tool, the rated current for the purpose of this standard is the current measured when the tool is operating under normal load, at rated voltage or at the lower limit of the rated voltage range

### 2.7

#### **rated frequency**

the frequency assigned to the tool by the manufacturer

### 2.8

#### **rated frequency range**

the frequency range assigned to the tool by the manufacturer, expressed by its lower and upper limits

### 2.9

#### **rated no-load speed**

the no-load speed at rated voltage or at the upper limit of the rated voltage range, assigned to the tool by the manufacturer

### 2.10

#### **aid of a tool/use of a tool**

where the expressions “with the aid of a tool”, “without the aid of a tool” and “requires the use of a tool” occur in the text, the word “tool” means a screwdriver, a coin or any other object that may be used to operate a screws or similar fixing means

### 2.11

#### **non-detachable flexible cable or cord**

a flexible cable or cord which can only be removed from the tool with the aid of a tool

<sup>2)</sup> Although the scope of this standard and of the harmonization document embraces magnetically driven tools, the title of the harmonization document has been retained in this standard without reference to these tools because of the close relationship between these and motor-operated tools.

**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 (protective insulation)**

an independent insulation provided in addition to the 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**

an improved basic insulation with such mechanical and electrical qualities that it provides the same degree of protection against electric shock as double insulation

**2.16****class I tool**

a tool having at least basic insulation throughout and provided with either an appliance inlet with earthing contact, or a non-detachable flexible cable or cord with earthing conductor

NOTE 1 If a class I tool intended to be used with a non-detachable flexible cable or cord is provided with a plug it has to have an earthing contact.

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

**2.17****class II tool**

a tool with double insulation and/or reinforced insulation throughout and without provision for earthing

such a tool may be one of the following types:

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

- b) a tool 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 a tool is called a “metal-encased class II tool”;

- c) a tool which is a combination of types a) and b).

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

NOTE 2 If a tool with double insulation and/or reinforced insulation throughout has an earthing terminal or earthing contact, it is considered to be of class I construction.

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

**2.18****class III tool**

a tool designed for operation at safety extra-low voltage having no circuits, either internal or external that operate at a voltage other than safety extra-low voltage and that has no provision for earthing

NOTE If a tool designed for operation at safety extra-low voltage has an earthing terminal or earthing contact, it is considered to be of class I construction.

**2.19****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 should be supplied 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.

**2.20****normal load**

the load to be applied to the tool so that the stress imposed corresponds to that occurring under normal conditions of use, any marking of short-time or intermittent operation being observed and heating elements, if any, being operated as in normal use

NOTE The normal load is based on the rated voltage or on the upper limit of the rated voltage range.

**2.21****accessible part**

any part that can be touched by the test finger shown in Figure 1. For accessible metal parts, it includes any other metal part that is in electrical contact with such parts

**2.22****detachable part**

a part that can be removed without the aid of a tool

**2.23****rated operating time**

the operating time assigned to the tool by the manufacturer

**2.24****continuous operation**

operation under normal load for an unlimited period

**2.25****short-time operation**

operation under normal load for a specified period, starting from cold, the intervals between successive periods of operation being sufficiently long to allow the tool to cool down to approximately room temperature

**2.26****intermittent operation**

operation in a series of specified identical cycles, each cycle being composed of a period of operation under normal load, followed by a rest period with the tool running idle or switched off

**2.27****thermal cut-out**

a device that, during abnormal operation, limits the temperature of a tool, or of parts of it, by automatically opening the circuit or by reducing the current and that is so constructed that its setting cannot be altered by the user

**2.28****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

**2.29****bounding surface of the tool**

the outer surface of the enclosure with and without detachable parts removed, considered as though metal foil were pressed into contact with accessible surface of insulating material

**2.30****creepage distance**

the shortest path between two conductive parts, or between a conductive part and the bounding surface of the tool, measured along the surface of the insulating material

**2.31****clearance**

the shortest distance between two conductive parts, or between a conductive part and the bounding surface of the tool, measured through air

**2.32****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

**3 General requirements**

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

Components included in the tools as being necessary to give an adequate degree of radio and television interference suppression, shall not impair the compliance of the tools with this standard.

Tools with an electric heating element shall also comply with BS 3456-101 as far as the heating element is concerned.

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

**4 General conditions for the tests**

**4.1** Tests carried out in accordance with this standard are type tests. Tools made to a design that has passed the type tests and that have themselves been subjected to and have passed the routine tests as set out in Appendix B, are deemed to comply with this standard.

**4.2** Unless otherwise specified in this standard, the tests shall be carried out on a single sample as supplied that shall withstand all the relevant tests.

NOTE 1 If the tool 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 2 If the test of 11.2 has to be made, three or possibly six additional samples are required.

NOTE 3 If it is necessary to dismantle a class II tool for the tests of 12.1 and clause 15, one additional sample may be 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 tool.

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

NOTE Before testing is started, the tool is operated at rated voltage or at the lower limit of the rated voltage range, in order to verify that it is in working order.

However, where, according to 13.1, the interference levels need to be measured, these measurements shall be made immediately after the tests in clause 8.

**4.4** Unless otherwise specified in this standard, the tests shall be carried out at an ambient temperature of  $20 \pm 5$  °C, the tool being placed in the most unfavourable position which may occur in normal use.

**4.5** Tools for a.c. only shall be tested with a.c. at rated frequency, if marked. Tools not marked with rated frequency shall be tested at 50 Hz. Tools marked with a rated frequency range shall be tested at 50 Hz if this frequency is within the range; otherwise they shall be tested at the most unfavourable frequency within the range.

Tools for d.c. only are tested with d.c.

Tools designed for more than one rated voltage, or for both a.c. and d.c. shall be tested at the most unfavourable voltage and nature of supply.

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

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

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

**NOTE 1** When testing tools designed for d.c. only, the possible influence of polarity on the operation of the tool should be taken into consideration.

**NOTE 2** If the tool is designed for more than one rated voltage or rated voltage range, it may be necessary to make some of the tests more than once, in order to establish the most unfavourable voltage.

**4.6** Heating elements incorporated in the tool shall be connected to a separate supply, unless otherwise specified, and shall be tested according to BS 3456-101.

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.

**4.7** Tools provided with a regulating device or a similar control shall be tested with these controls adjusted to their most unfavourable setting within the range specified by the manufacturer for the particular application, if the setting can be altered by the user.

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.

Where alteration of the setting by the user is prevented, e.g. by adequate sealing, this subclause does not apply.

**4.8** Electronic speed control devices shall be set for the highest speed.

**4.9** Tools intended to be used with a non-detachable flexible cable or cord shall be tested with the flexible cable or cord connected to the tool.

**4.10** When the conditions of normal load are specified in Part 2, the tool shall be loaded according to these conditions, irrespective of any marking of short-time operation or intermittent operation, unless it is evident from the design of the tool that these conditions will not occur in normal use.

When the conditions of normal load are not specified in Part 2, the tool shall be loaded according to the manufacturer's instruction sheet; in the absence of such instructions, the tool shall be operated continuously at a load such that rated input is attained.

Tools for which alternative accessories are available shall be tested with that accessory within the manufacturer's specification that gives the most unfavourable results.

For accessories performing a function that is within the scope of one of the Sections of Part 2, the tests shall be carried out in accordance with that Section.

For other accessories, the tests shall be carried out in accordance with the manufacturer's instruction sheet; in the absence of such instructions, the tool shall be operated continuously at a load such that rated input is attained.

**4.11** If a torque load is to be applied, the method of loading shall be chosen so as to avoid additional stresses, such as those caused by side thrust.

**NOTE** However, additional loads necessary for the correct operation of the tool should be taken into consideration.

**4.12** Tools intended to be operated at safety extra-low voltage supplied by a transformer delivered together with the tool shall be tested together with this transformer.

**4.13** If class I tools have parts with double insulation or reinforced insulation, such parts shall also be checked for compliance with the appropriate requirements specified for class II tools. Similarly, if class I or class II tools have parts operating at safety extra-low voltage, such parts shall also be checked for compliance with the appropriate requirements specified for class III tools.

## 5 Rating

**5.1** The maximum rated voltage shall be:

250 V for d.c. tools;

440 V for other tools.

NOTE For class III tools, the preferred values of the rated voltage are 24 V and 42 V.

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

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

## 6 Classification

### 6.1 Tools shall be classified:

- a) according to protection against electric shock:
  - class I tools;
  - class II tools;
  - class III tools.
- b) according to degree of protection against moisture:
 

|                                                                                                                          |   |               |
|--------------------------------------------------------------------------------------------------------------------------|---|---------------|
| <ul style="list-style-type: none"> <li>ordinary tools;</li> <li>splash-proof tools;</li> <li>watertight tools</li> </ul> | } | see clause 14 |
|--------------------------------------------------------------------------------------------------------------------------|---|---------------|
- c) according to degree of radio and television interference suppression:
 

|                                                                                                |   |          |
|------------------------------------------------------------------------------------------------|---|----------|
| <ul style="list-style-type: none"> <li>tools of class A;</li> <li>tools of class B.</li> </ul> | } | see 13.1 |
|------------------------------------------------------------------------------------------------|---|----------|

## 7 Marking

### 7.1 Tools shall be marked with:

- a) rated voltage(s) or rated voltage range(s) in volts, showing for star-delta connection the two rated voltages 415Y/240  $\Delta$ ;
- b) symbol for nature of supply, if applicable;
- c) rated frequency or rated frequency range in hertz, unless the tool is designed for d.c. only, or for a.c. of any frequency not exceeding 60 Hz;
- d) rated input in watts or kilowatts, if greater than 25 W;
- e) rated current in amperes, if greater than 10 A;
- f) manufacturer's name or trade mark;
- g) manufacturer's model or type reference;
- h) rated operating time, or rated operating time and rated resting time, in hours, minutes or seconds, if applicable;
- i) symbol for class II construction, for class II tools only;
- j) symbol for degree of protection against moisture, if applicable;
- k) rated no-load speed in revolutions per minute, if exceeding 10 000.

If the motor of a tool is marked separately, the marking of the tool and that of the motor shall be such that there can be no doubt with regard to the rating and manufacturer of the tool itself.

NOTE 1 For tools with heating elements incorporated, the rated input is considered to be equal to the total maximum rated input of the motor and of the heating elements that can be in operation simultaneously.

NOTE 2 Additional markings are allowed, provided they do not give rise to misunderstanding.

**7.2** For tools with heating elements incorporated, the complete marking for heating elements specified in BS 3456-101 shall also be given on the marking plate of the tool.

**7.3** Tools for short-time operation or intermittent operation shall be marked with rated operating time or rated operating time and rated resting time respectively, unless the operating time is either limited by the construction or corresponds to the description of normal load given in Part 2. The marking of short-time operation or intermittent operation shall correspond to normal use.

The marking of intermittent operation shall be such that the rated operating time precedes the rated resting time, the markings being separated by an oblique stroke.

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

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

For tools where frequent changes in voltage setting are not required, this requirement shall be deemed to have been complied with if the rated voltage or the rated input to which the tool is adjusted can be determined from a wiring diagram fixed to the tool.

NOTE 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 is essential that it is not on a label loosely attached to the tool.

**7.5** For tools 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 tool so that the relation between input and voltage appears distinctly.

NOTE When the difference between the limits of a rated voltage range does not exceed 10 % of the mean value of the range, the marking for rated input may be related to the mean value of this range.

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

|    |         |
|----|---------|
| V  | volts   |
| A  | amperes |
| Hz | hertz   |

|                                                                                     |                                                    |
|-------------------------------------------------------------------------------------|----------------------------------------------------|
| W                                                                                   | watts                                              |
| kW                                                                                  | kilowatts                                          |
| h                                                                                   | hours                                              |
| min                                                                                 | minutes                                            |
| s                                                                                   | seconds                                            |
| /min <sup>a</sup>                                                                   | revolutions or reciprocations per minute           |
|     | alternating current                                |
| 3   | three-phase alternating current                    |
| 3N  | three-phase alternating current with neutral       |
|     | direct current                                     |
|     | class II construction                              |
|     | splash-proof construction (one drop in a triangle) |
|     | watertight construction (two drops)                |

<sup>a</sup> This symbol has been retained from the harmonization document. It is equivalent to the symbol “r/min” or “min<sup>-1</sup>” normally used in British Standards.

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 tool does not exceed 15 cm, in which case the length of the sides of the outer square shall be not less than 3 mm.

The symbol for class II construction shall be so placed that it will be obvious that it is a part of the technical information and is unlikely to be confused with the manufacturer's name or trade mark.

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

Earthing terminals shall be indicated by the symbol  $\perp$ . These indications shall not be placed on screws, removable washers or other parts which might be removed when conductors are being connected.

**7.8** Tools to be connected to more than two supply conductors shall be provided with a wiring diagram, unless the correct mode of connection is obvious.

**NOTE** The earthing conductor is not a supply conductor. For tools for star-delta connection, the wiring diagram should show how the windings are to be connected. The wiring diagram may be that referred to in 7.4.

**7.9** A push-button shall be coloured red only if it serves to open the circuit to be controlled and has no other function.

**7.10** For tools that might cause danger when started unexpectedly, the “off” position of the mains switch shall be indicated, unless this position is obvious to the user; the indication, if required, shall be the Figure 0.

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

The position of the moving contacts of the mains switch shall correspond to the indications for the different positions of its operating means.

**7.11** Regulating devices and the like, intended to be adjusted during operation of the tool, shall be provided with a visible indication for the direction of adjustment to increase or to decrease the value of the characteristic being adjusted.

This requirement does not apply to regulating devices provided with reciprocating adjusting means, if its “fully-on” position is opposite to its “off” position.

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.

**NOTE 1** An indication of + and – is considered to be sufficient.

**NOTE 2** The indications for the different positions of the operating means of a control device need not be placed on the device itself.

**7.12** Tools provided with electronic regulating devices shall either have a special marking or be accompanied by an instruction sheet giving the necessary instructions for the use of the tool.

**7.13** If it is necessary to take special precautions when using the tool, details of these shall be given in an instruction sheet accompanying the tool. This instruction sheet shall be written in English. Where symbols are used, they shall be those indicated in this standard.

**7.14** Marking specified in 7.1 to 7.5 shall be placed on the main part of the tool in such a way that it is clearly discernible when the tool is ready for use.

Marking on, and indications for, switches, thermal cut-outs and similar 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 with the requirements of 7.1 to 7.14 shall be checked by inspection.

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

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

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

NOTE Provisionally, self-adhesive labels glued in recesses in the enclosure of the tool, are allowed for ordinary tools.

**7.I** A label shall be attached to the flexible cord of all single phase class I tools. This label shall state the following:

**“WARNING — THIS APPLIANCE MUST BE EARTHED**

**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 the label shall include the substance of the following:

**“WARNING — THIS APPLIANCE MUST BE EARTHED**

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

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

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

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

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

TEST. Compliance shall be checked by inspection.

**7.II** For tools fitted with a flexible cord and with a rated input exceeding 3 kW a label shall be attached to the flexible cord stating that the appliance must be connected to an outlet having a rated current greater than 13 A and that a 13 A plug to BS 1363 is therefore not suitable.

TEST. Compliance shall be checked by inspection.

NOTE For tools intended for export, labelling other than that specified in **7.I** and **7.II** may be required.

## 8 Protection against electric shock

**8.1** Tools shall be so constructed and enclosed that there is adequate protection against accidental contact with live parts and, for class II tools, with metal parts separated from live parts by basic insulation only, even after removal of detachable parts.

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 a tool or 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”.

Enclosures shall have no openings giving access to live parts other than openings necessary for the use and working of the tool, nor, for class II tools, to parts separated from live parts by basic insulation only. The insulating properties of lacquer, enamel, paper, cotton, oxide film on metal parts, beads, sealing compound and similar coverings shall not be relied upon to give the required degree of protection against accidental contact with live parts.

Unless otherwise specified in this standard, uninsulated parts operating at safety extra-low voltage are considered to be live parts.

TEST. Compliance shall be checked by inspection and, if necessary, by a test with the test finger shown in Figure 1.

In addition, apertures in class II tools and apertures in class I tools, other than those in metal parts connected to an earthing terminal or earthing contact, shall be tested with the test pin shown in Figure 2.

After removal of detachable parts, the test finger and the test pin are applied in every possible position, the test finger being applied without appreciable force and the test pin with a force of 10 N. Apertures preventing the entry of the test finger are further tested by means of a straight unjointed test finger of the same dimensions, which is applied with a force of 50 N; if this finger enters, the test with the test finger shown in Figure 1 is repeated, except that the force necessary to push the finger through the aperture is exerted. An electrical contact indicator is used to show contact.

It shall not be possible to touch bare live parts, nor live parts protected by lacquer, enamel, paper, cotton, oxide film, beads, sealing compound or similar covering only, with the test finger, nor for class II tools, with the test pin.

For class II tools, it shall not be possible to touch metal parts separated from live parts by basic insulation only, with the test finger.

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

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

8.2 Parts providing protection against electric shock shall have adequate mechanical strength and shall not work loose in normal use. It shall not be possible to remove them without the aid of a tool.

TEST. Compliance shall be checked by inspection, by manual test and by the tests of clauses 16 and 19.

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

TEST. Compliance shall be checked by inspection.

8.4 For class II tools, 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.

8.5 Tools shall be so designed that in normal use there is no risk of electric shock from charged capacitors.

TEST. Compliance shall be checked by the following test that shall be carried out ten times.

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

The mains switch, if any, is then moved to the “off” position and the tool is disconnected from the supply by means of the plug. One second after disconnection, the voltage between the pins of the plug shall not exceed 34 V.

NOTE Care should be taken that the voltage is measured with an instrument which does not appreciably affect the value to be measured. Capacitors having a rated capacitance not exceeding 0.1 µF are not considered liable to entail a risk of electric shock.

9 Starting

9.1 Motors shall start under all normal voltage conditions that may occur in use. Centrifugal and other automatic starting switches shall operate reliably and without contact chattering.

TEST. Compliance shall be checked by operating the tool, with no load, ten times in succession at a voltage equal to 0.85 times rated voltage or 0.85 times the lower limit of the rated voltage range, regulating devices, if any, being set as in normal use. Tools provided with a centrifugal or other automatic starting switch are, in addition, operated ten times in succession at a voltage equal to 1.1 times rated voltage or 1.1 times the upper limit of the rated voltage range. In all cases the tool shall function correctly.

10 Input and current

10.1 The input of the tool, at rated voltage and under normal load, shall not exceed the rated input by more than the deviation shown in Table 1.

Table 1 — Permissible variations in rated input

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

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

NOTE A lower limit of the input is not required. For tools marked with one or more rated voltage ranges, the test is 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 test is made at a voltage equal to the mean value of that range.

10.2 If the tool is marked with rated current, the current taken by the tool shall not exceed the rated current by more than 15 %.

TEST. Compliance shall be checked by measuring the current taken by the tool operating under normal load and at rated voltage or at the mean value of the rated voltage range.

11 Heating

11.1 Tools shall not attain excessive temperatures in normal use.

TEST. Compliance shall be checked by determining the temperature rise of the various parts under the following conditions.

The tool is operated in still air, under normal load or under the torque load necessary to attain rated input, whichever causes the higher temperature rise, and at a voltage equal to 0.94 times rated voltage, 1.00 times rated voltage or 1.06 times rated voltage, whichever is the most unfavourable.