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AMENDMENT 2
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Amendment 2

Hand-held motor-operated electric tools – Safety –

Part 1: General requirements

Amendement 2

Outils électroportatifs à moteur – Sécurité –

Partie 1: Règles générales

International Electrotechnical Commission, 3, rue de Varembé, PO Box 131, CH-1211 Geneva 20, Switzerland
Telephone: +41 22 919 02 11 Telefax: +41 22 919 03 00 E-mail: inmail@iec.ch Web: www.iec.ch

Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

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FOREWORD

This amendment has been prepared by subcommittee 61F: Safety of hand-held motor-operated electric tools, of IEC technical committee 61: Safety of household and similar electrical appliances.

The text of this amendment is based on the following documents:

FDIS	Report on voting
61F/534/FDIS	61F/540/RVD

Full information on the voting for the approval of this amendment can be found in the report on voting indicated in the above table.

The committee has decided that the contents of the base publication and its amendments will remain unchanged until 2006. At this date, the publication will be

- reconfirmed;
- withdrawn;
- replaced by a revised edition, or
- amended.

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1 Scope

Replace the 2nd paragraph by the following:

So far as is practicable, this standard deals with the common hazards presented by hand-held tools which are encountered by all persons in the normal use and reasonably foreseeable misuse of the tools.

2 Normative references

Add the following normative references:

IEC 60417-DB[1]:2002, *Graphical symbols for use on equipment*

IEC 60760:1989, *Flat, quick connect terminations*

IEC 60884 (all parts), *Plugs and socket-outlets for household and similar purposes*

IEC 60998-2-1:2002, *Connecting devices for low-voltage circuits for household and similar purposes – Part 2-1: Particular requirements for connecting devices as separate entities with screw-type clamping units*

Delete the following normative references:

IEC 60083:1997, *Plugs and socket-outlets for domestic and similar general use standardized in member countries of IEC*

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[1] 'DB' refers to the on-line IEC database.

3 Definitions

3.1.2

Amend the existing text to read as follows:

Where in this standard the expressions “with the aid of a tool”, “without the aid of a tool”, and “requires the use of a tool”, are used, the word “tool” means a hand tool, for example a screwdriver, which may be used to operate a screw or other fixing means.

Replace the existing text of the following definitions with the new text as follows:

3.2.3
working voltage
maximum voltage, without the effect of transient voltages, to which the part under consideration is subjected when the tool is supplied at its rated voltage and operating under normal load

3.2.9
normal load
load to be applied to a tool at rated voltage or at the upper limit of the rated voltage range, to obtain rated input or rated current, any marking of short-time or intermittent operation being observed and, unless otherwise specified, heating elements, if any, being operated as in normal use

3.3.3
type X attachment
method of attachment of the supply cord so that it can easily be replaced

3.3.4
type Y attachment
method of attachment of the supply cord such that any replacement is intended to be made by the manufacturer, its service agent or similar qualified person

3.4.1
basic insulation
insulation, not necessarily including insulation used for functional purposes, applied to live parts to provide basic protection against electric shock

3.4.4
reinforced insulation
insulation of hazardous live parts which provides a degree of protection against electric shock equivalent to double insulation

NOTE Examples of reinforced insulation are a single layer or several layers which cannot be tested singly as basic insulation or supplementary insulation.

3.4.5
class I tool
tool in which protection against electric shock does not rely on basic, double or reinforced insulation only, but which includes an additional safety precaution in that conductive accessible parts are connected to the protective earthing conductor in the fixed wiring of the installation in such a way that conductive accessible parts cannot become live in the event of a failure of the basic insulation. Also considered as class I tools are tools with double insulation and/or reinforced insulation throughout having an earthing terminal or earthing contact

3.4.6
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

3.4.8
class III tool
tool in which protection against electric shock relies on supply at safety extra-low voltage, and in which voltages higher than those of safety extra-low voltages are not generated

3.4.10
creepage distance
shortest path between two conductive parts, or between a conductive part and the outer surface of the enclosure, considered as though metal foil were pressed into contact with accessible surfaces of insulating material, measured along the surface of the insulating material

NOTE Examples of creepage distances are given in Annex A.

3.4.11
clearance
shortest distance between two conductive parts, or between a conductive part and the outer surface of the enclosure, considered as though metal foil were pressed into contact with accessible surfaces of insulating material, measured through air

NOTE Examples of clearance distances are given in Annex A.

3.5.2
safety extra-low voltage
rated voltage not exceeding 42 V between conductors and between conductors and earth, the no-load voltage not exceeding 50 V. When safety extra-low voltage is obtained from the supply mains, it is to be through a safety isolating transformer or a convertor with separate windings, the insulation of which complies with double or reinforced insulation requirements

3.6.1
hand-held tool (in this standard abbreviated to "tool")
electric motor-operated or magnetically-driven machine intended to do mechanical work, with or without provisions for mounting on a support, and so designed that the motor and the machine form an assembly which can easily be brought to the place of operation, and which is either held or supported by hand or suspended during operation

NOTE Hand-held tools may be provided with a flexible shaft, the motor being either fixed or portable.

3.8.2
temperature limiter
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 the controlled part reaches a predetermined value. It does not make the reverse operation during the normal duty cycle of the tool

3.8.4
self-resetting thermal cut-out
thermal cut-out which automatically restores the current after the relevant part of the tool has cooled down to a given value

3.9.2
"off" position of a switching device
stable position in which the related circuit is disconnected from the supply mains

NOTE The "off" position does not imply an all-pole disconnection.

3.9.4
live part
any conductor or conductive part intended to be energized in normal use, including a neutral conductor but, by convention, not a PEN conductor.

3.10.1
electronic component
part in which conduction is achieved principally by electrons moving through a vacuum, gas or semiconductor, with the exclusion of neon indicators

3.10.3
protective impedance
impedance connected between live parts and accessible conductive parts, and of value so that the current is limited to a safe value

3.11.3
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 ambient temperature

3.12.2
attachment
device attached to the housing or other component of the tool and which may or may not be attached to the output mechanism and does not modify the normal use of the tool within the scope of this standard

Delete definitions 3.9.2 and 3.11.2 and renumber the subsequent definitions accordingly.

Add the following new definition:

3.2.11
normal use
use of a tool for which it is designed, taking into account the manufacturer's instructions

4 General requirements

Amend the first paragraph to read as follows:

Tools shall be so constructed that in normal use they function safely so as to cause no danger to persons or surroundings, even in the event of reasonably foreseeable misuse.

5 General conditions for the tests

5.5 *Amend the first paragraph to read as follows:*

Tools provided with controls or switching devices are tested with these controls or devices adjusted to their most unfavourable settings, if the setting can be altered by the user. Electronic speed control devices are set for the highest speed.

5.7.1 *Amend the second paragraph to read as follows:*

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

5.7.3 *Amend the last paragraph to read as follows:*

When a factor is not specified, the input corresponds to the input at the most unfavourable rated voltage within the range.

5.8 *Amend the existing text to read as follows:*

When alternative attachments are made available for the tool by its manufacturer, the tool is tested with those attachments which give the most unfavourable results.

5.14 *Amend the existing text to read as follows:*

For attachments performing a function which is within the scope of one of the relevant parts 2, the tests are made in accordance with that part 2.

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

7 Classification

7.2 *Amend the first paragraph to read as follows:*

Tools shall have the appropriate degree of protection against harmful ingress of water according to IEC 60529. If a degree other than IPX0 is required this shall be specified in the relevant part 2.

8 Marking and instructions

8.1 *Amend the fourth and fifth dashed items to read as follows:*

– name or trade mark or identification mark or company name of the manufacturer or any other person responsible for placing the tool on the market;
– designation of series or type;

8.6 *Amend the first sentence to read as follows:*

If units or technical data are expressed by symbols, the following symbols shall be used:

*Delete the fifth paragraph, beginning "*The symbol for class II tools…*".*

Amend the sixth and seventh paragraphs to read as follows:

When other units are used, the units and their symbols shall be those of the international standardized system. Multiple or submultiple units are also allowed.

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

8.7

Delete the note.

8.10 *Amend the first paragraph to read as follows:*

For tools which might cause danger when started unexpectedly, the “off” position of the mains switch shall be indicated, unless this position is obvious; the indication, if required, shall be the figure O, as given by symbol IEC 60417-5008 (DB:2002-10).

8.11 *Amend the first three paragraphs to read as follows:*

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 regulating devices provided with an 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 O and the other positions shall be indicated by figures reflecting the greater output, input, speed, etc.

*Delete the fourth paragraph, beginning: “*An indication of + and – …*”.*

8.12 *Amend the first paragraph to read as follows:*

An instruction manual and general safety instructions shall be provided with the tool and packaged in such a way that is noticed by the user when the tool is removed from the packaging. The general safety instructions may be separate from the instruction manual. They shall be written in the official language(s) of the country in which the tool is sold.

Amend the third paragraph to read as follows:

The instruction manual shall include the name and address of the manufacturer or supplier of branded product and an explanation of the symbols used on the product.

8.12.1

Amend the first paragraph to read as follows:

General Safety Instructions. The Safety Rules specified in this clause, if in English, shall be verbatim and in the exact order as given and in any other official language to be equivalent.

Amend the warning instruction 4) c) to read as follows:

c) **Disconnect the plug from the power source and/or the battery pack from the power tool before making any adjustments, changing accessories, or storing power tools.** *Such preventive safety measures reduce the risk of starting the power tool accidentally.*

Amend the warning instruction 4) g) to read as follows:

g) **Use the power tool, accessories and tool bits etc. in accordance with these instructions and in the manner intended for the particular type of power tool, taking into account the working conditions and the work to be performed.** *Use of the power tool for operations different from those intended could result in a hazardous situation.*

8.14 *Amend the first paragraph to read as follows:*

Markings specified in 8.1 to 8.5 shall be on a main part of the tool. Markings specified in 8.1, 8.2, 8.3 and 8.5 shall be placed together.

12 Heating

12.2 *Amend the existing text to read as follows:*

The tool is operated in still air under normal load. While the torque is maintained, the voltage is then adjusted to 0,94 times the rated voltage or 1,06 times the rated voltage, or the mean of the rated voltage range, whichever is the most unfavourable.

Heating elements, if any, are operated under the conditions specified in Clause 11 of IEC 60335-1, when the tool is operated at a voltage equal to 1,06 times rated voltage.

12.4 *Amend the first dashed item to read as follows:*

– *for the rated operating time for tools for short time operation;*

12.5 *Add the following to footnote 1 of Table 1:*

Parts	Temperature rise K

The value of the temperature rise of a winding is calculated from the formula:

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

where

Δt is the temperature rise;

R_1 is the resistance at the beginning of the test;

R_2 is the resistance at the end of the test;

k is equal to 234,5 for copper windings, and 225 for aluminium windings;

t_1 is the ambient temperature at the beginning of the test;

t_2 is the ambient temperature at the end of the test.

At the beginning of the test, the windings are to be at ambient 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.

Delete Notes 1 and 2.

12.6 *Amend, in item b) and in the last paragraph, the term "item 1" to read "item a".*

13 Leakage current

13.2 *Amend the second paragraph to read as follows:*

Three-phase tools, which are suitable for single-phase supply, are tested as single-phase tools with the three sections connected in parallel. For single-phase tools and three-phase tools to be tested as single-phase tools, the leakage current is measured with the selector switch shown in Figure 3, in each of the positions 1 and 2, and the switch S1 in "on" position.

Amend the third paragraph to read as follows:

For three-phase tools not suitable for single-phase supply, the leakage current is measured according to Figure 4, with the switches a, b and c in the "on" position. For tools intended to be connected in star connection only, the neutral is not connected.

14 Moisture resistance

14.3 *Amend the fifth and sixth paragraphs to read:*

The humidity treatment is carried out in a humidity cabinet containing air with a relative humidity of (93 ± 2) %, obtained e.g. by placing in the humidity cabinet a saturated solution of Na_2SO_4 or KNO_3 in water, having a sufficiently large contact surface with the air. The temperature of the air, at all places where samples can be located, is maintained within 1 K of any convenient value t between 20 °C and 30 °C. 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.

Before being placed in the humidity cabinet, the sample is brought to a temperature between t and (t + 4) °C. The tool is considered to be brought to the specified temperature by keeping it at this temperature for at least 4 h before the humidity treatment.

15 Electric strength

15.2 *Amend the fifth and sixth paragraphs after Table 2 to read as follows:*

Care is taken that the r.m.s. value of the test voltage applied is measured within ±3 %.

Care is taken that the metal foil is so placed that no flashover occurs at its edges or the edges of the insulation.

16 Overload protection of transformers and associated circuits

16.1 *Add the following note:*

NOTE Protection of transformer windings may be, for example, obtained by the inherent impedance of the winding, or by means of fuses, automatic switches, thermal cut-outs or similar devices incorporated in the transformer, or similar devices located inside the tool only accessible with the aid of a tool.

17 Endurance

17.2 *Amend the note to read as follows:*

NOTE The change of position is made to prevent abnormal accumulation of carbon dust in any particular place. Examples of the three positions are horizontal, vertically up and vertically down.

18 Abnormal operation

18.1 *Amend the first paragraph to read as follows:*

Tools shall be so designed that the risk of fire and mechanical damage impairing safety or the protection against electric shock as a result of abnormal operation is obviated as far as is practicable.

Amend the compliance paragraph to read as follows:

Compliance is checked by the tests of 18.2 to 18.9.

18.2 *Add, to the first paragraph, the following additional sentences:*

Only one abnormal condition is simulated each time. If more than one of the tests are applicable to the same tool, these tests are made consecutively.

Delete the fourth paragraph.

18.6

Delete the note.

18.7 *Amend the last paragraph to read as follows:*

After the tests of 18.2 to 18.7, the safety of the tool shall not have been impaired, in particular windings and connections shall not have worked loose. After these tests, the tool need not be capable of further use.

18.8 *Amend the first paragraph to read as follows:*

The following categories of tools incorporating induction motors and:

a) with a starting torque less than the full-load torque; or

b) started by hand; or

c) provided with moving parts which are liable to be jammed, or where the moving parts can be stopped by hand, the motor remaining switched on during this operation;

are connected, starting from cold, to their rated voltage or the upper limit of their rated voltage range with the moving parts locked

- *for 30 s for tools that are operated by hand during use;*
- *for 5 min for tools that are attended during use.*

19 Mechanical hazards

19.1

Renumber the first note as Note 1.

Amend the second note to read as follows:

NOTE 2 In some cases, specified in the relevant part 2, a rigid test finger with the same dimensions of the test finger in Figure 1, but without any articulation, is used.

Delete the third note.

19.3 *Amend the first paragraph to read:*

It shall not be possible to reach the moving parts with the provisions for dust collection removed, if any.

20 Mechanical strength

20.2

Amend, in the first paragraph, the word "total" to read "tool".

21 Construction

21.9

Change the font of the two dashed items from italics to roman.

21.10 *Add the following additional paragraph:*

Compliance is checked by inspection.

21.18.1

*Amend, in the first paragraph, the phrase "*to lock it on the ON position*" to read "*to lock it in the ON position*".*

21.21 *Amend the first paragraph to read as follows:*

Tools 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. Capacitors, having a rated capacitance less than or equal to 0,1 µF, are not considered to entail a risk of electric shock.

Delete the last paragraph.

21.25 *Amend the existing text to read as follows:*

Current-carrying parts and other parts, the corrosion of which might result in a hazard, shall be resistant to corrosion under normal conditions of use. Stainless steel and similar corrosion-resistant alloys and plated steel are considered to be satisfactory for the purpose of this requirement.

Compliance is checked by verifying that, after the tests of Clause 18, the relevant parts show no sign of corrosion.

NOTE Examples of causes of corrosion are the incompatibility of materials and effects of heating.

21.26 *Amend the existing text to read as follows:*

Direct contact between live parts and thermal insulation shall be effectively prevented, unless such material is non-corrosive, non-hygroscopic, and non-combustible, such as glass-wool.

Compliance is checked by inspection, by the tests of Clauses 16 and 17 and, if necessary, by chemical tests or flammability tests.

NOTE Non-impregnated slag-wool is an example of corrosive thermal insulation.

21.37 *Amend the existing text of the subclause to read as follows:*

Air intake shall not enable the ingress of foreign bodies that could impair the safety.

Compliance is checked by the following test.

It shall not be possible to insert a steel ball of 6 mm diameter through the air intake openings other than those adjacent to the fan.

22 Internal wiring

22.3 *Amend the existing text of the subclause to read as follows:*

Internal wiring shall be either so rigid and so fixed or so insulated that, in normal use, creepage distances and clearances cannot be reduced below the values specified in 28.1. The insulation, if any, shall be such that it cannot be damaged in normal use.

Compliance is checked by inspection, by measurement, and by manual test.

For insulated internal wiring, it is checked that either their insulation is electrically equivalent to the insulation of the cords complying with IEC 60227 or IEC 60245, or it complies with the following electric strength test.

A voltage of 2 000 V is applied for 15 min between the conductor and metal foil wrapped around the insulation. There shall be no breakdown.

When sleeving is used as supplementary insulation on internal wiring, it shall be retained in position by positive means. A sleeve is considered to be fixed by positive means if it can only be removed by breaking or cutting, or if it is clamped at both ends.

Compliance is checked by inspection and by manual test.

22.5 *Amend the existing text of the subclause to read as follows:*

Aluminium wires shall not be used for internal wiring. Windings of a motor are not considered as internal wiring.

Compliance is checked by inspection.

23 Components

Change the font of 23.1.1 to 23.1.5 from italics to roman.

23.1.11 *Amend the third and the fourth paragraphs to read as follows:*

Switches intended for operation under no-load, and which can be operated only with the aid of a tool, are subjected to the tests of Clause 17 of IEC 61058-1. This applies also to such switches operated by hand which are interlocked so that they cannot be operated under load, but switches without that interlock are subjected to the test of 17.2.4.4 for 100 cycles of operation.

The tests of 17.2.4.4 of IEC 61058-1 are not carried out on a switch if the tool meets the requirements of this standard when the switch is short-circuited.

23.4

*Amend, in the first paragraph, the reference to IEC 60083 to read "*IEC 60884*".*

24 Supply connection and external flexible cords

24.2

Add, after the dashed items, the following new paragraph:

Supply cords with type X and type Y attachment may be either ordinary flexible cords or special cords and only available from the manufacturer or his service agent. A special cord may also include a part of the tool.

24.4 *Amend, in the fourth paragraph, the reference to IEC 60083 to read "IEC 60884".*

Replace the seventh paragraph and the note with the following:

Power supply cords of single-phase tools, having a rated current exceeding 16 A but not exceeding 63 A, and of multi-phase tools having a rated current not exceeding 63 A, shall be provided with a plug complying with IEC 60309, the standard sheets to be applied being as follows:

– class I tools Sheet 2 – III according to current
– class II tools Sheet 2
– class III tools Sheet 2 – III

Two-pole plugs, appliance inlets and connectors for cable couplers and plugs to standard sheet 2 are allowed in class II tools.

24.12 *Amend the fifth paragraph to read as follows:*

The oscillating member is moved backwards and forwards through an angle of 90° (45° on either side of the vertical), the number of flexings being 20 000 and the rate of flexing 60 per min. A flexing is one movement, either backwards or forwards. After 10 000 flexings, the sample is turned through 90° about the centre line of the cord guard.

Delete the note.

24.13 *Amend the sixth paragraph to read as follows:*

A mass equal to 10 D^2 g is then attached to the free end of the cable or cord. D is the external diameter of the flexible cable supplied with the tool in mm.

24.20 *Amend the third dashed item to read as follows:*

– *shall be so designed that the uninsulated end of the conductor, should it become free from a terminal, cannot come into contact with accessible metal parts, unless the cord is provided with terminations that are unlikely to slip free of the conductor.*

Amend the second paragraph to read as follows:

Compliance is checked by inspection and, for type X attachment, by an installation test with cables or flexible cords of the largest cross-sectional area specified in 25.2 and by the following additional test.

Delete the last paragraph.

25 Terminals for external conductors

25.1 *Amend the first paragraph to read as follows:*

Tools with type X attachments, except those with specially prepared cord, shall be provided with terminals in which connection is made by means of screws, nuts, or equally effective devices. Screw-type terminals in accordance with IEC 60998-2-1, screwless terminals in accordance with IEC 60998-2-2 and clamping units in accordance with IEC 60999-1 are considered to be equally effective devices.

Delete the note.

26 Provision for earthing

26.2 *Replace the existing text of the subclause by the following:*

The clamping means of earthing terminals shall be adequately locked against accidental loosening, and it shall not be possible to loosen them without the aid of a tool. Screw clamping terminals complying with Clause 25 or screwless terminals in accordance with IEC 60998-2-2 are considered to comply with the requirements of this clause.

For specifically prepared cords, terminals complying with IEC 60760 are considered to comply with the requirements of this clause.

Compliance is checked by inspection, by manual test and, for screwless terminals, by the tests specified in IEC 60998-2-2.

27 Screws and connections

27.1 *Amend the note to read as follows:*

NOTE Earthing connections are an example of electrical connections.

27.4 *Amend the existing text of the subclause to read as follows:*

Screws, which make a mechanical connection between different parts of the tool, shall be secured against loosening, if they also make electrical connections.

This requirement does not apply to screws in the earthing circuit if at least two screws are used for the connection, or if an alternative earthing circuit is provided.

Spring washers and the like may provide satisfactory security. Sealing compound which softens on heating provides satisfactory security only for screw connections not subject to torsion in normal use.

Rivets used for electrical connections shall be secured against loosening if these connections are subject to torsion in normal use. A non-circular shank or an appropriate notch may be sufficient to comply with this requirement.

This requirement does not imply that more than one rivet is necessary for providing earthing continuity.

Compliance is checked by inspection and by manual test.