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Safety of transportable motor-operated electric tools -- Part 1: General requirements

Sicherheit transportabler motorbetriebener Elektrowerkzeuge -- Teil 1: Allgemeine Anforderungen

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Sécurité des machines-outils électriques semi-fixes -- Partie 1: Règles générales

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English version

Safety of transportable motor-operated electric tools
Part 1: General requirements
(IEC 61029-1:1990, modified)

Sécurité des machines-outils
électriques semi-fixes
Partie 1: Règles générales
(CEI 61029-1:1990, modifiée)

Sicherheit transportabler
motorbetriebener Elektrowerkzeuge
Teil 1: Allgemeine Anforderungen
(IEC 61029-1:1990, modifiziert)

This European Standard was approved by CENELEC on 1998-08-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

Foreword

This European Standard has been prepared by the Technical Committee CENELEC TC 61F, Hand-held and transportable motor operated electric tools.

The text of the International Standard IEC 61029-1 with CENELEC common modifications was submitted to the formal vote and was approved by CENELEC as EN 61029-1 on 1998-08-01.

The text of the common modifications is indicated by a vertical line in the left margin of the text.

This European Standard supersedes EN 61029-1:1995.

The following dates were fixed:

- latest date by which the EN has to be implemented at national level
by publication of an identical national standard or by endorsement (dop) 2000-09-01
- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 2002-09-01

Part 1 of this standard together with related Parts 2 gives directly and by reference the complete requirements for the specific type of transportable tool defined in the scope.

Other standards to which this European Standard refers are listed in Annex A. This annex lists the valid edition of these documents at the time of issue of this EN. All reference to these standards is however to be understood to be a reference to the latest edition.

This standard is divided into two parts:

- Part 1 General requirements which are common to most transportable electric motor operated tools (for the purpose of this standard referred to simply as tools) which could come within the scope of this standard
- Part 2 Requirements for particular types of tool which either supplement or modify the requirements given in Part 1 to account for the particular hazards and characteristics of these specific tools.

This European Standard has been prepared under a mandate given to CEN/CENELEC by the European Commission and the European Free Trade Association and supports the essential safety requirements of the Machinery Directive.

Compliance with the relevant clauses of Part 1 together with a relevant Part 2 of this standard provides one means of conforming with the essential health and safety requirements of the Directive.

A relevant Part 2 is one in which the type of tool or an accessory which is to be used with such a tool is within the scope of that Part 2.

When a relevant Part 2 does not exist, Part 1 can help to establish the requirements for the tool, but will not by itself provide a means of conforming with the relevant essential health and safety requirements of the Machinery Directive.

Warning: Other requirements arising from other EC Directives can be applicable to the products falling within the scope of this standard.

CEN has proposed standards for industrial machines, which may extend to transportable machines. Although CEN and CENELEC have, where appropriate, used common solutions to provide uniform levels of protection, persons using this standard should check the scope of both this and CEN standards to ensure that a correct standard is used. Where necessary, normative reference is made to these standards in the relevant Part 2.

Annexes designated "normative" are part of the body of this standard. Annexes designated "informative" are given only for information. In this standard, annexes A, B, C, D and ZB are normative and annexes IA and ZA are informative.

NOTE In this standard the following print types are used:

- Requirements proper;
- *Test specifications*;
- Explanatory matter.

Introduction

This European Standard is divided into two parts:

Part 1: General requirements, comprising clauses of a general character.

Part 2: Particular requirements, dealing with particular types of tool.

The requirements in a clause in a Part 2 supplement or modify the corresponding clauses in Part 1.

Where the text of a Part 2 indicates an "addition" to or a "replacement" of the relevant requirement, test specification or explanation of Part 1, these changes are made to the relevant text of Part 1, which then becomes part of the standard. Where no change is necessary, the words "This clause of Part 1 is applicable" are used in the Part 2.

This standard follows the overall requirements of EN 292-1 and 292-2.

1 Scope

1.1 This standard consists in Part 1 and Part 2 and applies to electric motor-operated or magnetically-driven tools, intended for indoor and for outdoor use, which have all the following characteristics:

- a) easily moved by one person, simple devices to facilitate transportation may be incorporated, e.g. handles, wheels and the like;
- b) used in a safe stationary position with or without fixing, e.g. fast clamping devices, bolting and the like;
- c) used under the control of an operator;
- d) not intended for continuous production or production line use;
- e) intended to be connected to electric supply by a flexible cord and a plug;
- f) maximum rated voltage not exceeding 250 V single-phase, a.c. or d.c., or 440 V three-phase, a.c.;
- g) maximum rated input not exceeding 2500 W, for single-phase a.c. or d.c., and 4000 W for three-phase a.c.

These tools are commonly known as "transportable motor-operated electric tools", hereinafter referred to, in the text, as tools.

Examples of these tools are: Circular saws, band saws, planers, thicknessers, radial arm saws, spindle moulders, fret saws, jig saws, mitre/chop saws, wood lathes, belt sanders, disc sanders, thicknessers-planers, chain mortisers, multipurpose machines, combing machines, metal lathes, bench grinders, bench drilling machines, pipe threaders, pipe benders, pipe saws, key cutting machines, sharpening machines, sheet metal shears, concrete drills, concrete saws, wood shredders, pipe cleaners

1.2 This standard does not apply to

- electric motor-operated household and similar electrical appliances according to EN 60335-1;
- hand-held electric motor-operated tools according to EN 50144-1;
- small low voltage transformer operated bench tools intended for model making;
- machines for preparing or processing food;
- tools used in explosive atmospheres;
- additional driving mechanisms required for external cooling and dust extraction/collection systems.

2 Definitions

For the purpose of this European Standard, the following definitions apply.

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

2.1

rated voltage

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

2.2

rated voltage range

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

2.3

working voltage

maximum voltage to which the part under consideration can be subjected when the tool is operating at its rated voltage and under normal conditions of use

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

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

2.4

rated input

input in watts at rated voltage or the mean of the rated voltage range assigned to the tool by the manufacturer

2.5

rated current

current at rated voltage or at the mean of the rated voltage range assigned to the tool by the manufacturer

NOTE If no current is assigned to the tool, 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 tool is operating at rated voltage under normal load and at normal operating temperature.

2.6

rated frequency

frequency assigned to the tool by the manufacturer

2.7

rated frequency range

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

2.8

rated no-load speed

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

2.9

detachable flexible cord

flexible cord, for supply or other purposes, intended to be connected to the tool by means of a suitable appliance coupler

NOTE Cord sets are covered by EN 60799; appliance couplers for household and similar general purposes by EN 60320-1.

2.10

power supply cord

flexible cord, for supply purposes, fixed to, or assembled with, the tool according to one of the following methods:

- **type X attachment:** Method of attachment such that the flexible cord can easily be replaced, without the aid of special purpose tools, by a flexible cord not requiring any special preparation;
- **type M attachment:** Method of attachment such that the flexible cable or cord can easily be replaced, without the aid of special purpose tools, by a special cord with, for example, a moulded-on cord or crimped terminations.

2.11

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.

2.12

supplementary insulation

independent insulation applied in addition to the basic insulation, in order to ensure protection against electric shock in the event of a failure of the basic insulation

2.13

double insulation

insulation comprising both basic insulation and supplementary insulation

2.14

reinforced insulation

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

"Single 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.

2.15

class I tool

tool 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 in such a way that accessible conductive parts cannot become live in the event of a failure of the basic insulation

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

For tools intended for use with a flexible cord, the provision includes a protective conductor as part of the flexible cord.

2.16

class II tool

tool 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 a tool may be of one of the following types:

- a) a tool having a durable and substantially continuous enclosure of insulating material which envelopes 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 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).

2.17

class III tool

tool in which protection against electric shock relies on supply at safety extra-low voltage (SELV) and in which voltages higher than those of SELV are not generated

2.18

extra-low voltage

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

2.19

safety extra-low voltage (SELV)

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

NOTE 1 When SELV is obtained from the supply mains, it must be through a safety isolating transformer or a convertor 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.

Limitations to voltages lower than 50 V a.c. should be specified in the particular standards, especially when direct contact with live parts is involved.

Separation from the mains by protective impedance is excluded.

2.20

safety isolating transformer

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, a tool or other equipment at safety extra-low voltage

2.21

normal load

Load to be applied to a 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, unless otherwise specified, 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.

2.22

rated operating time

operating time assigned to the tool by the manufacturer

2.23

continuous operation

operation under normal load for an unlimited period

2.24

short-time operation

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

2.25

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

2.26

non-detachable part

part which can only be removed with the aid of a tool

Where expressions such as "with the aid of a tool" occur, the word tool means a hand tool, for example screwdrivers, which may be used to operate a screw or other means of fixing.

2.27

detachable part

part which can be removed without the aid of a tool.

2.28

thermal cut-out

device which, 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 which is so constructed that its setting cannot be altered by the user

2.29

non-self-resetting thermal cut-out

thermal cut-out which requires resetting by hand, or replacement of a part, in order to restore the current

2.30

creepage distance

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

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

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

2.32

all-pole disconnection

for single-phase a.c. tools and for d.c. tools, disconnection of both supply conductors by a single switching action or, for tools to be connected to more than two supply conductors, disconnection of all supply conductors, except the earthed (grounded) conductor, by a single switching action

NOTE The protective earthing conductor is not a supply conductor.

2.33

accessible part or accessible surface

part or surface which can be touched by means of the standard test finger shown in Figure 1

For accessible metal parts, it includes any other metal part which is in electrical contact with such parts.

The term body includes all accessible metal parts, shafts of handles, knobs, grips and the like and metal foil in contact with all surfaces of insulating material; it does not include inaccessible metal parts.

2.34

power circuit

circuit which contains electrical equipment intended for generation, transformation, distribution or consumption of electric energy

2.35

control circuit

auxiliary circuit which is used to control electrical equipment

2.36

control device

device, for example push-buttons, selector switches, which is used to control, by hand, the function of the tool

3 General requirement

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

The materials used for the construction of the tool should not introduce additional hazards during the use or disposal of the tool.

In general, compliance is checked by carrying out all the relevant tests.

4 General notes on tests

4.1 *Tests according to this standard are type tests.*

4.2 *Unless otherwise specified, tests are carried out on a single test sample as delivered, the said sample withstanding all the relevant tests.*

Where the tool is designed for varying supply voltages, for both a.c. and d.c. and for different speeds, etc., then more than one sample may be required.

When testing a tool in accordance with EN 60529 a further test sample is required when the type of protection concerned involves a higher degree of severity than IP20.

Testing of components may necessitate the submission of additional samples of the said components. When the submission of such samples is necessary, they should be submitted together with the tool.

4.3 *Unless otherwise specified, tests are carried out in the order of the clauses in which they are given in this standard.*

Prior to testing, the tool shall be operated at rated voltage or at the lower limit of its rated voltage range in order to verify that it is in working order.

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

4.5 *If the test results are influenced by the temperature of the ambient air, the room temperature is, in general, maintained at $20\text{ °C} \pm 5\text{ °C}$. 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 is, in case of doubt, maintained at $23\text{ °C} \pm 2\text{ °C}$.*

4.6 *Tools for a.c. only are tested with a.c., at rated frequency, if marked; those for d.c. only are tested with d.c. and those for a.c./d.c. are tested at the more unfavourable supply.*

Tools for a.c. which are not marked with rated frequency or are marked with a frequency range of 50 Hz to 60 Hz are tested with either 50 Hz or 60 Hz, whichever is the national frequency.

Tools marked with a rated frequency range other than 50 Hz to 60 Hz are tested at the most unfavourable frequency within the range.

Tools designed for more than one rated voltage are tested at the most unfavourable voltage.

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

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

Where reference is made to the 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 tools for d.c. only, the possible influence of polarity on the operation of the tools is taken into consideration.

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 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 Tools for which alternative heating elements or accessories are available are tested in accordance with the relevant Part 2, with those elements or accessories which give the most unfavourable results, provided that the elements or accessories used are within the tool manufacturer's specification.

4.8 If, in normal use, the heating element cannot be operated unless the motor is running, the element is tested with the motor running. If the heating element can be operated without the motor running, the element is tested with or without the motor running, whichever is the more unfavourable. Heating elements incorporated in the tool are connected to a separate supply unless otherwise specified, and tested according to EN 60335-1.

4.9 Unless otherwise specified, tools provided with a regulating device or similar control are tested with these controls adjusted to their most unfavourable setting, 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.

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

4.10 When the conditions of normal load are specified in Part 2, the tool is loaded according to these conditions, irrespective of any marking of short-time 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 is loaded according to the manufacturer's instructions; in the absence of such instructions, the tool is operated continuously at a load such that rated input is attained.

For accessories performing a function which is within the scope of a Part 2, the tests are made in accordance with that Part 2.

For other accessories, the tests are made in accordance with the manufacturer's instructions; in the absence of such instructions, the tool is operated continuously at a load such that rated input is attained.

Electronic speed control devices are set for the highest speed.

4.11 When the normal load or the loading conditions are not specified in a Part 2, only the test at rated input applies.

4.12 *If a torque is to be applied, the method of loading is chosen so as to avoid additional stresses, such as those caused by a side thrust. Additional loads necessary for the correct operation of the tool are, however, taken into consideration.*

4.13 *Tools intended to be operated at safety extra-low voltage are tested together with their supply transformer if this is normally sold with the tool.*

4.14 *For the purpose of clauses 8, 15, 23 and 25, parts separated from live parts by double insulation or reinforced insulation are not regarded as 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 these tests.*

4.15 *If class I tools have accessible conductive parts which are not connected to an earthing terminal and are not separated from live parts by an intermediate metal part which is connected to an earthing terminal, such parts are checked for compliance with the appropriate requirements specified for class II tools.*

4.16 *Unless otherwise specified, if class I or class II tools have parts operating at safety extra-low voltage, such parts are checked for compliance with the appropriate requirements specified for class III tools.*

4.17 *For tools incorporating electronic circuits, see Annex C.*

5 Rating

5.1 The maximum rated voltage is

- 250 V for single-phase a.c. or d.c. tools;
- 440 V for three-phase tools.

Compliance is checked by inspection of the marking.

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

6 Classification

Tools are classified

6.1 According to protection against electric shock:

- class I tools;
- class II tools;
- class III tools.

6.2 According to degree of protection against ingress of foreign bodies and moisture in accordance with EN 60529.

7 Marking and information for use

7.1 Tools shall be marked with

- rated voltage(s) or rated voltage range(s) in volts;
- symbol for nature of supply, if applicable;
- rated frequency or rated frequency range, in hertz, unless the tool is designed for d.c. only or for a.c. of both 50 Hz and 60 Hz;
- rated input in W or kW, or rated current in amperes;
- rated current in A, if greater than 10 A;
- manufacturer's or responsible vendor's name, trade mark or identification mark;

- manufacturer's address or country of origin;
- manufacturer's or responsible vendor's model or type reference and serial number, if any;
- rated operating time, or rated operating time and rated resting time, in h, min or s, if applicable;
- symbol for class II construction, for class II tools only;
- symbol for degree of protection against foreign bodies and moisture if greater than IP20;
- any mandatory mark showing compliance with legislation by reference to this standard.

Tools for star-delta connection should be clearly marked with the two voltages(e.g. 230 Δ /400 Y).

The rated input or current to be marked on the tool is the total maximum input or current that can be on circuit at the same time.

If a tool has alternative components which can be selected by a control device, the rated input is that corresponding to the highest loading possible.

Additional markings are allowed, provided that they do not give rise to misunderstanding. If the motor of a tool is marked separately, the marking of the tool and that of the motor should be such that there can be no doubt with regard to the rating and manufacturer of the tool itself.

7.2 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 limited by the construction of the tool or by 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, both markings being separated by an oblique stroke.

7.3 For tools with heating elements incorporated, the complete marking for heating elements required in EN 60335-1 shall, in addition, be given on the marking plate of the tool.

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 is deemed to be met 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; 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 shall not be 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.

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, 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 this range.

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
3 	three-phase alternating current
3N 	three-phase alternating current with neutral
	direct current
n ₀	no-load speed
	class II tools
IPXX	degree of protection
min ⁻¹ or .../min	revolutions or reciprocations per minute


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

The dimensions of the symbol of class II 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 not be less than 5 mm.

The symbol for class II tools 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 Terminals intended exclusively for the neutral conductor shall be marked with the letter N.

Earthing terminals shall be marked with the symbol .

This marking shall not be positioned on screws, removable washers or other parts which might be removed and forgotten when conductors are connected.

7.8 The different positions of regulating devices and different positions of switches on tools shall be indicated by numerals, letters, or other visual means.

If figures are used for indicating the different positions, the "OFF" position shall be indicated by the symbol "0" and the position for a greater output, input, speed, etc. shall be indicated by a higher numeral or appropriate symbol.

Where push-buttons are used the "OFF" position shall be marked with the figure "0" and the actuator shall, in addition, be red.

The "ON" position shall be marked with the figure "1" and the actuator may be any colours except red.

Switches without locking means need not be marked, if their intended operation is obvious.

Manual reset buttons of thermal cut-outs incorporated in motors are exempt from the requirements of this subclause provided these cannot be mistaken for main controls.

7.9 Marking shall be easily legible and durable.

Marking specified in 7.1 to 7.12 shall be on a main part of the tool in such a way that it is clearly discernible when the tool is ready for use.

Self-adhesive labels glued in recesses in the body of the tool or on a surface where they cannot be damaged during normal use are allowed for tools with degree of protection IPX0.

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.

Compliance is checked by inspection and by rubbing the marking by hand for 15 s with a piece of cloth soaked in water and then for a further 15 s with a piece of cloth soaked in petroleum spirit.

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

The petroleum spirit to be used for the test is aliphatic solvent hexane having a maximum aromatics content of 0,1% by volume, a kauri-butanol value of 29, an initial boiling point of approximately 65 °C, a dry point of approximately 69 °C and a specific mass of approximately 0,66 kg/l.

7.10 Regulating devices and the like, intended to be adjusted during operation shall be provided with an indication for the direction of adjustment to increase or to decrease the value of the characteristic being adjusted.

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

The requirement does not apply to a regulating device provided with an adjusting means if its "fully-on" position is opposite to its "OFF" position.

The indication for the different positions of the operating means of a control device need not be placed on the device itself.

7.11 Unless it is obviously unnecessary, switches shall be marked or placed so as to indicate clearly which part of the tool they control.

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

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

The correct mode of connection is deemed to be obvious if the terminals for the supply conductors are indicated by arrows pointing towards the terminals. 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 connection diagram may be that referred to in 7.4.

7.13 A handbook or information sheet to cover the subjects listed below, shall be provided with the tool by the manufacturer or supplier. It shall be written in the official language(s) of the country in which the tool is sold.

The subjects are:

- a) Installation instructions
 - 1 - Unpacking and assembly.
 - 2 - Setting-up or fixing tool in a stable position.
 - 3 - Connection to power supply, cabling, fusing, socket-type and earthing requirements.
 - 4 - Illustrated description of functions.
 - 5 - Limitations on ambient conditions.
 - 6 - List of contents.