TEST REPORT
EN 62841-1
Electric motor-operated hand-held tools, transportable tools and lawn and garden machinery - Safety - Part 1: General requirements

Report Number.....:	AOC251016013S
Tested by (name + signature).....:	Wanyang Ye
Approved by (name + signature)..:	Robin Liu
Date of issue .....:	October 16, 2025
Total number of pages .....:	115 pages

Testing Laboratory .....:	Shenzhen AOCE Electronic Technology Service Co., Ltd
Address.....:	Room 202, 2nd Floor, No.12th Building of Xinhe Tongfuyu Industrial Park, Fuhai Street, Baoan District, Shenzhen, Guangdong, China

Applicant's name.....:	ZHUJI LUSHUN IMP.&EXP.CO.,LTD.
Address.....:	HUANGJIABU VILLAGE, DIANKOU TOAN, ZHUJI CITY, ZHEJIANG PROVINCE, CHINA

Test specification:	
Standard .....:	EN 62841-1:2015+A11:2022; EN ISO 12100: 2010; EN 62841-3-12:2019
Test procedure.....:	CE -MD
Non-standard test method……..:	N/A

Test Report Form No......:	EN 62841-1
Test Report Form(s) Originator .....:	N/A
Master TRF.....:	2015-08-21

General disclaimer:

The test results presented in this report relate only to the object tested.

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Test item description.....:	PIPE THREADING MACHINE
Trade Mark .....:	N/A
Manufacturer .....:	ZHEJIANG LUSHUN INDUSTRIAL CO.,LTD.
Address.....:	HUANGJIABU VILLAGE, DIANKOU TOAN, ZHUJI CITY, ZHEJIANG PROVINCE, CHINA
Model/Type reference.....:	ZIT-R2, ZIT-R3, ZIT-R4, ZIT-50A, ZIT-R65
Ratings.....:	AC 220-230V, 50Hz, Max. 1100W

List of Attachments (including a total number of pages in each attachment):
Attachment 1 report: Photos (2 pages)

Summary of testing:

Full tests were carried out and found that complied with the standard.

Testing location:

Shenzhen AOCE Electronic Technology Service Co., Ltd

Room 202, 2nd Floor, No.12th Building of Xinhe Tongfuyu Industrial Park, Fuhai Street, Baoan District, Shenzhen, Guangdong, China

Copy of marking plate:

The artwork below may be only a draft. The use of certification marks on a product must be authorized by the respective NCBs that own these marks.

PIPE THREADING MACHINE
ZIT-R2
AC 220-230V, 50/60Hz, Max. 1100W

Manufacturer: ZHEJIANG LUSHUN INDUSTRIAL CO.,LTD.
Address: HUANGJIABU VILLAGE, DIANKOU TOAN, ZHUJI CITY, ZHEJIANG PROVINCE, CHINA

Made in China

Test item particulars ..... :	
Category of equipment..... :	☒Hand held, ☐Transportable, ☐Lawn / Garden
Protection Class of tool ..... :	☐Class I, ☐Class II, ☒Class III
Method of supply cord attachment..... :	☐Type X, ☐Type Y, ☐Type Z, ☐appliance inlet
Duty conditions ..... :	☒Normal, ☐severe, ☐extra-severe
Type of operation ..... :	☒Normal, ☐short-time, ☐intermittent
Degree of protection..... :	IPX0
Mass of equipment (kg) ..... :	/
Accessories and detachable parts included ..... :	/
Other options included ..... :	/
Classification of installation and use ..... :	Hand-held appliance
Supply Connection ..... :	Non-detachable cord with a plug; Type Y attachment

Possible test case verdicts:	
- test case does not apply to the test object ..... :	N(/A)
- test object does meet the requirement..... :	Pass (P)
- test object does not meet the requirement..... :	Fail (F)

Testing..... :	
Date of receipt of test item ..... :	October 9, 2025
Date (s) of performance of tests ..... :	October 9, 2025 to October 16, 2025

General remarks:

"(See Enclosure #)" refers to additional information appended to the report.
"(See appended table)" refers to a table appended to the report.

Throughout this report a comma / point is used as the decimal separator.

This Test Report Form is intended for the investigation of screwdrivers and impact wrenches in accordance with IEC62841-2-2. It can only be used together with the IEC 62841-1 Test Report.

When differences exist, they shall be identified in the General product information section.

Name and address of factory (ies) ..... :	**Same as manufacturer**

General product information and other remarks:

All series models are identical, except for model name difference for trading purpose.

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Clause	**Requirement — Test**	**Result - Remark**	**Verdict**
4	General requirements		P
	Tools that have clearly separate modes of operation shall comply separately with the requirements		P
5	General conditions for the tests		P
5.1	Tests according to this standard are type tests. General test conditions in Clause 5 apply unless otherwise specified in this standard.		P
5.2	The tests are made on separate samples. However, at the manufacturer' s discretion, fewer samples may be used.		N
	The cumulative stress resulting from successive tests on electronic circuits is to be avoided. It may be necessary to replace components or to use additional samples.		N
	If several tests are conducted on a single sample, then the results shall not be affected by previous tests.		P
5.3	If it is evident from the construction of the tool that a particular test is not applicable, the test is not made.		P
5.4	The tests are carried out with the tool, and/ or any movable part of it, placed in the most unfavourable position that may occur in normal use.		P
5.5	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.		P
	If the adjusting means of the control is accessible without the aid of a tool, 5.5 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, and if the setting is not intended to be altered by the user, 5.5 does not apply.		P
	Adequate sealing is regarded as preventing alteration of the setting by the user.		P
5.6	The tests are made in a draught- free location and at an ambient temperature.	(20±5) °C	P
5.7	The test conditions related to frequency and voltage are specified in 5.7.1 to 5.7.3.		N
	Tools for a.c. only are tested with a.c. at rated		

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Clause	**Requirement — Test**	**Result - Remark**	**Verdict**
5.7.1	frequency, if marked, and those for a.c./d.c. are tested with the most unfavourable supply.		N
	Tools for a.c. which are not marked with rated frequency, or marked with a rated frequency range of 50 Hz to 60 Hz or with 50/60 Hz, are tested with either 50 Hz or 60 Hz, whichever is the most unfavourable, unless the tool employs only series motors, in which case either frequency may be used.		N
5.7.2	Tools having more than one rated voltage or having a rated voltage range are tested at the highest voltage.		N
5.7.3	For tests that require a value for rated current and with tools where there is no marked rated current, the value of the rated current is substituted by the current measured when the tool is operated at rated input at the lowest rated voltage or the lower value of the rated voltage range.		N
5.8	When alternative heating elements or attachments are made available for the tool by its manufacturer, the tool is tested with those heating elements or attachments which give the most unfavourable results.		N
5.9	Tools are tested with the specified flexible cord connected to the tool. supply		N
5.10	If class I tools have accessible parts which are not connected to an earthing terminal or earthing contact, and are not separated from live parts by an intermediate metal part which is connected to an earthing terminal or earthing contact, such parts are checked for compliance with the appropriate requirements specified for class II construction.		N
5.11	If class I tools 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.		N
5.12	When testing electronic circuits, the supply is to be free from those perturbations from external sources that can influence the results of the tests.		P
5.13	If, in normal use, a heating element, if any, 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		P
	separate supply unless otherwise specified.		
	For attachments performing a function which is within the scope of one of the relevant parts of IEC 62841-2,		

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Clause	**Requirement — Test**	**Result - Remark**	**Verdict**
5.14	IEC 62841-3 or IEC 62841-4, the tests are made in accordance with that part of IEC 62841-2, IEC 62841-3 or IEC 62841-4.		N
5.15	If a torque is to be applied, the method of loading is chosen so as to avoid additional stresses, such as those caused by side thrust. Additional loads necessary for the correct operation of the tool are, however, taken into consideration.		P
	If a brake is used for applying a load, it must be applied gradually to assure that the starting current does not affect the test. Modification of output means for purpose of loading is permitted for the connection to a brake.		N
5.16	Tools intended to be operated at safety extra-low voltage are tested using a supply transformer intended to be used with the tool.		P
5.17	If a requirement is based upon the mass of the tool, the mass shall be determined without supply cord, if any, and without tool bits or accessories, but with all equipment and attachments needed for normal use. Details of the required accessories, equipment and attachments are given in the relevant part of IEC 62841-2, IEC 62841-3 or IEC 62841-4.		P
	If the tool is supplied with more than one accessory, equipment or attachment, the heaviest configuration shall be used to determine the mass.		P
5.18	If linear and angular dimensions are specified without a tolerance, ISO 2768- 1, class “c” is applicable.		P
5.19	All electrical measurements shall be made with a maximum measurement error of 5 %.		P
	Instruments for measuring voltage shall have an input resistance of at least 1 MΩ with a maximum parallel capacitance		P
5.20	Thermal equilibrium is considered achieved when the total deviation of three successive temperature rise readings, taken at 3 min intervals, does not exceed 4 K. For induction motors, a measurement time of 1 h is considered sufficient.		P
	For motors, thermal equilibrium may be evaluated by measuring the temperature of the stator laminations.		P
6	Radiation, toxicity and similar hazards		P
6.1	Tools shall not emit harmful radiation, or present a toxic or similar hazard.		P
6.2	If the tool is fitted with a laser to indicate a cutting line or the like, the laser class shall be 2M or lower, according to IEC 60825- 1:2007.		N

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Clause	**Requirement — Test**	**Result - Remark**	**Verdict**
6.3	If a tool is fitted with non-coherent light sources, users of tools shall be cautioned as to the risk of potential photo- biological harm, if such harm exists.		N
6.3.1	Visible light indicators (pilot lamps) and Infrared sources used for signalling and communication are considered to have no risk of photo-biological harm and require no marking.		N
6.3.2	Tools emitting visible light from electroluminescent, incandescent or LED sources are considered to be for short term, non- general light services use where exposure is both incidental and intermittent.		N
	Tools emitting light from these sources shall be marked with one of the following: – "CAUTION Do not stare at operating lamp", or – symbol IEC 60417-6041 (2010-08).		N
	The marking may be omitted, if it can be demonstrated that the emitted light presents no reasonable risk of harm .	no risk	N
	The emitted light is considered to present no reasonable risk or harm, if either – the light emission at a distance of 200 mm along any direction of the tool is below 500 Lux; or – the luminance light emission is less than 10 000 cd/ m^2 in the range of visible light; or – the light source (if not focused by external optics) is in Risk Group 1 or lower evaluated by the methods of IEC 62471; or – the tool itself is evaluated by the methods of IEC 62471 and found to be in Risk Group 1 or lower.		N
6.3.3	For light derived by sources other than those mentioned in 6.3.2, the product shall be evaluated by the methods of IEC 62471 and the markings shall be guided by 5.4 of IEC/TR 62471-2:2009.		N
7	Classification		P
7.1	Tools shall be of one of the following classes with respect to protection against electric shock: class I, class II, class III.		P
7.2	Tools shall have the appropriate degree of protection against harmful ingress of water according to IEC 60529:2013. If a degree other than IPX0 is required this shall be specified in the relevant part of IEC 62841-2, IEC 62841-3 or IEC 62841-4.		P

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Clause	**Requirement — Test**	**Result - Remark**	**Verdict**
8	Marking and instructions		P
8.1	Tools shall be marked with rating information as follows:		-
	– rated voltage(s) or rated voltage range, in volts. Tools for star- delta connection shall be clearly marked with the two rated voltages (for example 230 Δ/ 400 Y). A tool that complies with this standard for a voltage range, may also be marked with any single voltage or smaller voltage range within that range;		P
	– symbol for nature of supply, unless the rated frequency(ies) or rated frequency range is marked. The symbol for nature of supply shall be placed next to the marking for rated voltage;		N
	– rated input, in watts or rated current, in amperes. The rated input or rated current to be marked on the tool is the total maximum input or current that can be drawn from external circuit at the same time. If a tool has alternative components which can be selected by a control device, the rated input or rated current is that corresponding to the highest loading possible;		P
	– symbol for class II construction, for class II tools only;		N
	– IP number according to degree of protection against ingress of water other than IPX0. If the first numeral for the IP numbering is omitted, the omitted numeral shall be replaced by the letter X, for example IPX5.		P
8.1.1	Tools having a range of rated values such as for voltage and frequency and which can be operated without adjustment throughout the range shall be marked with the lower and upper limits of the range separated by a hyphen.		P
8.1.2	For tools marked with more than one rated voltage, a rated voltage range or with more than one rated voltage range, the rated input for each of these voltages shall be marked.		P
	The upper and lower limits of the rated power input shall be marked on the tool so that the relation between input and voltage appears distinctly, unless the difference between the upper and lower limits of a rated voltage range does not exceed 20 % of the mean value of the range, in which case the marking for rated input may be related to the mean value of the range.		P
8.2	Tools shall be marked with a safety warning in one of the following versions:		P
	– " WARNING – To reduce the risk of injury, user		

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Clause	**Requirement — Test**	**Result - Remark**	**Verdict**
	must read instruction manual", or – symbol M002 of ISO 7010, or – the appropriate symbol stated in the relevant part of IEC 62841-2, IEC 62841-3 or IEC 62841-4.		P
	If used, the word "WARNING" shall be in capital letters not less than 2,4 mm high and shall not be separated from either the cautionary statement or the symbol ISO 7000-0434A or ISO 7000-0434B (2004-01).		P
	If used, the statement shall be verbatim except the term "operator's manual" or "user guide" may be used for the term "instruction manual" .		P
	If additional symbols are used, they shall be in accordance with ISO 7010 or be designed in accordance with ISO 3864-2 or ISO 3864-3.		P
	Cautionary statements having the same signal word such as " WARNING" may be combined into one paragraph under one signal word. The order of statements shall be markings required by IEC 62841- 1, markings required by the relevant part of IEC 62841-2, IEC 62841-3 or IEC 62841-4 and then any optional markings.		P
8.3	Tools shall be marked with additional information as follows:		P
	–the business name and address of the manufacturer and, where applicable, his authorized representative. Any address shall be sufficient to ensure contact. Country or state, city and postal code (if any) are deemed sufficient for this purpose;		P
	–designation of the tool, designation of the tool may be achieved by a code that is any combination of letters, numbers or symbols, providing that this code is explained by giving the explicit designation such as "drill", "planer" etc. in the instructions supplied with the tool;		P
8.4	Markings specified in 8.1 to 8.3 shall not be on a detachable part of the tool.		P
	Markings specified in 8.2 and 8.3 shall be clearly discernible from the outside of the tool.		P
	Indications for switches and controls shall be placed on or in the vicinity of these components; they shall not be placed on parts which can be repositioned, or positioned in such a way that the marking is misleading.		P
8.5	If the tool can be adjusted to suit different rated voltages, the voltage to which the tool is adjusted shall be clearly discernible.		P

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Clause	**Requirement — Test**	**Result - Remark**	**Verdict**
	This requirement does not apply to tools for star-delta connection.		P
	For tools where frequent changes in voltage setting are not required, this requirement is considered to be met if the rated voltage 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. It shall not be on a label loosely attached to the tool.		P
8.6	For units the following shall be used:		P
	V ..... volts		P
	A ..... amperes		P
	Ah ..... ampere-hours		P
	Hz ..... hertz		P
	W ..... watts		P
	kW ..... kilowatts		N
	F ..... farads		N
	µF ..... microfarads		P
	l ..... litres		N
	g ..... grams		N
	kg ..... kilograms		P
	bar ..... bars		N
	Pa ..... pascals		N
	h ..... hours		P
	min .... minutes		P
	s..... seconds		P
	n0 ..... no-load speed		P
	.../min or …min– 1 ..... revolutions or reciprocations per minute (rpm)		P
	If additional symbols are used, they shall not give rise to misunderstanding and be explained in the instructions.		P
	When other units are used, the units and their symbols shall be those of the international standardized system .		P
8.7	Tools to be connected to more than two supply conductors shall be provided with a connection diagram, fixed to the tool, unless the terminals are clearly identified.		N
	The earthing conductor is not considered to be a supply conductor. For tools for star-delta		

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Clause	**Requirement — Test**	**Result - Remark**	**Verdict**
	connection, the wiring diagram shall show how the windings are to be connected.		N
8.8	Except for type Z attachment, terminals shall be indicated as follows:		N
	– Terminals intended exclusively for the neutral conductor shall be indicated by the letter N.		N
	– Earthing terminals shall be indicated by the symbol IEC 60417-5019		N
	These indications shall not be placed on screws, removable washers or other parts which might be removed when conductors are being connected.		N
8.9	Switches which may give rise to a hazard when operated shall be marked or so placed as to indicate clearly which part of the tool they control.		P
8.10	The “off” position of a multi-stable power switch shall be indicated; the indication shall be the figure O, as given by symbol IEC 60417-5008 (2002-10). A momentary power switch which can be locked in the “on” position is not considered as a multi-stable switch.		P
	Push-buttons used only for the "off" function shall be indicated by marking the button/position with the figure O and the colour of the button shall be red or black .		P
	The figure O shall not be used for any other indication.		P
	For transportable tools, a power switch actuator or its cover shall not have a colour in a combination of yellow and red as specified for an emergency stop in accordance with ISO 13850.		N
	When a flap/cover is provided and covers only the start button, the colour of the flap/cover shall not be black, red or yellow.		N
	When a flap/cover is provided and covers the stop button, such flap/cover shall be red or black .		N
8.11	Control devices 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 for this requirement.		P
	The requirement does not apply to control devices provided with an adjusting means, if its fully “on” position is opposite to its “off” position.		P
	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.		P
	The indication for the different positions of the operating means of a control device shall be placed on the device itself, or adjacent to the operating means.		P

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Clause	**Requirement — Test**	**Result - Remark**	**Verdict**
8.12	Markings required by the standard shall be legible and durable. Signs shall be in contrast such as colour, texture, or relief, to their background such that the information or instructions provided by the signs are clearly legible when viewed with normal vision from a distance of (500 + 50) mm . Signs need not be in accordance with the blue colour requirements of ISO 3864-2.	legible and durable	P
	Compliance is 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.		P
	After the tests of 8.12, the marking shall be easily legible, it shall not be easily possible to remove markings.		P
	In considering the durability of the marking, the effect of normal use is taken into account. Thus, for example, marking by means of paint or enamel other than vitreous enamel on containers that are likely to be cleaned frequently is not considered to be durable.		P
	The petroleum spirit to be used for the test shall be a reagent grade hexane with a minimum of 85 % as n-hexane.		P
	If the marking has an adhesive backing, the adhesive backing shall be durable.		P
	Compliance is checked by either meeting the requirements of UL 969 under the conditions of occasional exposure to oil, humidity and water, and appropriate for the surface to which it is applied, or by the following tests.		P
	– Three labels applied to the tools or a panel of the test surface material are placed in an oven for a minimum of 24 h with the oven is maintained at a temperature of (120±2) °C, or alternatively for a minimum of 200 h at the temperature that the label is exposed to during the test of Clause 12.		P
	– Six additional labels applied to the tool or a panel of the test surface material are placed in a controlled atmosphere maintained at 21 °C to 30 °C with a relative humidity of minimum 45 % for at least 24 h. After this conditioning, immerse three labels in water and the other three labels in IRM 903 oil at a temperature of 21 °C to 30 °C for 48 h.		P
	– Three additional labels applied to the tool or a panel of the test surface material are placed in a controlled atmosphere maintained at 21 °C to 30 °C with a relative humidity of minimum 45 % for 72 h.		P
	After these conditionings, it shall not be easy to remove the label by scraping across the label with a flat steel blade of 0,8 mm thickness and any convenient width, held at right angles, and the label shall show no signs of curling.		P

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Clause	**Requirement — Test**	**Result - Remark**	**Verdict**
8.13	If compliance with this standard depends upon the operation of a replaceable thermal link or fuse-link, the reference number or other means for identifying the link shall be marked on the link, or in a place that it is clearly visible after the link has failed, when the tool has been dismantled to the extent necessary for replacing the link .		P
	This requirement does not apply to links which can only be replaced together with a part of the tool.		P
8.14	An instruction manual and 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.	see the manual	P
	They shall be written in the official language(s) of the country in which the tool is sold.		P
	The words “Original instructions” shall appear on the language version(s) verified by the manufacturer or his authorised representative. Where no “Original instructions” exist in the official language(s) of the country where the tool is to be used, a translation into that/those language(s) shall be provided by the manufacturer or his authorised representative or by the person bringing the tool into the language area in question. The translations shall bear the words “Translation of the original instructions”, and they shall be accompanied by a copy of the “Original instructions” .		P
	They shall be legible and contrast with the background		P
	They shall include the business name and address of the manufacturer and, where applicable, his authorised representative. Any address shall be sufficient to ensure contact. Country or state, city and postal code (if any) are deemed sufficient for this purpose		P
	They shall include the designation of the tool and series or type as required by 8.3, including description of machine such as “drill”, “planer” etc.		P
8.14.1	The subjects of safety instructions are the “General Power Tool Safety Warnings” of Part 1 as given in 8.14.1.1, the specific tool safety warnings of the relevant part of IEC 62841-2, IEC 62841-3 or IEC 62841-4 and any additional safety warning statements deemed necessary by the manufacturer. The “General Power Tool Safety Warnings” and the specific tool safety warnings, if in English, shall be verbatim and in any other official language to be equivalent. The numbering of the safety instructions, as given below, is not mandatory and may be omitted or replaced by other sorting means such as bullets. The “General Power Tool Safety Warnings” may be separate from the instruction manual.		P

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Clause	**Requirement — Test**	**Result - Remark**	**Verdict**
	As the term "power tool" or "tool" is not appropriate for lawn and garden machinery, for these products an appropriate term such as "machine" may be used.		P
	The term verbatim means word-for-word but permits the differences in spelling between English-speaking countries.		P
	Format of all safety warnings must differentiate, by font, highlighting or similar means, the context of clauses as illustrated below.		P
	All notes in the safety instructions are not to be printed, they are information for the designer of the manual.		P
8.14.1.1	General power tool safety warnings		P
	WARNING Read all safety warnings, instructions, illustrations and specifications provided with this power tool. Failure to follow all instructions listed below may result in electric shock, fire and/or serious injury.		P
	Save all warnings and instructions for future reference.		P
	The term "power tool" in the warnings refers to your mains-operated (corded) power tool or battery-operated (cordless) power tool.		P
	1) Work area safety a) Keep work area clean and well lit. Cluttered or dark areas invite accidents. b) Do not operate power tools in explosive atmospheres, such as in the presence of flammable liquids, gases or dust. Power tools create sparks which may ignite the dust or fumes. c) Keep children and bystanders away while operating a power tool. Distractions can cause you to lose control.		P
	2) Electrical safety a) Power tool plugs must match the outlet. Never modify the plug in any way. Do not use any adapter plugs with earthed (grounded) power tools. Unmodified plugs and matching outlets will reduce risk of electric shock . b) Avoid body contact with earthed or grounded surfaces, such as pipes, radiators, ranges and refrigerators. There is an increased risk of electric shock if your body is earthed or grounded. c) Do not expose power tools to rain or wet conditions. Water entering a power tool will increase the risk of electric shock . d) Do not abuse the cord. Never use the cord for		P

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Clause	**Requirement — Test**	**Result - Remark**	**Verdict**
	carrying, pulling or unplugging the power tool. Keep cord away from heat, oil, sharp edges or moving parts. Damaged or entangled cords increase the risk of electric shock . e) When operating a power tool outdoors, use an extension cord suitable for outdoor use. Use of a cord suitable for outdoor use reduces the risk of electric shock . f) If operating a power tool in a damp location is unavoidable, use a residual current device (RCD) protected supply. Use of an RCD reduces the risk of electric shock .		
	3) Personal safety a) Stay alert, watch what you are doing and use common sense when operating a power tool. Do not use a power tool while you are tired or under the influence of drugs, alcohol or medication. A moment of inattention while operating power tools may result in serious personal injury. b) Use personal protective equipment. Always wear eye protection. Protective equipment such as a dust mask, non-skid safety shoes, hard hat or hearing protection used for appropriate conditions will reduce personal injuries. c) Prevent unintentional starting. Ensure the switch is in the off-position before connecting to power source and/or battery pack, picking up or carrying the tool. Carrying power tools with your finger on the switch or energising power tools that have the switch on invites accidents. d) Remove any adjusting key or wrench before turning the power tool on. A wrench or a key left attached to a rotating part of the power tool may result in personal injury. e) Do not overreach. Keep proper footing and balance at all times. This enables better control of the power tool in unexpected situations. f) Dress properly. Do not wear loose clothing or jewellery. Keep your hair and clothing away from moving parts. Loose clothes, jewellery or long hair can be caught g) If devices are provided for the connection of dust extraction and collection reduce dust-related hazards. h) Do not let familiarity gained from frequent use of tools allow you to become complacent and ignore tool safety principles. A careless action can cause severe injury within a fraction of a second.		P
	4) Power tool use and care a) Do not force the power tool. Use the correct power tool for your application. b) Do not use the power tool if the switch does not turn it on and off. d) Store idle power tools out of the reach of		

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Clause	**Requirement — Test**	**Result - Remark**	**Verdict**
	children and do not allow persons Power tools are dangerous in the hands of untrained users. e) Maintain power tools and accessories. Check for misalignment or binding of moving parts, breakage of parts and any other condition that may affect the power tools's operation. If damaged, have the power tool repaired before use. f) Keep cutting tools sharp and clean. Properly maintained cutting tools with sharp cutting edges are less likely to bind and are easier to control. g) Use the power tool, accessories and tool bits etc. in accordance with these instructions, 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. h) Keep handles and grasping surfaces dry, clean and free from oil and grease.		P
	5) Service a) Have your power tool serviced by a qualified repair person using only identical replacement parts.		P
8.14.1.2	The order of the safety warnings shall be in accordance with either item A) or B) and in accordance with item C):		N
	A) The IEC 62841- 1 warnings are followed by the relevant part of IEC 62841-2, IEC 62841-3 or IEC 62841-4 warnings. The order of the warnings within IEC 62841- 1 and the IEC 62841-2, IEC 62841-3 or IEC 62841-4 warnings shall remain as given above and in the relevant part of IEC 62841-2, IEC 62841-3 or IEC 62841-4.		N
	B) The IEC 62841- 1 and the IEC 62841-2, IEC 62841-3 or IEC 62841-4 warnings may be divided into the sections defined by the numbered subtitles and the associated warnings below the numbered subtitle. The order of warnings within each section shall remain as given above and in the relevant part of IEC 62841-2, IEC 62841-3 or IEC 62841-4.		N
	C) Any additional warnings deemed necessary by the manufacturer, shall not be inserted within any of the IEC 62841- 1 or IEC 62841-2, IEC 62841-3 or IEC 62841-4 warnings. They may be either appended to the section(s) of the IEC 62841- 1 or IEC 62841-2, IEC 62841-3 or IEC 62841-4 in accordance with the topic of the safety warnings or located in any other part of the instruction manual.		N
8.14.1.3	If the safety instructions are separate from the instruction manual, then the following mwarnings shall be included in the instruction manual. These warnings, if in English, shall be verbatim and in any other official language to be equivalent.		N
8.14.2	The instruction manual shall be provided with the following, if appropriate.		P

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Clause	**Requirement — Test**	**Result - Remark**	**Verdict**
	a) Instructions for putting into use 1) Setting-up or fixing power tools in a stable position as appropriate for power tools which can be mounted on a support or fixed to a bench or the floor; 2) Assembly; 3) Connection to power supply, cabling, fusing, socket type and earthing requirements; 4) For tools adjustable to different rated voltages: instructions, illustrations, or both for changing the voltage. The terminal identification shall be provided if the motor connection has to be altered to operate at a voltage other than that for which it was connected when shipped from the factory; 5) Illustrated description of functions; 6) Limitations on ambient conditions; 7) Fitting and adjusting of guards required by 19. 1; 8) Information about disassembly and reassembly if applicable for transportation and/or use.		P
	b) Operating instructions 1) Setting and testing; 2) Tool changing; 3) Clamping of the workpiece; 4) Limits on size of workpiece and type of material; 5) General instructions for use; 6) Identification of handle(s) and grasping surface(s) required by 19.4; 7) For tools with 8) For transportable tools only: instruction on lifting and transportation.		P
	c) Maintenance and servicing instructions 1)User maintenance, such as cleaning, sharpening, lubricating, servicing and/or replacing of parts; 2)Servicing by manufacturer or agent; list of addresses; 3) List of user-replaceable parts and instruction how to replace them; 4) Special tools which may be required; 5)For power tools with type X attachment: instruction that, if the supply cord of this power tool is damaged, it must be replaced by a specially prepared supply cord available through the service organization; 6) For power tools with type Y attachment: instruction that, if the replacement of the supply cord is necessary, this has to be done by the manufacturer or his agent in order to avoid a		P

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Clause	**Requirement — Test**	**Result - Remark**	**Verdict**
	safety hazard; 7) For power tools with type Z attachment: information that the supply cord of this power tool cannot be replaced, and the power tool shall be scrapped.		
	d) For tools with a liquid system, the substance of the following, as appropriate: 1) Instructions for – the connection to the liquid supply; – the use of the liquid and the use of attachments to comply with 14.3 in order to 2) For tools provided with an RCD – warning never to use the tool without the RCD provided with the tool; – instruction always to test the correct operation of the RCD before starting work, unless the RCD is of a self-checking type; 3) For tools for use in combination with an isolating transformer: warning never to use the tool without the transformer delivered with the tool or of the type as specified in these instructions; 4) Instruction that replacement of the plug or the supply cord shall always be carried out by the manufacturer of the tool or his service organization; 5) Instruction to keep liquid clear of the parts of the tool and away from persons in the working area.		P
	Za) Emissions 1) The noise emission, measured in accordance with I.2, as follows: − A-weighted emission sound pressure level LpA and its uncertainty KpA , where LpA exceeds 70 dB(A). Where LpA does not exceed 70 dB(A), this fact shall be indicated; − A-weighted sound power level LWA and its uncertainty KWA , where the A-weighted emission sound pressure level LpA exceeds 80 dB(A); − C-weighted peak emission sound pressure level LpCpeak, where this exceeds 63 Pa (130 dB in relation to 20pa 2)Recommendation for the operator to wear hearing protection. 3)The vibration total value and its uncertainty measured in accordance with I.3. When the vibration total value does not exceed 2,5 m/s², this shall be stated. When the vibration total value exceeds 2,5 m/s², its value shall be given in the instructions. 4)The following information:		P

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Clause	**Requirement — Test**	**Result - Remark**	**Verdict**
	– that the declared vibration total value(s) and the declared noise emission value(s) have been measured in accordance with a standard test method and may be used for comparing one tool with another; – that the declared vibration total value(s) and the declared noise emission value(s) may also be used in a preliminary assessment of exposure.		
	5)A warning: –that the vibration and noise emissions during actual use of the power tool can differ from the declared values depending on the ways in which the tool is used especially what kind of workpiece is processed; and –of the need to identify safety measures to protect the operator that are based on an estimation of exposure in the actual conditions of use (taking account of all parts of the operating cycle such as the times when the tool is switched off and when it is running idle in addition to the trigger time)		N
8.14.3	If information about the mass or weight of the tool is provided, it shall be the mass specified in 5.17.		P
9	Protection against access to live parts		N
9.1	Tools shall be so constructed and enclosed that there is adequate protection against accidental contact with live parts. The requirement applies for all positions of the tool, even after removal of detachable parts and soft materials (elastomers), such as soft grip coverings.		N
9.2	An accessible part is not considered to be live if:		N
	– the part is supplied with safety extra- low voltage or – the part is separated from live parts by protective impedance. In the case of protective impedance, the current between the part and the supply source shall not exceed 2 mA for d.c., and its peak value shall not exceed 0,7 mA for a.c., and moreover: – for voltages having a peak value over 42,4 V up to and including 450 V, the capacitance shall not exceed 0,1 µF; – for voltages having a peak value over 450 V up to and including 15 kV, the discharge shall not exceed 45 µC		N
9.3	Lamps located behind a detachable cover are not removed, provided the tool can be isolated from the supply by means of a plug or an all-pole disconnection. However, during insertion or removal of lamps which are located		N

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Clause	**Requirement — Test**	**Result - Remark**	**Verdict**
	behind a detachable cover, protection against contact with live parts of the lamp cap shall be ensured.		
	This excludes the use of screw type fuses and screw-type miniature circuit breakers which are accessible without the aid of a tool.		N
	Test probe B of IEC 61032:1997 is applied with a force not exceeding 5 N, the tool being in every possible position except that tools normally used on the floor and having a mass exceeding 40 kg are not tilted. Through openings, the test probe is applied to any depth that the probe will permit, and it is rotated or angled before, during, and after insertion to any position.		N
	If the opening does not allow the entry of the probe, a rigid test probe with the dimensions of the test probe B of IEC 61032:1997, but without any articulation, is used, the force on the probe is increased to 20 N and the test with the articulated test probe B of IEC 61032:1997 repeated.		N
	It shall not be possible to touch with the test probe live parts or live parts protected only by lacquer, enamel, ordinary paper, cotton, oxide film, beads or sealing compound.		N
9.4	Test probe 13 of IEC 61032:1997 is applied with a force not exceeding 5 N through openings in class II tools and class II constructions, except for those giving access to lamp caps and live parts in socket-outlets.		N
	The test probe is also applied through openings in earthed metal enclosures having a non-conductive coating such as enamel or lacquer.		N
	It shall not be possible to touch live parts with the test probe.		N
9.5	Class II tools and class II constructions shall be so constructed and enclosed that there is adequate protection against accidental contact with basic insulation, and metal parts separated from live parts by basic insulation only.		N
	Parts which are not separated from live parts by double insulation or reinforced insulation shall not be accessible.		N
	This requirement applies for all positions of the tool, even after removal of detachable parts.		N

10	Starting		P
10.1	Tools shall start under all normal voltage conditions which may occur in use.		P

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Clause	**Requirement — Test**	**Result - Remark**	**Verdict**
	Compliance is checked by starting the tool 10 times at no-load in succession at a voltage equal to 0,85 times the lowest rated voltage or 0,85 times the lower limit of the rated voltage range, control devices other than speed controls, if any, being set as in normal use.		P
	Tools shall in addition be started 10 times in succession at a voltage equal to 1,1 times rated voltage.		P
	The interval between consecutive starts is made sufficiently long enough to prevent undue heating.		P
	In all cases, the tool shall operate and overload protection devices incorporated in the tool shall not activate. Centrifugal and other automatic starting switches, if any, shall operate reliably, and without contact chattering.		P
10.2	Tools shall not draw excessive input current during starting that could lead to nuisance operation of facility mains over- current protection devices.		P
	Compliance is checked by starting the tool once at rated voltage and no-load with any speed controls set for maximum speed and all other control devices set as in normal use.		P
	The current drawn by the tool at (2,0 ±0,2) s after starting shall not exceed the greater of 30 A or 4 times the rated current of the tool.		P
11	Input and current		N
	The rated input or rated current shall be at least 110 % of the measured no- load input or current.		N
	Compliance is checked by measuring the power input or current of the tool when stabilized while all circuits which can operate simultaneously are in operation. The test shall be conducted without accessories attached or external load.		N
	For tools marked with one or more rated voltages, the test is made at each of the rated voltages. 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.		N

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Clause	**Requirement — Test**	**Result - Remark**	**Verdict**
12	Heating		P
12.1	Tools shall not attain excessive temperatures with rated input or rated current.		P
	Compliance is checked by determining the temperature rise of the various parts under the conditions specified in 12.2 to 12.5. Then the test of Clause C.3 at 1,06 times the rated voltage is made under heated conditions.		P
12.2	For tools with one or more rated voltages: The tool is operated at each rated voltage, under the load conditions specified in 12.2. 1, the torque being applied is measured. While maintaining the previously measured torque, the voltage is then adjusted to 0,94 times the rated voltage and 1,06 times the rated voltage.		P
	The temperatures are measured at the most unfavourable of the two voltage settings. The temperatures that are measured by means of thermocouples are taken while the tool is operating.		P
12.2.1	The load conditions for the heating test of 12.2 are as follows.		N
	– For tools without an inherent operating cycle, the tool is operated with a torque load applied such that rated input or rated current is drawn until thermal equilibrium is reached.		N
	– For tools with an inherent operating cycle, the tool is operated with a torque load applied such that rated input or rated current is drawn some time during each of the tool's operating cycles. The tool is cycled consecutively for 30 min.		N
12.3.1	Heating elements, if any, are operated under the conditions specified in Clause 11 of IEC 60335-1:2010, when the tool is operated at a voltage equal to 1,06 times the rated voltage.		P
12.3.2	For tools provided with an automatic cord reel, one third of the total length of the cord is unreeled. The temperature rise of the cord sheath is determined as near as possible to the hub of the reel and also between the two outermost layers of the cord on the reel.		P
	For cord storage devices, other than automatic cord reels, which are intended to accommodate the supply cord partially while the tool is in operation, 50 cm of the cord is unwound. The temperature rise of the stored part of the cord is determined at the most unfavourable place.		P
	Temperature rises, other than those of windings, are		

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Clause	**Requirement — Test**	**Result - Remark**	**Verdict**
12.4	determined by means of fine-wire thermocouples so chosen and positioned that they have the minimum effect on the temperature of the part under test.		P
	The temperature rise of electrical insulation, other than that of windings, is determined on the surface of insulation, at places where failure could cause a short circuit, contact between live parts and accessible parts, bridging of insulation, or reduction of creepage distances or clearances below the values specified in 28.1.		P
	Temperature rises of windings are determined by the resistance method, unless the windings are non-uniform, or the method involves severe complications to make the necessary connections for the resistance measurement. In that case, the measurement is made by thermocouples.		P
	In determining the temperature rises of handles, knobs, grips and the like, consideration is given to all parts which are gripped in normal use, and, if of insulating material, to those parts in contact with hot metal.		P
12.5	During the test, protective devices shall not operate and sealing compound, if any, shall not flow out. The temperature rises shall not exceed the values shown in Tables 1a and 1b, except as allowed by 12.6.		N
12.6	The following tests shall be conducted when the temperature rises of the armature and/or field windings exceed the values in Table 1 or when there is doubt with regards to the temperature classification of the insulation system .		N
	Three samples of the armature and/or field are subjected to the following tests.		N
	a)Windings are kept for 10 days (240 h) in a heating cabinet, the temperature of which is (80 ±2) °C in excess of the temperature rise of the windings determined according to 12.4. Then the samples shall be gradually cooled to ambient temperature without introducing thermal shock . b)After this treatment, no interturn short circuit shall occur. c)The samples are then subjected to a humidity treatment as specified in 14.1. d)Immediately after this treatment, they shall withstand the tests of Annex D.		N

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Clause	**Requirement — Test**	**Result - Remark**	**Verdict**
13	Resistance to heat and fire		P
13.1	The following parts shall be sufficiently resistant to distortion due to heat, if this could cause the tool to fail to comply with this standard:		P
	– parts of thermoplastic material provided as an enclosure to comply with Clause 9; – parts of thermoplastic material supporting current carrying parts; – parts of thermoplastic material providing supplementary insulation or reinforced insulation.		P
	For the purpose of 13. 1, “supporting” means that the retention of the current carrying part by the insulating material is relied upon to fulfil 28.1. Contact alone does not constitute support.		P
	This requirement does not apply to: – insulation and sheath of flexible supply cords or internal wiring; – cord guards; – ceramic materials; – insulating part of motors:e.g. shaft insulation, end spiders, slot liners, wedges, commutators.		P
	The test is carried out at a temperature of (40 ±2) °C plus the maximum temperature rise determined during the test of Clause 12, but it shall be at least – (75±2)°C, for parts provided as an enclosure to comply with Clause 9 and for parts providing supplementary insulation or reinforced insulation; – (125 ±2) °C, for parts supporting current carrying parts.		P
13.2	Parts of non-metallic material shall be adequately resistant to ignition and to spread of fire.		P
	This requirement does not apply to – internal parts that are more than 13,0 mm from an arcing part such as a commutator, unenclosed switch contacts, and the like; – internal parts that are more than 1,0 mm from a non-arcing uninsulated live part, such as a bus bar, a connecting strap, a terminal, enamelled wire, and the like; – internal parts that are 1,0 mm or less from connections or conductors carrying 0,2 A or less during normal operation or from a low power-circuit as described in Annex H;		

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Clause	**Requirement — Test**	**Result - Remark**	**Verdict**
	–the insulation of wires; –gears, cams, belts, bearings, fans, decorative trims, knobs which would contribute negligble fuel to fire; –ceramic materials; – insulating parts of motor e.g. shaft insulation, end spiders, slot liners, wedges, commutators; –small parts, the plastic content of which is less than 5 g; –other external parts not likely to be ignited or to propagate flames originating from inside the tool.		P
14.1	Tools shall be proof against humid conditions which may occur.		P
	The humidity treatment is carried out in a humidity cabinet containing air with a relative humidity of (93 ± 3) %, 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 2 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.		P
	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.		P
	The tool is kept in the cabinet for 48 h		P
	Immediately after this test, the tool shall withstand the tests of Clause C.2 at rated voltage. Then the tool shall withstand the test of Annex D in the humidity cabinet, or in the room in which the tool was brought to the prescribed temperature after reassembly of those parts which may have been removed.		N
	In addition a test of Clause D.2 is applied between accessible metal parts and the supply cord which is wrapped with metal foil where it is located in an inlet bushing, a cord guard or a cord anchorage, any clamping screws being tightened to the torque specified in Table 11. The test voltage is 1 250 V for class I tools and 1 750 V for class II tools.		P
14.2	The enclosure of the tool shall provide the degree of protection against moisture in accordance with		P

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Clause	**Requirement — Test**	**Result - Remark**	**Verdict**
	the classification of the tool.		
14.2.1	The tool is not connected to the supply.		P
	Tools are turned continuously at approximately 1 rev/ min through the most unfavourable positions during the test.		P
	Electrical components, covers and other parts which can be removed without the aid of a tool are removed and subjected, if necessary, to the relevant treatment with the main part.		P
14.2.2	Tools other than IPX0 are subjected to tests of IEC 60529:2013 as follows:	IPX0	N
	– IPX1 tools are subjected to the test described in 14.2. 1; – IPX2 tools are subjected to the test described in 14.2.2; – IPX3 tools are subjected to the test described in 14.2.3a; – IPX4 tools are subjected to the test described in 14.2.4a; – IPX5 tools are subjected to the test described in 14.2.5; – IPX6 tools are subjected to the test described in 14.2.6; – IPX7 tools are subjected to the test described in 14.2.7.		N
	For this last test, the tool is immersed in water containing approximately 1,0 % NaCl.		N
	Immediately after the appropriate treatment, the tool shall withstand the electric strength test of Annex D, and inspection shall show that there is no trace of water on insulation which could result in a reduction of creepage distances and clearances below the values specified in 28.1.		N
14.3	Liquid systems or spillage of liquid shall not subject the user to an increased risk of electrical shock .		N
	The residual current device, if any, shall be disabled during the test. Electrical components, covers and other parts which can be removed without the aid of a tool are removed, except those fulfilling the test of 21.22.		N
	The tool is prepared with approximately 1,0 % NaCl solution in the following modes if applicable: –as described in 8. 14.2;		

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Clause	**Requirement — Test**	**Result - Remark**	**Verdict**
	–the liquid container of the tool is completely filled, and a further quantity, equal to 15 % of the capacity of the container, or 0,25 l, whichever is the greater, is poured in steadily over a period of 60 s, while the tool is resting in its filling position according to 8.14.2 d); –a detachable liquid container is filled completely and mounted and dismounted 10 times on the tool.		N
	–2 mA for a class II tool; –5 mA for a class I tool.		N
	Following this test, the tool shall meet the electric strength test of D.2 between live parts and accessible parts after being allowed to dry for 24 h at ambient temperature.		N
14.4	Liquid systems shall not subject the user to an increased risk of electrical shock by components not capable of withstanding the pressure during operation.		P
	The residual current device, if any, shall be disabled during the test.		P
	The liquid system is closed and an approximately 1,0 % NaCl solution at a hydrostatic pressure equal to twice the pressure stated in 8.14.2 d) 1) is applied for 1 h.		P
	The tool is then placed for 1 min, in all positions consistent with the relevant part of IEC 62841- 2, IEC 62841-3 or IEC 62841-4 and the instructions according to 8.14.2 b) while monitoring the leakage current as in Clause C.2. During the test the leakage current shall not exceed: –2 mA for a class II tool; –5 mA for a class I tool.		N
	Following this test, the tool shall meet the electric strength test of Clause D.2 between live parts and accessible parts after being allowed to dry for 24 h at ambient temperature.		P
14.5	Residual current devices used to provide protection from shock in the case of failure of the liquid system shall comply with IEC 61540:1999 and shall meet the following requirements a) to c):		P
	a)The RCD shall disconnect both mains conductors, but not the earth conductor if provided, when the leakage exceeds 10 mA and with a maximum response of 300 ms. Compliance is checked by inspection and the test of 9.9.2 of IEC 61540:1999. In addition, during the test, the earthing conductor shall		P

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Clause	**Requirement — Test**	**Result - Remark**	**Verdict**
	not become disconnected.		
	b)The RCD shall be reliable for its intended use. Compliance is checked at rated voltage by operating the residual current device under conditions of simulated leakage as in a) above during conditions of locked rotor of the tool for 50 cycles. The residual current device shall operate correctly for all cycles.		P
	c)The RCD shall be installed such that it is unlikely to be removed during use or normal maintenance.		P
	This requirement is considered fulfilled if the residual current device is fixed to the tool or the power supply cord connected to the tool		P
	Where fitted in the supply cord the residual current device shall be provided with Type Y attachment or Type Z attachment for connection with the supply cord and interconnection cord.		P
15	Resistance to rusting		P
15.1	Ferrous parts used to conduct electricity and those mechanical parts specified in the relevant part of IEC 62841-2, IEC 62841-3 or IEC 62841-4 shall be adequately protected against rusting.		P
	All grease is removed from the parts to be tested by immersing them in a suitable degreasing agent for 10 min.		P
	The parts are then immersed for 10 min in a 10 % solution of ammonium chloride in water at a temperature of (20 ±5) °C.		P
	Without drying, but after shaking off any drops, the parts are placed for 10 min in a box containing air saturated with moisture at a temperature of (20±5) °C.		P
	When using the liquids specified for the test, adequate precautions must be taken to prevent the inhalation of their vapours.		P
	After the parts have been dried for 10 min in a heating cabinet at a temperature of (100±5) °C, their surfaces shall show no signs of rust when viewed with normal vision from a distance of (500 + 50) mm .		P
	Traces of rust on sharp edges and any yellowish film removable by rubbing are ignored.		P
	For small helical springs and the like, and for parts exposed to abrasion, a layer of grease may provide sufficient protection against rusting. Such parts are only subjected to the test if there is doubt about the effectiveness of the grease film, and the test is then made without previous removal of the		P

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Clause	**Requirement — Test**	**Result - Remark**	**Verdict**
	grease.		
16	Overload protection of transformers and associated circuits		N
	Tools incorporating circuits supplied from a transformer shall be so constructed that, in the event of short circuits which are likely to occur, excessive temperatures do not occur in the transformer, or in the circuits associated to the transformer.		N
	Examples of short- circuits which are likely to occur are the short- circuiting of bare or inadequately insulated conductors of safety extra- low voltage circuits which are accessible, and the internal short- circuiting of lamp filaments.		N
	A failure of insulation complying with the requirements specified for basic insulation of class I or class II construction is not, for the purpose of this requirement, considered as likely to occur.		N
	Compliance is checked by applying the most unfavourable short circuit or overload which is likely to occur in normal use, the tool being operated as follows: – for tools with rated voltage(s), the tool is operated at a voltage equal to 1,06 times or 0,94 times rated voltage, whichever is the more unfavourable; – for tools with a rated voltage range, the tool is operated at a voltage equal to 1,06 times the upper limit of the rated voltage range or at a voltage equal to 0 ,94 times the lower limit of the rated voltage range, whichever is the more unfavourable.		N
	The temperature rise of the insulation of the conductors of safety extra- low voltage circuits is determined, and shall not exceed the relevant value specified in Table 1 by more than 15 K.		N
	The winding temperature of transformers shall not exceed the value specified for windings in Table 3, except for transformers which comply with IEC 61558- 1.		N
17	Endurance		P
17.1	Tools shall be so constructed that there will be no electrical or mechanical failure that might impair compliance with this standard. The insulation shall not be damaged and contacts and connections shall not work loose as a result of heating, vibrations, etc.		P

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Clause	**Requirement — Test**	**Result - Remark**	**Verdict**
	Moreover, overload protection devices incorporated in the tool shall not activate under normal running conditions.		P
	Compliance is checked by the test of 17.2 and, for tools provided with a centrifugal or other starting switch, also by the test of 17.3.		P
	Immediately after these tests, the tool shall withstand an electric strength test as specified in Annex D, the test voltages being, however, reduced to 75 % of the specified values. Connections shall not have worked loose, and there shall be no deterioration impairing safety in normal use.		P
17.2	Hand-held tools and transportable tools are operated intermittently at no-load.		P
	Each cycle of operation comprises an "on" period of 100 s and an "off" period of 20 s, the "off" periods being included in the specified operating time. If the cycle of operation limited by the construction and/or marking is less than 100 s “on” and 20 s “off”, then this cycle may be used.		P
	The tool may be switched on and off by means of a switch other than that incorporated in the tool unless this disables a functionality of the tool switch.		P
	Hand-held tools are operated for 24 h at a voltage equal to 1,1 times the highest rated voltage or 1,1 times the upper limit of the rated voltage range, and then for 24 h at a supply voltage equal to 0,9 times the lowest rated voltage or 0,9 times the lower limit of the rated voltage range. The 24 h of operation need not be continuous. During the test, the tool is placed in three different positions, the operating time, at each test voltage, being approximately 8 h for each position.		P
	Transportable tools are operated for 12 h at a voltage equal to 1,1 times the highest rated voltage or 1,1 times the upper limit of the rated voltage range, and then for 12 h at a supply voltage equal to 0,9 times the lowest rated voltage or 0,9 times the lower limit of the rated voltage range. The 12 h of operation need not be continuous. During the test, the tool is placed in its normal operating position according to 8.14.2.		P
	During this test, replacement of the carbon brushes is allowed, and the tool is oiled and greased as in normal use. If mechanical failure occurs and does not impair compliance with this standard, the part that failed may be replaced.		P

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Clause	**Requirement — Test**	**Result - Remark**	**Verdict**
	If the temperature rise of any part of the tool exceeds the temperature rise determined during the test of 12. 1, forced cooling or rest periods may be applied, the rest periods being excluded from the specified operating time. If forced cooling is applied, it shall not alter the air flow of the tool or redistribute carbon deposits.		P
	During these tests, overload protection devices incorporated in the tool shall not activate.		P
17.3	Tools provided with a centrifugal or other automatic starting switch are started 10 000 times at rated input or rated current, and at a voltage equal to 0,9 times the lowest rated voltage or 0,9 times the lower limit of the rated voltage range, the operating cycle being that specified in 17.2.		P
18	Abnormal operation		P
18.1	Tools shall be so designed that the risk of fire and mechanical damage impairing safety and the protection against electric shock as a result of abnormal operation is obviated as far as is practicable.		P
18.1.1	During the tests, the tool shall not emit flames or molten metal, checked by inspection.		P
	After the tests, and when the tool has returned to within 5 K of the ambient temperature, compliance with Clause 9 shall be maintained and the tool shall withstand the electric strength test of Annex D between live parts and accessible parts.		P
	If the tool can still operate at the conclusion of the test, it shall continue to comply with 19.1 but without repeating the tests of Clause 20.		P
18.2	Fuses, non-self-resetting-thermal cut-outs, overcurrent protection devices or the like, incorporated into the tool, may be used to provide the necessary protection. Electronic circuits that are relied upon for protection shall be evaluated for this safety critical function as in 18.8.		N
	Unless otherwise specified, the tests are continued until a protective device operates, or until steady conditions are established or an open circuit occurs. If it is an intentionally weak part that is permanently open-circuited to terminate the test, the relevant test is repeated on a second sample. This second test shall be terminated in the same way, unless the test is otherwise satisfactorily completed.		N
	An intentionally weak part is a part intended to fail under conditions of abnormal operation so as to		

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	prevent the occurrence of a condition which could impair compliance with this standard. Such a part may be a replaceable component, such as a resistor, a capacitor, or a thermal link, or a part of a component to be replaced, such as an inaccessible and non-resettable thermal cut-out incorporated in a motor.		N
18.3	Tools incorporating a series motor are operated without accessories at a voltage equal to 1,3 times rated voltage for 1 min at no-load.		N
	During the test, parts shall not be ejected from the tool. After this test, the tool need not be capable of further use.		N
18.4	Tools incorporating multiphase induction motors are operated, starting from cold, – for 30 s, if they are kept switched on by hand or continuously loaded by hand; – or otherwise, for 5 min; with one phase disconnected, and under the torque produced while operated at rated voltage or the mean value of the rated voltage range with rated input or rated current. At the end of the test period specified, or at the instant of operation of fuses, thermal cut-outs, motor protection devices, and the like, the temperature of the windings shall not exceed the values shown in Table 3.		P
18.5	Protection against electric shock shall not be impaired when a class II tool or a class I tool employing class II construction (see 5.10) is subjected to running overload conditions.		N
	For tools other than lawn and garden machinery covered by a relevant part of IEC 62841-4 with – series motors, compliance is checked by the test of 18.5.1. In the case of a class I tool with a series motor employing a class II armature construction, the test of 18.5.1 is replaced by the test of 18.5.2; – motors having electronically commutated stator windings, compliance is checked by the test of		N
	18.5.4; – other motors, compliance is checked by the test of 18.5.3.		N
18.5.1	All fuses, thermal cut-outs, overload protectors and the like specified in 18.2 that are accessible or can be reset by the user without the aid of a tool and any self-resetting protective devices are shorted.		N
	The function of electronic circuits that prevent the tool from operating at 160 % of the rated current shall be disabled unless that function has been evaluated as a		

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	safety critical function in accordance with 18.8. The tool is connected to a minimum 12 kVA circuit.		N
	The leakage current between live parts and accessible parts, that are not grounded by class I construction, is measured in accordance with Clause C.3 and is monitored throughout the test and after the test until the leakage current has stabilized or decreases. The leakage current shall not exceed 2 mA.		N
	The tool is operated at rated voltage. The tool is loaded to 160 % of the rated current. The mechanical load is maintained for either 15 min or until the tool open-circuits or flame appears. If the tool will not operate at 160 %, the tool is stalled for 15 min or until the tool open-circuits or flame appears. If either condition occurs, immediately switch off the current and, if flames appear, extinguish with CO2 extinguisher.		N
	After the tool has returned to within 5 K of the ambient temperature, an electric strength test per Clause D.2 is performed between live parts and those accessible parts that are not grounded by class I construction as follows: – if a tool does not operate after the 15 min, apply a 1 500 V electric strength test; – if a tool still operates after the 15 min, apply a 2 500 V electric strength test.		N
	If the tool has permanently open-circuited due to an over temperature condition before 15 min has elapsed for any reason except the opening of a motor winding, the test shall be repeated. This second test shall be terminated in the same mode unless the test is otherwise satisfactorily completed.		N
	If the test terminated due to a non-self-resetting thermal limit function of an electronic circuit, this circuit shall either be bypassed or evaluated as a safety critical function in 18.8.		N
	If the tool has permanently open-circuited for reasons other than above, the cause is determined and bypassed in a new sample and the test is repeated.		N
18.5.2	A sample of the armature is connected to a minimum 12 kVA circuit.		N
	The leakage current between the commutator segments and the armature shaft, is measured with 1,06 times the tool's rated voltage applied between the commutator segments, located 180°apart, and the armature shaft (see Figure 3). The leakage current is monitored throughout the test and after the		N

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Clause	**Requirement — Test**	**Result - Remark**	**Verdict**
	test until it has stabilized or decreases. The leakage current shall not exceed 2 mA.		
	The armature is subjected to carry 160 % of the rated current. The current is applied to the commutator segments that are located 180°apart. The current, without further adjustment, is applied for either 15 min or until the armature open-circuits or flame appears. If either condition occurs, immediately open S1 of Figure 3 and, if flames appear, extinguish with CO2 extinguisher.		N
	After the armature has returned to within 5 K of the ambient temperature, a 1 500 V electric strength test per Clause D.2 is performed between the commutator segments and the armature shaft.		N
18.5.3	The tool is connected to a minimum 12 kVA circuit and is operated under stalled conditions and under the conditions in 18.2 by		N
	– locking the rotor of tools for which the locked rotor torque is smaller than the full load torque; – locking moving parts of other tools.		N
	If a tool has more than one motor, the test is carried out for each motor separately.		N
	Tools incorporating motors and having capacitors in the circuit of an auxiliary winding are operated with the rotor locked, the capacitors being open-circuited one at a time. The test is repeated with the capacitors short-circuited one at a time unless they are of class P2 of IEC 60252- 1.		N
	Other tools are supplied at rated voltage for a period – of 30 s for • hand-held tools, • tools that have to be kept switched on by hand or foot, and • tools that are continuously loaded by hand; – of 5 min for other tools that are operated while attended. Tools that are tested for 5 min are indicated in the relevant part of IEC 62841-3 or IEC 62841-4.		N
	During the test, the temperature of the windings shall not exceed the relevant value specified in Table 3 and the acceptance criteria of 18.1.1 shall be applied.		N
18.5.4	Motors with electronically commutated stator windings are evaluated under conditions that represent all possible static faults of the outputs of the motor drive circuitry unless such circuitry has a protective function to prevent these faults which has been evaluated as an SCF in accordance with 18.8		N

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Clause	**Requirement — Test**	**Result - Remark**	**Verdict**
	with a minimum PL = a.		
	A new sample is used for each representative fault.		N
	All fuses, thermal cut-outs, overload protectors and the like specified in 18.2 that are accessible or can be reset by the user without the aid of a tool and any self-resetting protective devices are shorted.		N
	The leakage current between live parts and accessible parts, that are not grounded by class I construction, is measured in accordance with Clause C.3 and is monitored throughout the test and after the test until the leakage current has stabilized or decreases. The leakage current shall not exceed 2 mA.		N
	The windings are energized by applying the voltage of the source for the motor drive circuitry for either 15 min or until the winding open-circuits or flame appears. If either condition occurs, immediately switch off the current and, if flames appear, extinguish with CO2 extinguisher.		N
	After the tool has returned to within 5 K of the ambient temperature, an electric strength test per Clause D.2 is performed between live parts and those accessible parts that are not grounded by class I construction as follows: – if any winding is open circuited, apply a 1 500 V electric strength test; – if no windings are open circuited, apply a 2 500 V electric strength test.		N
18.6	Electronic circuits shall be so designed and applied so that a fault condition will not render the tool unsafe with regard to electric shock, fire hazard or accessibility to moving parts.		P
	The tool containing the circuit is to be placed on a soft wood surface covered by two layers of tissue paper; the sample is to be covered by one layer of untreated 100 % cotton medical gauze. The tool is operated at rated voltage. A new sample can be used for each fault listed in 18.6.1.		P
	No charring or burning of the gauze or tissue paper shall result. Charring is defined as a blackening of the gauze caused by combustion. Discolouration of the gauze caused by smoke is acceptable. Charring or igniting of the tissue paper or gauze from the means that is used to create the short is not regarded as a failure.		P
	Protection against electric shock as specified in Clause 9 shall be maintained.		P
	Protection against accessibility to moving parts as specified in 19.1 shall be maintained, if the test		

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Clause	**Requirement — Test**	**Result - Remark**	**Verdict**
	resulted in new openings being created in the enclosure.		P
	If a circuit fulfils the requirements of a low power circuit as described in Annex H and there is no risk of electric shock or the loss of a safety critical function as defined in 18.8, then this evaluation is not performed.		P
	If the circuit is encapsulated with an insulating material with a minimum thickness of 0,5 mm and there is no risk of loss of a safety critical function, then the circuit may be evaluated by open-circuiting of any connection and short-circuiting of any two connections to the encapsulated circuit. Encapsulation is not necessary to fully cover electrolytic capacitors.		P
	Any fuse, thermal cut-outs, thermal links, temperature limiters, electronic devices or any component(s) or conductor(s) that interrupt the current may operate during the above tests, provided at least any of the following is fulfilled: – the test is repeated and passed two more times, using two additional samples; or – the tool withstands the test of 18.6.1 with the fuse, thermal cut-out or thermal link bridged; or – if a miniature fuse link complying with IEC 60127 operates, the tool withstands the test of 18.6.2.		P
	If a conductor of a printed circuit board becomes open-circuited, the tool is considered to have withstood the particular test, provided all of the following conditions are met: – any loosened conductor does not reduce the creepage distances or clearances between live parts and accessible conductive parts below the values specified in Clause 28; – the tool withstands the test when repeated with the open-circuited conductor bridged or, alternatively, the test may be repeated two more times, using two additional samples, providing each test opens the conductor at the same point.		N
	The following fault conditions are considered and, if necessary, applied one at a time, consequential faults being taken into consideration:		N
18.6.1	The following fault conditions are considered and, if necessary, applied one at a time, consequential faults being taken into consideration:		P
	a) short-circuit of creepage distances and clearances between conductive parts of different polarity, if these distances are less than the values specified in Clause 28, unless the relevant part is encapsulated;		

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Clause	**Requirement — Test**	**Result - Remark**	**Verdict**
	b) open-circuit at the terminal of any component; c) short-circuit of capacitors, unless they comply with IEC 60384- 14; d) short-circuit of any two terminals of an electronic component, other than a monolithic integrated circuit. This fault is not applied between the two circuits of an optocoupler; e) failure of triacs in the diode mode; f) failure of a monolithic integrated circuit or other circuits that cannot be assessed by the fault conditions a) to e). In this case the possible hazardous situations of the tool are assessed to ensure that safety does not rely on the correct functioning of such a component. All possible output signals are considered under fault conditions within the integrated circuit. If it can be shown that a particular output signal is unlikely to occur, then the relevant fault is not considered.		P
	Positive temperature coefficient resistors (PTC's) are not short-circuited if they are used within their manufacturer's declared specification.		P
	For simulation of the conditions, the tool is operated at no-load adjusted to maximum output speed.		P
	The test is conducted until failure or until one of the following occurs: – for mains-operated tools, the tool no longer draws supply current; or – steady conditions are established; or – the test samples return to within 5 K of the ambient temperature; or – a test period of 3 h has elapsed.		P
18.6.2	If the safety of the tool depends upon the operation of a miniature fuse-link complying with IEC 60127 during any of the fault conditions specified in 18.6. 1, the test results of 18.6.1 are acceptable, provided the test is repeated but with the miniature fuse-link replaced by an ammeter. If the current measured		P
	– does not exceed 2,1 times the rated current of the fuse-link, the circuit is not considered to be adequately protected and the test is carried out with the fuse-link short-circuited; – is at least 2,75 times the rated current of the fuse-link, the circuits is considered to be adequately protected; – is between 2,1 times and 2,75 times the rated current of the fuse-link, the fuse-link is short circuited		

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Clause	**Requirement — Test**	**Result - Remark**	**Verdict**
	and the test is carried out • for the relevant period or for 30 min, whichever is the shorter, for quick acting fuse-links; • for the relevant period or for 2 min, whichever is the shorter, for time lag fuse-links.		P
	In case of doubt, the maximum resistance of the fuse-link has to be taken into account when determining the current.		P
18.7	Switches or other devices for motor reversal shall withstand the stresses occurring when the sense of rotation is reversed under running conditions where such a reversal is possible.		P
	The tool is operated at a voltage equal to rated voltage at no-load; the device for reversing the sense of rotation being in such a position that the rotor rotates in one direction at full speed.		P
	The direction of the rotation is then reversed, without the device resting in an intermediate "off" position.		P
	This operation sequence is performed 25 times.		P
	After the test, the switch shall have no electrical or mechanical failure. If the switch operates properly in the “on” and “off” positions at the end of the test, it is considered to have no mechanical or electrical failure.		P
18.8	Electronic circuits providing safety critical functions		P
18.8.1	General		P
	Electronic circuits that provide safety critical functions shall be – reliable and – not susceptible to loss of safety critical function due to exposure to electromagnetic environmental stresses encountered in anticipated environments.		P
	Compliance is checked by exposing these electronic circuits to the immunity tests described in – 18.8.2 to 18.8.6 for electronic circuits with no internal clock frequency or oscillator frequency higher than 15 MHz; – 18.8.2 to 18.8.7 for all other electronic circuits;		N
	which shall be passed without a loss of the safety critical function. The tests are carried out with the tool supplied at rated voltage or the mean value of the rated voltage range, unless the difference between the upper and lower limit of the rated voltage range is greater than 20 % of the mean value of the range, in which case the test is conducted at both the upper and lower limits of the rated voltage range.		N

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Clause	**Requirement — Test**	**Result - Remark**	**Verdict**
	In addition, these electronic circuits shall be evaluated using the fault conditions of 18.6.1 but shall not result in a loss of any safety critical function or shall place and maintain the tool into a safe state while the fault condition is present. If the concept of 18.6.1 is not appropriate due to the design of the electronic circuit (e.g. in the case of a single channel design), then its reliability shall be evaluated by the methods of ISO 13849- 1. Required performance levels for applicable safety critical functions are specified by the relevant part of IEC 62841-2, IEC 62841-3 or IEC 62841-4. Typical safety critical functions are indicated in Table 4.		P
18.8.2	The tool is subjected to electrostatic discharges in accordance with IEC 61000-4- 2:2008, test level 4 being applicable for air discharge and test level 3 being applicable for contact discharge. Ten discharges having a positive polarity and ten discharges having a negative polarity are applied.		P
18.8.3	The tool is subjected to fast transient bursts in accordance with IEC 61000-4-4:2012, test level 3 being applicable. The bursts are applied with a repetition frequency of 5 kHz for 2 min with a positive polarity and for 2 min with a negative polarity.		P
18.8.4	The power supply terminals of the tool are subjected to voltage surges in accordance with IEC 61000-4-5:2005, five positive impulses and five negative impulses being applied at the selected points. Test level 3 is applicable for the line-to-line coupling mode, a generator having a source impedance of 2 Ω being used. Test level 4 is applicable for the line-to-earth coupling mode, a generator having a source impedance of 12 Ω being used.		N
	For tools having surge arresters incorporating spark gaps, the test is repeated at a level that is 95 % of the flashover voltage.		N
18.8.5	The tool is subjected to injected currents in accordance with IEC 61000-4-6:2008, test level 3 being applicable. During the test, all frequencies between 0,15 MHz to 230 MHz are covered.		P
18.8.6	The tool is subjected to the Class 3 voltage dips and interruptions in accordance with IEC 61000-4- 11:2004. The values specified in Table 1 and Table 2 of IEC 61000-4- 11:2004 are applied at zero crossing of the supply voltage.		P
18.8.7	The tool is subjected to radiated fields in accordance with IEC 61000-4-3:2010, test level 3 being applicable. The frequency ranges tested shall be 80 MHz to 1 000 MHz.		N

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Clause	**Requirement — Test**	**Result - Remark**	**Verdict**
19	Mechanical hazards		P
19.1	Moving and other dangerous parts of the tool shall, as far as is compatible with the use and working of the tool, be so positioned or enclosed to provide adequate protection against personal injury.		P
	Protective enclosures, covers, guards and the like shall have adequate mechanical strength for their intended purpose. They shall not be removable without the aid of a tool.		P
	When used as protection of the working element, an adjustable guard shall have an easily accessible means of accurate adjustment with the objective of minimizing access to the dangerous parts.		P
	The use and adjustment of a guard shall not create other dangers, for example by reducing or obstructing the operator' s view, by transferring heat, or causing other reasonably foreseeable hazards.		N
	Compliance is checked by inspection, by the tests of Clause 20 and by means of the test probe B of IEC 61032:1997 with a force not exceeding 5 N. Prior to the application of the test probe any soft materials (elastomers) , such as soft grip coverings, shall be removed. It shall not be possible to touch dangerous moving parts with this test probe. This test is not applicable for dust collection openings with the dust collection devices removed, as they are tested in accordance with 19.3.		P
19.2	Tools shall have no ragged or sharp edges, other than those necessary for the functioning of the tool, which could create a hazard for the user.		P
19.3	It shall not be possible to reach dangerous moving parts through dust collection openings with the detachable parts or provisions for dust collection removed, if any.		P
	Compliance is checked by applying a rigid test probe with the dimensions of the test probe B of IEC 61032:1997, but without any articulation, with a force not exceeding 5 N.		P
19.4	Hand- held tools shall have at least one handle or grasping surface to ensure safe handling during use.		P
	Transportable tools shall be provided with at least one handle, grasping surface or the like to ensure safe transportation.		P

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Clause	**Requirement — Test**	**Result - Remark**	**Verdict**
	Lawn and garden machinery shall have adequate grasping surfaces to ensure safe handling during use.		P
19.5	Tools shall be designed and constructed to allow, where necessary, a visual check of the contact of the cutting tool with the workpiece.		P
19.6	For all tools where the relevant part of IEC 62841-2, IEC 62841-3 or IEC 62841-4 requires the tool to be marked with the rated no-load speed, the no-load speed of the spindle at rated voltage shall not exceed 110 % of the rated no-load speed.		P
	Compliance is checked by measuring the speed of the spindle after the tool has been operating for 5 min at no-load. During the test, separable accessories are not mounted.		P
19.7	Transportable tools and lawn and garden machinery intended to be used on a surface such as the floor or a table shall have adequate stability.		N
	The tool is placed with the motor switched off in any normal position of use on a plane inclined at an angle of 10°to the horizontal, the cable or cord resting on the inclined plane in the most unfavourable position. If, however, the tool is such that, were it to be tilted through an angle of 10°when standing on a horizontal plane, a part of it not normally in contact with the supporting surface would touch the horizontal plane, the tool is placed on a horizontal support and tilted in the most unfavourable direction through an angle of 10°. For the test, the tool is prevented from sliding.		N
	Tools provided with doors are tested with the doors open or closed, whichever is the more unfavourable.		N
	Tools intended to be filled with liquid by the user in normal use are tested empty or filled with the most unfavourable quantity of water or the recommended liquid, up to the rated capacity.		N
19.8	Transportable tools provided with wheels identified in the relevant part of IEC 62841-3 shall have adequate stability during transportation.		N
	The tool is held in its normal transportation position while traversing in both directions perpendicular to the slope of a plane inclined at an angle of 10°to the horizontal, the cable or the cord wrapped up and stored. The tool shall not tip over.		N
20	Mechanical strength		P

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Clause	**Requirement — Test**	**Result - Remark**	**Verdict**
20.1	Tools shall have adequate mechanical strength, and shall be so constructed that they withstand rough handling that may be expected.		P
	Immediately after the tests, the tool shall withstand the electric strength test as specified in Annex D between live parts and accessible parts, and live parts shall not have become accessible, as specified in Clause 9.		P
	Damage to the finish, small dents and cracks which do not reduce creepage distances or clearances below the values specified in 28. 1, or small chips which do not adversely affect protection against shock or moisture are neglected.		P
	The mechanical safety of the tool as required by this standard shall not be impaired.		P
	If a decorative cover is backed by an inner cover, a fracture of the decorative cover is neglected when the inner cover withstands the test after removal of the decorative cover.		P
20.2	Blows are applied to the tool by means of the spring- operated impact test apparatus according to Clause 5 of IEC 60068-2-75:1997.		P
20.3	For hand- held tools and hand- held lawn and garden machinery, 20.3.1 applies. For transportable tools, 20.3.2 applies. For ground supported lawn and garden machinery, requirements are given in the relevant part of IEC 62841-4.		P
20.3.1	A hand- held tool is dropped three times in total on a concrete surface from a height of 1 m . For these three drops, the sample is tested in the three most unfavourable positions the lowest point of the tool being 1 m above the concrete surface. Separable accessories are not mounted.		P
	If attachments are provided as specified in accordance with 8. 14.2, the test is repeated with each attachment or combination of attachments mounted to a separate tool sample.		P
20.3.2	A transportable tool, placed in its normal operating position, is impacted with a smooth steel sphere having a diameter of (50 ±2) mm and weighing (0,55 ± 0,03) kg. If a part of the tool can be impacted from above, the sphere is dropped from a rest position to strike the component. Otherwise, the sphere is suspended by a cord and is allowed to fall from a rest position as a pendulum to strike the area of the tool to be tested. In either case, the vertical travel of the sphere is (1,3 ±0,1) m .		N

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Clause	**Requirement — Test**	**Result - Remark**	**Verdict**
20.4	Accessible caps of brush holders shall have adequate mechanical strength.		P
	After this test, the brush holder shall show no damage impairing its further use, the thread, if any, shall not be damaged and the cap shall show no cracks.		P
	The blade width of the test screwdriver must be as large as possible, but must not exceed the length of the recess in the cap. If, however, the thread diameter is smaller than the length of the recess, the blade width must not exceed this said diameter. The torque must not be applied in jerks.		P
20.5	For all tools that are likely to cut into concealed wiring or their own cord, handles and grasping surfaces, as specified in the instruction manual in accordance with 8.14.2 b) 6), shall have adequate mechanical strength in order to provide insulation between the grasping area and the output shaft. The relevant part of IEC 62841-2, IEC 62841-3 or IEC 62841-4 specifies if 20.5 does not apply.		P
21	Construction		P
21.1	Tools which can be adjusted to suit different voltages, or to different speeds, shall be so constructed that accidental changing of the setting is unlikely to occur, if such a change might result in a hazard.		N
21.2	Tools shall be so constructed that accidental changing of the setting of control devices is unlikely to occur.		P
21.3	It shall not be possible to remove parts which ensure the required degree of protection against moisture without the aid of a tool.		P
21.4	If handles, knobs and the like are used to indicate the position of switches or similar components, it shall not be possible to fix them in a wrong position if this might result in a hazard.		P
21.5	Replacement of a flexible cable or cord requiring the moving of a switch which acts also as a terminal for external conductors shall be possible without subjecting internal wiring to undue stress; after repositioning the switch, and before reassembling the tool, it shall be possible to verify whether the internal wiring is correctly positioned.		N
21.6	Wood, cotton, silk, ordinary paper and similar fibrous or hygroscopic material shall not be used as insulation, unless impregnated.		P
	Insulating material is considered to be impregnated if the interstices between the fibres of the material are		

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Clause	**Requirement — Test**	**Result - Remark**	**Verdict**
	substantially filled with a suitable insulant.		P
21.7	Driving belts shall not be relied upon to provide the required level of insulation.		P
	This requirement does not apply if the tool incorporates a special design of belt which prevents inappropriate replacement.		P
21.8	Insulating barriers of class II tools, and parts of class II tools which serve as supplementary insulation or reinforced insulation, and which might be omitted during reassembly after user maintenance, shall either: – be fixed in such a way that they cannot be removed without being seriously damaged; or – be so designed that they cannot be replaced in an incorrect position, and that, if they are omitted, the tool is rendered inoperable or manifestly incomplete.		N
	This requirement is met if the barrier is so fixed that it can only be removed by breaking or cutting.		N
	Fixing by means of rivets is allowed, provided that these rivets need not be removed during user maintenance.		N
	Fixing by means of an adhesive is only allowed if the mechanical strength of the joint is at least equal to that of the barrier.		N
	An adequate internal lining of insulation material, or an adequate internal insulating coating on metal enclosures, is considered to be an insulating barrier provided that the coating cannot easily be removed by scraping.		N
	For class II tools, a sleeve on an insulated internal conductor, other than the core of an external flexible cable or cord, is considered to be an adequate insulating barrier, if it can only be removed by breaking or cutting, or if it is clamped at both ends.		N
	Ordinary lacquering on the inside of metal enclosures, varnished cambric, flexible resin-bonded paper, or the like are not considered to be insulating barriers.		N
21.9	The insulation of the inner conductors of a flexible cable or cord used as wiring within the tool is considered as basic insulation. No additional insulation is required in areas of class I construction. When these conductors are used in areas of class II construction, they shall be insulated from accessible metal parts by any of the following:		P
	– the sheath of the supply cord itself, provided this sheath is not exposed to undue thermal stress, clamping against accessible metal or other mechanical stress (e.g. pressure or tension) that		

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Clause	**Requirement — Test**	**Result - Remark**	**Verdict**
	could cause damage to the sheath; or – a sleeve, tubing or barrier complying with the requirements of supplementary insulation.		P
21.10	Air intake of motor enclosures shall not enable the ingress of foreign bodies that could impair safety.		P
21.11	Class I tools shall be so constructed that, should any wire, screw, nut, washer, spring, brush, brush holder component or similar part become loose or fall out of position, it cannot become so disposed that accessible metal is made live.		N
	Class II tools or class II constructions shall be so constructed that, should any such part become loose or fall out of position, it cannot become so disposed that creepage distances or clearances over supplementary insulation or reinforced insulation are reduced to less than 50 % of the values specified in 28.1.		N
	Class II tools or class II constructions, other than those of the all-insulated type, shall be provided with insulating barriers between accessible metal and motor parts and other live parts.		N
	For class I tools, this requirement can be met by the provision of barriers, or by fixing the parts adequately, and by providing sufficiently large creepage distances and clearances.		N
	It is not to be expected that two independent parts will become loose or fall out of position at the same time. For electrical connections, spring washers are considered to be adequate for preventing the loosening of the parts.		N
	Wires are considered as likely to become free from terminals or soldered connections, unless they are held in place near to the terminal or termination, independent of the terminal connection or solder.		N
	Short rigid wires are not regarded as liable to come away from a terminal, if they remain in position when the terminal screw is loosened.		N
21.12	Supplementary insulation and reinforced insulation shall be so designed or protected that they are not likely to be impaired by deposition of dirt, or by dust resulting from wear of parts within the tool, to such an extent that creepage distances or clearances are reduced below the values specified in 28.1.		N
	Ceramic material not tightly sintered and similar materials, and beads alone, shall not be used as supplementary insulation or reinforced insulation.		N
	Elastomer, natural or synthetic rubber parts used as supplementary insulation and/or reinforced insulation shall be resistant to ageing, or be so arranged and dimensioned that creepage distances are not reduced below the values specified in 28. 1, even if		N

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Clause	**Requirement — Test**	**Result - Remark**	**Verdict**
	cracks occur.		
	Insulating material in which heating conductors are embedded serves as basic insulation, and shall not be used as reinforced insulation.		N
	Elastomer and rubber parts are aged at a temperature of (100 ±2) °C for 70 h. After the test, the parts shall withstand the test of Clause D.2 using 75 % of the values indicated in Table D. 1. For the test in accordance with Clause D.2, the parts may be tested individually or reassembled in the tool. If a part is tested reassembled in the tool, the test shall only be conducted between live parts and accessible parts.		N
	In case of doubt, the following test is carried out to determine, if ceramic material is tightly sintered.		N
	The ceramic material is broken into pieces that are immersed in a solution containing 1 g of fuchsine in each 100 g of methylated spirit. The solution is maintained at a pressure not less than 15 MPa for a period so that the product of the test duration in hours and the test pressure in megapascals is approximately 180.		N
21.13	Tools shall be so constructed that internal wiring, windings, commutators, slip rings and the like, and insulation in general, are not exposed to oil, grease or similar substances.		P
	If the construction necessitates that insulation be exposed to oil or grease or similar substance, as in gears and the like, the oil or grease or substance shall have adequate insulating properties so that compliance with the standard is not impaired, and shall have no effect on insulation.		P
21.14	It shall not be possible to gain access to brushes without the aid of a tool.		P
	Screw-type brush-caps shall be so designed that, when tightening, two surfaces are clamped together.		P
	Brush-holders, which retain the brushes in position by means of a locking device, shall be so designed that the locking does not depend upon the brush-spring tension, if the loosening of the locking device might make accessible parts live.		P
	Screw-type brush-caps, which are accessible from the outside of the tool, shall be of insulating material, or be covered with insulating material; they shall not project beyond the surrounding surface of the tool.		P
21.15	Tools employing liquid systems shall protect the user against the increased risk of shock due to the presence of liquid under faults of the liquid system .		N
	Tools employing liquid systems shall be either:		

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Clause	**Requirement — Test**	**Result - Remark**	**Verdict**
	– of class III construction; or – of class I or class II construction and be provided with a residual current device and comply with 14.3, 14.4 and 14.5; or – of class I or class II construction and be designed for use in combination with an isolating transformer and comply with 14.3 and 14.4.		N
21.16	For tools having compartments to which access can be gained without the aid of a tool and that are likely to be cleaned in normal use, the electrical connections shall be arranged so that they are not subject to pulling during cleaning.		N
21.17	Tools shall be fitted with a power switch to control the motor. The actuating member of this switch shall be easily visible and accessible.		N
21.17.1	For tools incorporating a switch with a lock-off device, whereby the switch trigger is operated with a squeezing action by closing the fingers towards the palm of the hand, the lock off system shall be designed to ensure sufficient durability to withstand abuse and environmental conditions to prevent activation of the tool by the switch trigger alone.		N
21.17.1.1	A sample of the switch and its lock-off system assembled into the relevant tool housing is kept for 1 h in a heating cabinet at 80 °C.		N
	After the sample has returned to within 5 K of the ambient temperature, the switch lock-off system shall then comply with the test of 21.17.1.3.		N
21.17.1.2	A sample of the switch and its lock-off system assembled into the relevant tool housing is operated for the number of cycles in accordance with 23.1.10.2, where one cycle is defined as follows: 1) the lock-off device is actuated; 2) the switch is actuated; 3) the lock-off device or the switch is released as required to restore the switch to the locked state.		N
	The switch actuations shall be conducted at a rate of 10 to 20 per min. Following the operations as specified above, the sample shall then comply with the test of 21.17.1.3. During this test, the tool need not be connected to the supply.		N
21.17.1.3	A push force as specified in Table 7 is applied to the most unfavourable point of the switch actuating member in the direction of the switch actuation for a period of 10 s without prior actuation of the lock-off device. The switch shall not actuate during the application of the specified force. The switch and its lock-off system shall operate as designed after the applied force is terminated.		N

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Clause	**Requirement — Test**	**Result - Remark**	**Verdict**
21.18	Additional requirements for power switches for hand-held tools are given in 21.18.1. Additional requirements for power switches for transportable tools are given in 21.18.2. Additional requirements for power switches for lawn and garden machinery are given in the relevant part of IEC 62841-4.		P
21.18.1	For hand-held tools, the power switch required by 21.17 shall be a momentary power switch, with or without a lock-on device, which can be switched on and off by the user without releasing any of the handle(s) or grasping surface(s) required by 19.4.		P
21.18.1.1	When a momentary power switch has a separate action to lock it in the "on“ position, the switch shall unlock automatically with a single actuation motion without releasing the grasp on the tool. For tools supplied with more than one switch of which any can be locked on, the lock-on switch(es) shall be within the grasping zone necessary to control the tool, and any one of these switches shall unlock or make ineffective all remaining lock-on devices automatically with a single actuation motion without releasing the grasp on the tool.		P
21.18.1.2	Where there is a risk associated with inadvertent starting as defined by the relevant part of IEC 62841-2, power switch triggers and lock-off devices, if applicable, shall be so located, designed or guarded that inadvertent operation is unlikely to occur.		P
	It shall either not be possible to start the tool when a rigid sphere with a diameter of (100 ± 1) mm is applied to the power switch in any direction with a single linear motion;		P
	two separate and dissimilar actions shall be necessary before the motor is switched on (e.g. a power switch which has to be pushed in before it can be moved laterally to close the contacts to start the motor). It shall not be possible to achieve these two actions with a single grasping motion or a straight line motion		P
21. 18. 1.Z 1	Unless hand-held tools are equipped with a momentary power switch without lock-on device, voltage recovery following an interruption of the supply shall not give rise to a hazard The relevant part of EN 62841-2 specifies if this subclause applies and gives specific requirements		P
21.18.2	For transportable tools, the power switch required by 21.17 shall be able to be easily actuated “on” or “off” without any reasonably foreseeable hazard from the operator's position as specified in the instruction manual in accordance with 8.14.2.		N
	Unless transportable tools are equipped with a momentary power switch without lock-on device, voltage recovery following an interruption of the supply shall not give rise to a hazard The relevant part		

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Clause	**Requirement — Test**	**Result - Remark**	**Verdict**
21.18.2.1	of EN 62841-3 specifies if this subclause applies and gives specific requirements		N
21.18.2.2	An “on”/”off” control shall be capable of being turned off by the operator with a single straight-line motion. When a flap/cover is provided and covers the stop button it shall do so in a way such that pushing the flap actuates the stop.		N
21.18.2.3	A power switch shall be located, designed or guarded so that unintentional movement to the “on” position is unlikely.		N
	It shall either not be possible to start the tool when a rigid sphere with a diameter of (100 ± 1) mm is applied to the power switch in any direction with a single linear motion;		N
21.18.2.4	A push-pull switch shall be turned off by an inward push.		N
21.19	Tools shall be so designed that the protection against electric shock is not affected when screws removed during user maintenance are incorrectly replaced during reassembly.		N
21.20	If the tool is marked with the first numeral of the IP system, the relevant requirements of IEC 60529:2013 shall be fulfilled.		N
21.21	Tools shall be so designed that 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 even if connected to the supply side of the switch. This requirement does not apply to capacitors complying with the requirements for protective impedance specified in 9.2 and 21.34.		N
	Compliance is checked by the following test, which is made 10 times. The tool is operated at rated voltage.		N
	The power switch is then moved to the "off" position and the tool is disconnected from the supply by means of the plug.		N
	One second after disconnection, the voltage between the pins of the plug is measured with an instrument which does not appreciably affect the value to be measured.		N
	The voltage shall not exceed 34 V.		N
21.22	Non-detachable parts, which provide the necessary degree of protection against electric shock, moisture, or contact with moving parts, shall either require removal with the aid of a tool or be fixed in a reliable manner.		P
	Snap-in devices used for fixing such parts shall have an obvious locked position. The fixing properties of		

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Clause	**Requirement — Test**	**Result - Remark**	**Verdict**
	snap-in devices used in parts which are likely to be removed shall not deteriorate.		P
21.23	Handles, knobs, grips, levers and the like shall be fixed in a reliable manner so that they will not work loose, if loosening might result in a hazard.		P
	Compliance is checked by inspection, by manual test, and by trying to remove the handle, knob, grip or lever applying, for 1 min, a 30 N axial force either pushing or pulling.		P
21.24	Storage hooks and similar devices for flexible cords shall be smooth and well rounded.		P
21.25	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.		P
21.26	Tools having parts where reliance is based upon safety extra-low voltage to provide the necessary degree of protection against electric shock, shall be so designed that the insulation between parts operating at safety extra-low voltage and other live parts complies with the requirements for double insulation or reinforced insulation.		P
21.27	Parts bseparated by protective impedance shall comply with the requirements for double insulation or reinforced insulation.		P
21.28	Shafts of operating knobs, handles, levers and the like shall not be live unless the shaft is not accessible when the knob, handle, lever and the like is removed.		P
21.29	For constructions other than those of class III, handles, levers and knobs which are held or actuated shall not become live in the event of an insulation fault.		N
	If these handles, levers or knobs are of metal, and if their shafts or fixings are likely to become live in the event of a basic insulation fault, they shall either be adequately covered by insulating material, or their accessible parts shall be separated from their shafts or fixings by insulation.		N
	For transportable tools and lawn and garden machinery of class I, this requirement does not apply to handles, levers and knobs, other than those of electrical components, if they are reliably connected to an earthing terminal or earthing contact or separated from live parts by earthed metal.		N
	For all tools that are likely to cut into concealed wiring or their own cord, handles and grasping surfaces, as specified in the instruction manual in accordance with 8.14.2 b) 6), shall be formed of insulating material or, when of metal, shall be either adequately covered by insulating material or their accessible parts shall be separated by insulating barrier(s) from accessible metal parts that may become live by the output shaft. These insulating barriers are not to be regarded as		

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Clause	**Requirement — Test**	**Result - Remark**	**Verdict**
21.30	basic insulation, supplementary insulation or reinforced insulation.		P
	If a stick type auxiliary handle is provided with such tool, it shall be insulated and be provided with a flange having a height not less than 12 mm above the grasping surface between the grasping area and accessible parts that may become live by the output shaft.		P
21.31	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.		N
21.32	Capacitors shall not be connected between the contacts of a thermal cut-out.		P
21.33	Lamp holders shall be used only for the connection of lamps.		N
21.34	Protective impedance shall consist of at least two separate components, the impedance of which is unlikely to change significantly during the lifetime of the tool. If any one of the components is short-circuited or open-circuited, the values specified in 9.2 shall not be exceeded.		P
21.35	Dust collection		P
	Tools as identified in the relevant part of IEC 62841-2 or IEC 62841-3, which produce a considerable amount of dust, shall have either an integral dust collection/suction device or have dust outlet(s) designed which allow the mounting of external suction device(s) for evacuating the by-products of the working process. These dust outlets shall direct the discharge away from the operator and they along with any external suction device(s) for evacuating the by-products of the working process shall not impede the normal use of the tool.		P
22	Internal wiring		P
22.1	Wireways shall be smooth and free from edges. sharp		P
	Wires shall be protected so that they do not come into contact with burrs, cooling fins, etc., which may cause damage to the insulation of conductors.		P
	Holes in metal through which insulated wires pass shall be provided with bushings or, unless required otherwise in the relevant part of IEC 62841-2, IEC 62841-3 or IEC 62841-4, shall have smooth,well-rounded edges. A radius of 1,5 mm is considered to be well rounded.		P

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Clause	**Requirement — Test**	**Result - Remark**	**Verdict**
	Wiring shall be effectively prevented from coming into contact with moving parts.		P
22.2	Internal wiring shall be either so rigid and so fixed or insulated that creepage distances and clearances cannot be reduced below the values specified in 28.1.		P
	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.		P
22.3	Conductors identified by the colour combination green or green/ yellow shall not be connected to terminals other than earthing terminals.		P
22.4	Aluminium wires shall not be used for internal wiring. Windings of a motor are not considered as internal wiring.		N
	Connections to aluminium windings shall consider the effects of possible corrosion between aluminium and other metals and comply with the requirements of 26.4.		N
22.5	Stranded conductors shall not be consolidated by lead- tin soldering where they are subjected to contact pressure, unless the clamping means is so designed that there is no risk of bad contact due to cold flow of the solder.		P
	Consolidation of a stranded conductor by lead-tin soldering is allowed if spring terminals are used; securing the clamping screws alone is not considered adequate.		P
22.6	Different parts of a tool that can move relative to each other a) in normal use, b) during adjustment operations, c) during user maintenance		P
	shall not cause undue stress to electrical connections and internal conductors, including those providing earthing continuity. Flexible metallic tubes shall not cause damage to the insulation of the conductors contained within them . Open-coil springs shall not be used to protect the wiring. If a coiled spring, the turns of which touch one another, is used for this purpose, there shall be an adequate insulating lining in addition to the insulation of the conductors.		P
	This requirement does not apply to movements of parts with small amplitudes caused by vibration.		P

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Clause	**Requirement — Test**	**Result - Remark**	**Verdict**
	If flexing occurs in normal use, the tool is placed in the normal position of use. With no power applied, the movable part is moved backwards and forwards, so that the conductor is flexed through the largest angle allowed by the construction, the rate of flexing being a minimum of 6 per minute. The number of flexings is − 10 000, for conductors/connections flexed during normal use; − 2 000, for conductors/connections flexed during adjustments; − 100, for conductors/connections flexed during user maintenance. A flexing is one movement, either backwards or forwards.		P
23	Components		P
23.1	Components referenced in this standard shall comply with the safety requirements specified in the referenced IEC standards, as far as they reasonably apply.		P
	Batteries are not regarded as components, but as part of the tool. They shall comply with the applicable requirements as specified in Annexes K and L.		P
	If components are marked with their operating characteristics, the conditions under which they are used in the tool shall be in accordance with these markings, unless a specific exception is made.		P
	Unless otherwise specified, the requirements of Clause 28 of this standard apply between live parts of components and accessible parts of the tool.		N
	Unless components have been previously tested and found to comply with the relevant IEC standard for the number of cycles specified, they are tested in accordance with 23.1.1 to 23.1.11.		N
23.1.1	Capacitors in auxiliary windings of motors shall be marked with their rated voltage and their rated capacitance.		P
23.1.2	Capacitors for radio interference suppression shall comply with IEC 60384- 14.		P
23.1.3	Small lampholders similar to E10 lampholders shall comply with the requirements for E10 lampholders in IEC 60238. However, they need not accept a lamp with an E10 cap complying with the current edition of Standard Sheet 7004-22 of IEC 60061- 1.		N
	Isolating transformers or safety isolating transformers, except incorporated transformers as defined in IEC 61558- 1, shall comply with IEC		

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Clause	**Requirement — Test**	**Result - Remark**	**Verdict**
23.1.4	61558-2-4 or IEC 61558-2-6, respectively. Switch mode power supply units and transformers for switch mode power supply units shall comply with IEC 61558-2- 16.		P
23.1.5	Appliance couplers shall either comply with IEC 60320 or the manufacturer shall inform the user in the instructions for use to connect the tool only by means of the appropriate connector specified by the manufacturer.		P
23.1.6	Automatic temperature controls containing electromechanical contacts that cycle in normal use, shall have suitable endurance for their intended application.		P
23.1.7	The testing of components which have to comply with other standards is, in general, carried out separately, according to the relevant standard as follows.		N
	If the component is marked and used in accordance with its marking, it is tested in accordance with its marking, the number of samples being that required by the relevant standard.		N
23.1.8	Components that have not been separately tested and found to comply with the component standards as references in 23.1 or components that are not marked or not used in accordance with their marking, are tested in accordance with the referenced relevant standard under the conditions occurring in the tool.		N
23.1.9	For capacitors connected in series with a motor winding, the voltage across the capacitor shall not exceed 1,1 times the rated voltage of the capacitor, when the tool is operated at a voltage equal to 1,1 times rated voltage and under no-load.		P
23.1.10	Switches shall be so constructed that there will be no failure that might impair compliance with this standard.		P
	Switches, if separately tested and found to comply with IEC 61058- 1:2008, shall meet the requirements specified in 23.1.10.1.		P
	Switches which have not been separately tested and found to comply with IEC 61058- 1:2008 or do not meet the requirements of 23. 1.10. 1, are tested as in 23.1.10.2 to 23.1.10.3.		P
23.1.10.1	Switches shall be rated and classified as follows.		P
	Power switches shall be rated as follows: – for a voltage not less than the rated voltage of the tool;		

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Clause	**Requirement — Test**	**Result - Remark**	**Verdict**
	– for a current not less than the rated current of the tool; – for a.c., if the tool is rated for a.c.; – for d.c., if the tool is rated for d.c.		P
	Electronic power switches shall, as a minimum, be classified for Continuous Duty in accordance with IEC 61058- 1:2008.		N
	Power switches shall further be classified with respect to load: – switches for motor-operated tools and motor-operated lawn and garden machinery: for resistive and motor load in accordance with 7.1.2.2 of IEC 61058- 1:2008, if the switch would encounter this load in normal use; – switches for magnetically driven tools and magnetically driven lawn and garden machinery: for inductive load in accordance with 7.1.2.8 of IEC 61058- 1:2008, if the switch would encounter this load in normal use; – alternatively, switches may be regarded as switches for a declared specific load in accordance with 7.1.2.5 of IEC 61058- 1:2008 and may be classified based upon the load conditions encountered in the tool in normal use.		N
	Switches shall further be classified as follows with respect to endurance: – power switches for hand-held tools: for 50 000 operating cycles; – power switches for transportable tools and lawn and garden machinery: for 10 000 operating cycles; – power switches which possess series electronics must also endure 1 000 operating cycles with the electronics bypassed;		P
	– switches other than power switches, such as speed selector switches, which are likely to be switched under electrical load: for 1 000 operating cycles. However, this test is not required, if the requirements of this standard are met with the switch short-circuited; – switches other than power switches that either • are intended for operation without electrical load, and which can be operated only with the aid of a tool or are interlocked so that they cannot be operated under electrical load; or		

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Clause	**Requirement — Test**	**Result - Remark**	**Verdict**
	• provide a motor direction reversing function; or • are switches for 20 mA load as classified in 7.1.2.6 of IEC 61058- 1:2008 are not required to possess any particular endurance characteristic.		P
23.1.10.2	The endurance properties of switches shall be adequate.		P
	Compliance is checked by submitting three samples of the switch to the accelerated cycle endurance test of 17.2.4.4 of IEC 61058- 1:2008, but with load conditions as specified in either 23.1.10.2.1 or 23.1.10.2.2 and with the number of operating cycles as specified below.		P
	Power switches for hand-held tools are tested for 50 000 operating cycles. Power switches for transportable tools and lawn and garden machinery are tested for 10 000 operating cycles.		P
	If a power switch is comprised of mechanical contacts in series with electronic circuitry containing one or more semiconductor switching devices (SSD) as defined in IEC 61058- 1:2008 where the circuitry provides a protective function by reducing the current during switch operation, then: – on three additional samples, the electronic circuitry shall be bypassed and the test repeated for at least 1 000 operating cycles; or – the protective function shall be considered to be a safety critical function and comply with the greater of the performance levels for power switches in 18.8.		P
	Switches other than power switches, such as speed selector switches, which are likely to be switched while energized, are tested as described above, but for 1 000 operating cycles only for the load conditions encountered in normal use.		P
	Switches, other than power switches, intended for operation without electrical load, and which can be operated only with the aid of a tool or are interlocked so that they cannot be operated under electrical load, are not subjected to the tests of 17.2.4.4 of IEC 61058- 1:2008.		P
23.1.10.2 .1	For switches tested with an external load, the load conditions are as follows:		P
	Power switches for motor-operated tools and motor-operated lawn and garden machinery are regarded as classified to 7.1.2.2 of IEC 61058- 1:2008. They are tested with 6 times I-M		

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Clause	**Requirement — Test**	**Result - Remark**	**Verdict**
	making current and a power factor 0,6 ± 0,05, and with I-M breaking current and a power factor ≥ 0,9, the I-M current being the rated current of the tool.		P
	Power switches for magnetically driven tools and magnetically driven lawn and garden machinery are regarded as classified to 7.1.2.8 of IEC 61058- 1:2008. They are tested with 6 times I-I making current and a power factor 0,6 ± 0,05, and with I-I breaking current and a power factor 0,6 ± 0,05, the I-I current being the rated current of the tool.		P
	Switches other than power switches, but which would encounter the same load conditions as power switches in normal use, shall be tested with the corresponding load conditions above.		P
23.1.10.2 .2	For switches tested utilizing the motor or magnetic load encountered in the tool, the switch is tested at rated voltage for the required number of operating cycles, each cycle composed as follows: 1) With the tool at rest, the switch is closed without any mechanical load applied to the tool. 2) The switch is opened with the tool loaded to rated current or rated input.		N
23.1.10.3	The breaking capacity of power switches of motor-operated tools and lawn and garden machinery shall be adequate.		P
	Compliance is checked by the locked-rotor test (TC9) of 17.2.4.9 of IEC 61058- 1:2008 with a current of 6 ´ I-M. Alternatively, the test is performed with the switch incorporated in the tool with the motor locked, each “on” period being not more than 0,5 s, and each “off” period being not less than 10 s.		P
	After this test the power switch shall have no electrical or mechanical failure. If the switch operates properly in the “on” and “off” positions at the end of the test, it is considered to have no mechanical or electrical failures.		P
23.1.11	Electronic power switches, without series mechanical contact separation (air gap), are allowed, provided the requirements of 18.6 and 18.8 are met.		P
23.2	Tools shall not be fitted with – switches or automatic controls in flexible cords, however protective devices such as RCDs are allowed; – devices, except for earthing conductors, which are intended to cause the protection device in the fixed wiring to operate in the event of a fault in the tool;		

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Clause	**Requirement — Test**	**Result - Remark**	**Verdict**
	– thermal cut-outs which can be reset by a soldering operation.		P
23.3	Protection devices (e.g. overload or over-temperature protection devices) or circuits that switch off the tool shall be of the non-self-resetting type where there is a risk associated with inadvertent starting as specified in the relevant part of IEC 62841-2 (by 21.18.1.2), IEC 62841-3 or IEC 62841-4.		P
	Electronic speed and load regulators are not considered to be protection devices, if they do not switch off the tool but reduce the speed of the tool as a load is applied and increase the speed of the tool when the load is removed. An RCD is not considered a protection device.		P
	Resetting a protection device by switching the tool off and on with the power switch is considered to be a non-self-resetting action.		P
23.4	Plugs and socket-outlets for extra-low voltage circuits, and those used as terminal devices for heating elements, shall not be interchangeable with mains plugs and socket-outlets listed in IEC 60884, IEC/TR 60083 or IEC 60906- 1 or with connectors and appliance inlets complying with the standard sheets of IEC 60320- 1.		P
23.5	Motors connected to the supply mains, and having basic insulation which is inadequate for the rated voltage of the tool, shall comply with the requirements of Annex B.		P

24	Supply connection and external flexible cords		N
24.1	Tools shall be provided with one of the following means of connection to the supply:		N
	– a supply cord with a minimum length of 1,8 m and with a plug; – a supply cord with a minimum length of 1,8 m and without a plug, the information for connection shall be given in the instructions in accordance with 8.14.2 a); – an appliance inlet having at least the same degree of protection against moisture as required for the tool; – a supply cord with a length between 0,2 m and 0,5 m and fitted with a plug or other connector having at least the same degree of protection against moisture as required for the tool.		N
24.2	Supply cords shall be assembled to the tool by one		N

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Clause	**Requirement — Test**	**Result - Remark**	**Verdict**
	of the following methods:		
	– type X attachment; – type Y attachment; – type Z attachment, if allowed in the relevant part of IEC 62841-2, IEC 62841-3 or IEC 62841-4.		N
	Supply cords with type X attachment shall be specially prepared cords only available from the manufacturer or his service agent. A specially prepared cord may also include a part of the tool.		N
24.3	Plugs shall not be fitted with more than one flexible cord.		N
24.4	Supply cords shall be not lighter than:		N
	– ordinary rubber sheathed flexible cord (code designation 60245 IEC 53); or – ordinary polyvinyl chloride sheathed flexible cord (code designation 60227 IEC 53).		N
	Polyvinyl chloride insulated flexible cords shall not be used for tools having external metal parts, the temperature rise of which exceeds 75 K during the test of Clause 12.		N
24.5	Supply cords shall have a nominal cross-sectional area not less than those shown in Table 8.		N
24.6	For class I tools, the supply cord shall be provided with a green or green/yellow core; it shall be connected to the internal earthing terminal of the tool, and to the earthing contact of the plug.		N
24.7	Conductors of supply cords shall not be consolidated by lead-tin soldering where they are subject to contact pressure, unless the clamping means is so designed that there is no risk of a bad contact due to cold flow of the solder.		N
24.8	For all types of attachment, moulding together the supply cord to the enclosure or part of it shall not affect the insulation of the cord.		N
24.9	Tools provided with a supply cord shall be constructed so that the supply cord is protected against damage where it enters the tool.		N
	This shall be achieved by either: – a flexible cord guard; or – a cord inlet; or		N

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Clause	**Requirement — Test**	**Result - Remark**	**Verdict**
	– a bushing.		
24.10	Cord inlets and bushings shall:		N
	– be so shaped as to prevent damage to the supply cord; – be reliably fixed; – not be removable without the aid of a tool.		N
24.11	Tools, other than transportable tools, provided with a supply cord that is flexed while in operation shall be constructed so that the supply cord is protected against excessive flexing where it enters the tool.		N
	a) The part of the tool fitted with the supply cord and its entry system is fixed in the oscillating member of an apparatus similar to that shown in Figure 2. The distance X, as shown in Figure 2, between the axis of oscillation and the point where the supply cord enters the tool, is adjusted so that when the oscillating member moves over its full range, the cord and load make the minimum lateral movement. A weight, having the mass of the tool as specified in 5. 17, but not less than 2 kg or more than 6 kg, is attached to the supply cord. 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 supply cord entry and the final 10 000 flexings are conducted.		N
	b) For tools provided with a cord guard, the cord anchorage and the terminal screws are loosened, without removing the conductors of the supply cord. However, if the cord guard is clamped under the cord anchorage, the cord anchorage is not loosened. The tool is then lifted by the cord guard, without jerks, over a distance of approximately 500 mm in approximately 1 s, and replaced on a support. The operation is made 10 times. During this test, the cord guard shall not slip out of its location.		N
24.12	Supply cords of tools, other than transportable tools, that are flexed while in operation shall be protected against excessive bending at the inlet opening of the tool.		N
	The cord guard, if any, shall be fixed in a reliable manner, and shall be of such a design that they project outside the tool for a distance beyond the		

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	inlet opening of at least five times the overall diameter of the cable or cord delivered with the tool.		N
	The tool is fitted with a supply cord that extends approximately 100 mm from the end of the supply cord entry or the cord guard, if any.		N
	The tool is so held that the axis of the supply cord entry or cord guard, if any, where the cord leaves it, projects upwards at an angle 45°to the horizontal when the supply cord is free from stress.		N
	A mass equal to 10 Dc^2g is then attached to the free end of the supply cord. Dc is the external diameter of the supply cord supplied with the tool in mm .		N
	Immediately after the mass has been attached, the radius of the curvature of the supply cord shall not be less than 1,5 Dc anywhere along the length of the supply cord.		N
24.13	Tools provided with a supply cord shall have a cord anchorage. The cord anchorage shall relieve conductors from strain, including twisting, at the terminals and protect the insulation of the conductors from abrasion.		N
	It shall not be possible to push the cord into the tool to such an extent that the cord, or internal parts of the tool, could be damaged.		N
	A mark is made on the cord while it is subjected to the pull force shown in Table 9, at a distance of approximately 20 mm from the cord anchorage or other suitable point.		N
	The cord is then pulled, without jerking, for 1 s in the most unfavourable direction with the force specified. The test is carried out 25 times.		N
	The cord, unless on an automatic cord reel, is then subjected to a torque that is applied as close as possible to the tool. The torque is specified in Table 9 and is applied for 1 min.		N
	During the tests, the cord shall not be damaged and shall show no appreciable strain at the terminals. The pull force is reapplied and the cord shall not be longitudinally displaced by more than 2 mm .		N
24.14	Cord anchorages shall either be so arranged that they are only accessible with the aid of a tool, or be so designed that the cord can only be fitted with the aid of a tool.		N

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24.15	Cord anchorages shall be so designed or located that:		N
	– the cord cannot touch the clamping screws of the cord anchorage, if these screws are accessible, unless they are separated from accessible metal parts by supplementary insulation;		N
	– the cord is not clamped by a metal screw which bears directly on the cord;		N
	– glands are not used as cord anchorages;		N
	– for class I tools, if an insulation fault on the cord could make accessible metal parts live, they are of insulating material or are provided with an insulating lining complying with the requirements for basic insulation. The sheath of the cord is considered adequate for this purpose;		N
	– for class II tools, they are of insulating material or are insulated from accessible metal parts by insulation complying with the requirements for supplementary insulation. The sheath of the cord alone is not considered to fulfil this requirement.		N
24.16	For type X attachments, cord anchorages shall be designed or located that:		N
	– replacement of the cord is easily possible; – it is clear how the relief from strain and the prevention of twisting are to be obtained; – screws, if any, which have to be operated when replacing the cord, do not serve to fix any other component, unless, when omitted or incorrectly mounted, they render the tool inoperative or clearly incomplete, or unless the parts intended to be fastened by them cannot be removed without the aid of a tool during the replacement of the cord; – in the case of labyrinths, these labyrinths cannot be bypassed in such a way that the test of 24.13 is not withstood; – at least one part of the cord anchorage is securely fixed to the tool or to a functional part of the tool such as the switch, terminal block or the like, unless it is part of the specially prepared cord.		N
	The conductors are introduced into the terminals, the terminal screws, if any, being tightened just sufficiently to prevent the conductors from easily changing their position. The cord anchorage is used in the normal way, the clamping		

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	screws, if any, being tightened with a torque equal to two-thirds of that specified in 27.1.		N
	Screws of insulating material bearing directly on the cord are fastened with two-thirds of the torque specified in column I of Table 11; the length of the slot in the screw head being taken as the nominal diameter of the screw.		N
24.17	For type X attachment, production methods such as tying the cord into a knot, or tying the ends with string, are not allowed.		N
24.18	The space for the supply cord provided inside, or as a part of the tool for type X attachment shall be so designed:		N
	– as to permit checking, before fitting the cover, if any, that the conductors are correctly connected and positioned; – that covers, if any, can be fitted without risk of damage to the supply conductors or their insulation; – that the uninsulated end of the conductor, should it become free from a terminal, cannot come into contact with accessible parts, unless the cord is provided with terminations that are unlikely to slip free of the conductor.		N
	For pillar terminals where the conductors are not separately clamped at a distance of 30 mm or less from the terminal, and for other terminals with screw clamping, the clamping screws or nuts are loosened in turn. Without removing the conductor from the conductor space, a force of 2 N is applied to the wire in any direction and adjacent to the terminal, screw or stud. The uninsulated end of the conductor shall not then come into contact with accessible metal parts or any other metal part connected thereto.		N
	For pillar terminals, where the conductors are separately clamped at a distance of 30 mm or less from the terminal, the tool is considered to meet the requirement that the uninsulated end of the conductor must not come into contact with accessible metal parts.		N
24.19	Appliance inlets shall:		N
	– be so located or enclosed that live parts are not accessible during insertion or removal of the connector; – be so placed that the connector can be inserted without difficulty; – be so placed that, after insertion of the		

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	connector, the tool is not supported by the connector when in any position of normal use on a horizontal flat surface.		N
24.20	Interconnection cords shall comply with the requirements for the supply cord, except that		N
	– the cross-sectional area of the conductors of the cord is determined on the basis of the maximum current carried by the conductor during the test of Clause 12; – the insulation of the conductor shall be adequate for its working voltage; – the test of 24.11 is restricted to the range of motion of the tool during normal use.		N
24.21	Interconnection cords shall not be detachable without the aid of a tool if compliance with this standard is impaired when they are disconnected.		N
25	Terminals for external conductors		P
25.1	Tools shall be provided with terminals or equally effective devices for the connection of external conductors. The terminals shall only be accessible with the aid of a tool.		P
	Screws and nuts shall not serve to fix any other component, except that they may also clamp internal conductors, if these are so arranged that they are unlikely to be displaced when fitting the supply conductors.		P
	For tools with type X attachment, soldered connections may be used for the connection of external conductors, provided that the conductor is so positioned or fixed that reliance is not placed upon the soldering alone to maintain the conductor in position, unless barriers are provided so that creepage distances and clearances between live parts and other metal parts cannot be reduced to less than 50 % of the values specified in 28. 1, should the conductor become free at the soldered joint.		P
	For type Y attachment and type Z attachment, soldered, welded, crimped and similar connections may be used for the connection of external conductors; moreover, for class II tools, the conductor shall be so positioned or fixed that reliance is not placed upon the soldering, crimping, or welding alone to maintain the conductor in position, unless barriers are provided so that creepage distances and clearances between live		N

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	parts and other metal parts cannot be reduced to less than 50 % of the values specified in 28. 1, should the conductor become free at the soldered or welded joint, or slip out of the crimped connection.		
	It is not to be expected that two independent fixings will become loose at the same time.		N
	Conductors connected by soldering are not considered to be adequately fixed, unless they are held in place near to the termination, independently of the solder; but "hooking in" before soldering is, in general, considered to be a suitable means for maintaining the conductors of a power supply cord other than a tinsel cord in position, provided the hole through which the conductor is passed is not unduly large.		N
	The terminals of a component (such as a switch) built into the tool may be used as terminals intended for external conductors.		N
	Conductors connected to terminals or terminations by other means are not considered to be adequately fixed, unless an additional fixing is provided near the terminal or termination; this additional fixing, in the case of stranded conductors, clamps both the insulation and the conductor.		N
25.2	Terminals for supply cords shall be suitable for their purpose.		P
25.3	For tools with type X attachment, terminals shall be so fixed that, when the clamping means is tightened or loosened, the terminal does not work loose, internal wiring is not subjected to stress, and creepage distances and clearances are not reduced below the values specified in 28.1.		P
	Compliance is checked by inspection, and by the test of 9.6 of IEC 60999- 1:1999, the torque applied being, however, equal to two-thirds of the torque specified in Table 4 of that standard.		P
	Terminals may be prevented from working loose by fixing with two screws, by fixing with one screw in a recess, so that there is no appreciable play, or by other suitable means.		P
	The requirement for fixation of terminals does not preclude the provision of supply terminals on switches, or similar device in a recess if, after connection of the supply cord, and after repositioning of the switch or similar device in its recess, it can be verified by inspection that these components and the supply cord are, after reassembly of the tool, in the correct position.		P
	Covering with sealing compound without other		

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	means of locking is not considered to be sufficient. Self-hardening resins may, however, be used to lock terminals which are not subject to torsion in normal use.		P
25.4	For tools with type X attachment, terminals shall be so designed that they clamp the conductor between metal surfaces with sufficient contact pressure, and without damage to the conductor.		P
25.5	Terminals of the pillar type shall be so constructed and located that the end of a conductor introduced into the hole is visible, or can pass beyond the threaded hole for a distance at least equal to half the nominal diameter of the screw but at least 2,5 mm .		P
25.6	For type X attachment, the terminals shall be clearly recognizable and accessible after opening the tool. All terminals shall be located behind one cover, or one part of the enclosure.		P
25.7	Terminal devices of tools with type X attachment shall be so located or shielded that should a wire of a stranded conductor escape when the conductors are fitted, there is no risk of accidental connection between live parts and accessible metal parts and, in the case of class II tools, between live parts and metal parts separated from accessible metal parts by supplementary insulation only.		P
	An 8 mm length of insulation is removed from the end of a flexible conductor having a nominal cross-sectional area as specified in 24.5.		P
	One wire of the stranded conductor is left free, and the other wires are fully inserted into and clamped in the terminal.		P
	The free wire is bent, without tearing the insulation back, in every possible direction, but without making sharp bends around barriers.		P
	The free wire of a conductor connected to a live terminal shall not touch any metal part which is accessible, or is connected to an accessible metal part or, for class II tools, any metal part which is separated from accessible parts by supplementary insulation only. The free wire of a conductor connected to an earthing terminal shall not touch any live part.		N
26	Provision for earthing		N
26.1	Accessible parts of class I tools, which may become live in the event of an insulation fault, shall be permanently and reliably connected to an		N

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Clause	**Requirement — Test**	**Result - Remark**	**Verdict**
	earthing terminal or termination within the tool, or to the earthing contact of the tool inlet.		
	The printed conductors of printed circuit boards shall not be used to provide continuity of the protective earthing circuit		N
	Earthing terminals and earthing contacts shall not be electrically connected to the neutral terminal.		N
	Class II tools and class III tools shall have no provision for earthing.		N
	If accessible metal parts are screened from live parts by metal parts which are connected to the earthing terminal or termination, or to the earthing contact, they are not, for the purpose of this requirement, regarded as likely to become live in the event of an insulation fault.		N
	Rotating motor components that have metal- to- metal bearing surfaces shall be considered to be electrically bonded to each other through the bearing surfaces for earthing purposes.		N
	Accessible parts, which are separated from live parts by double insulation or by reinforced insulation, are not considered likely to become live in the event of an insulation fault.		N
	Metal parts behind a decorative cover which does not withstand the test of Clause 20 are considered to be accessible parts.		N
26.2	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 26.2.		N
	For specifically prepared cords, terminals complying with IEC 61210 and the specifications in Table 10 are considered to comply with the requirements of 26.2 . The connector material of quick connect terminals, if steel, shall comply with the requirements of Clause 15.		N
26.3	If detachable parts have an earth connection, this connection shall be made before the current-carrying connections are established when placing the part in position, and the current carrying connections shall be separated before the earth connection is broken when removing the part.		N
	For tools with supply cords, the arrangement of the terminals, or the length of the conductors between the		

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	cord anchorage and the terminals, shall be such that the current-carrying conductors become taut before the earthing conductor, if the cord slips out of the cord anchorage.		N
26.4	All parts of the earthing terminal intended for the connection of external conductors shall be such that there is no risk of corrosion resulting from contact between these parts and the copper of the earthing conductor, or any other metal in contact with these parts.		N
	Parts which may transmit current in the event of an insulation fault, other than parts of a metal frame or enclosure, shall be of coated or uncoated metal having adequate resistance to corrosion. If such parts are of steel, they shall be provided at the essential areas with an electroplated coating having a thickness of at least 5 µm .		N
	Parts of coated or uncoated metal, which are only intended to provide or to transmit contact pressure, shall be adequately protected against rusting.		N
	If the body of the earthing terminal is a part of a frame or enclosure of aluminium or aluminium alloy, precautions shall be taken to avoid the risk of corrosion resulting from contact between copper and aluminium or its alloys.		N
	Parts of copper alloys containing at least 58 % copper for parts that are worked cold, and at least 50 % copper for other parts, and parts of stainless steel containing at least 13 % chrome, are considered to be sufficiently resistant to corrosion. Parts subjected to a treatment such as chromate conversion coating are in general not considered to be adequately protected against corrosion, but they may be used to provide or to transmit contact pressure.		N
	The essential areas of steel parts are, in particular, those transmitting current. In evaluating such areas, the thickness of the coating in relation to the shape of the part has to be taken into account. In case of doubt, the thickness of the coating is measured as described in ISO 2178 or in ISO 1463.		N
26.5	The connection between the earthing terminal or earthing contact, and earthed metal parts shall be of low resistance.		N
	A current derived from a source having a no-load voltage not exceeding 12 V (a.c. or d.c.) and equal to 1,5 times rated current of the tool, or 25 A, whichever is the greater, is passed between the earthing terminal or earthing contact, and each of the accessible metal parts in turn.		N

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Clause	**Requirement — Test**	**Result - Remark**	**Verdict**
	The voltage drop between the earthing terminal of the tool or the earthing contact of the tool inlet, and the accessible metal part is measured, and the resistance calculated from the current and this voltage drop.		N
	In no case shall the resistance exceed 0,1 Ω		N
	In case of doubt, the test is carried out until steady conditions have been established.		N
	The resistance of the flexible cord is not included in the resistance measurement.		N
	Care is taken that the contact resistance between the tip of the measuring probe and the metal part under test does not influence the test results.		N
27	Screws and connections		P
27.1	Fixings, and electrical connections, the failure of which may impair compliance with this standard, and connections providing earthing continuity shall withstand mechanical stresses occurring.		P
	Screws used for this purpose shall not be of metal which is soft or liable to creep, such as zinc or aluminium .		P
	Such screws, when of insulating material, shall have a nominal diameter of at least 3 mm; they shall not be used for any electrical connection or connections providing earthing continuity.		N
	Screws transmitting electrical contact pressure shall screw into metal.		P
	Screws shall not be of insulating material if their replacement by a metal screw could impair supplementary insulation or reinforced insulation.		P
	Screws which may be removed when replacing a supply cord having a type X attachment, or when undertaking user maintenance, shall not be of insulating material if their replacement by a metal screw could impair basic insulation.		P
27.2	Electrical connections shall be so designed that contact pressure is not transmitted through insulating material which is liable to shrink or to distort, unless there is sufficient resiliency in the metallic parts to compensate for any possible shrinkage or distortion of the insulating material. Ceramic material is not liable to shrink or to distort.		P

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Clause	**Requirement — Test**	**Result - Remark**	**Verdict**
27.3	Space-threaded (sheet metal) screws shall not be used for the connection of current carrying parts, unless they clamp these parts directly in contact with each other, and are provided with a suitable means of locking.		P
	Thread-cutting (self-tapping) screws shall not be used for the electrical connection of current carrying parts, unless they generate a full-form standard machine screw thread. Such screws shall not, however, be used if they are likely to be operated by the user, unless the thread is formed by a swageing action.		P
	Thread-cutting and space-threaded screws may be used to provide earthing continuity, provided that it is not necessary to disturb the connection in normal use, and that at least two screws are used for each connection.		P
27.4	Screws, which make a mechanical connection between different parts of the tool, shall be secured against loosening, if they also make electrical connections.		P
	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.		P
	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.		P
	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.		P
	This requirement does not imply that more than one rivet is necessary for providing earthing continuity.		N
27.5	Screwless connectors, not intended for disconnection in normal use, shall prevent disconnection in normal use.		P
	Connectors that terminate a wire shall withstand a pull of 5 N applied through the wire in the opposite direction from the force used to apply the connector. Neither the connector nor the wire shall become disconnected. In the case where the direction of the application is not in line with the		P

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Clause	**Requirement — Test**	**Result - Remark**	**Verdict**
	exit direction of the wire, then the force shall be applied in both directions, one at a time.		
27.5.1	Conductors shall be secured by more than one means or shall not impair safety in the event of detachment.		P
	If there is only one means of securing, the conductors are detached from their connector one at a time and subjected to the following.		P
	The detached conductor is moved around its nearest point of retention to check that clearances cannot be reduced to less than 50 % of the values specified in 28.1.		P
28	Creepage distances, clearances and distances through insulation		N
28.1	Creepage distances and clearances shall not be less than the values in millimeters shown in Table 12. The values specified in the table do not apply to cross- over points of motor windings.		N
	The values in Table 12 are equal or larger than the values required by IEC 60664- 1, when – an overvoltage category II; – a material group III; – a pollution degree 1 for parts protected against deposition of dirt and for lacquered or enamelled windings; – a pollution degree 3 for other parts; – inhomogeneous electric field are applied.		N
	If a resonance voltage occurs between the point where a winding and a capacitor are connected together, and metal parts which are separated from live parts by basic insulation only, the creepage distance and clearance shall not be less than the values specified for the value of the voltage imposed by the resonance, these values being increased by 4 mm in the case of reinforced insulation.		N
	For tools provided with an appliance inlet, the measurements are made with an appropriate connector inserted. For other tools, they are made on the tool as delivered.		N

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Clause	**Requirement — Test**	**Result - Remark**	**Verdict**
	For tools provided with belts, the measurements are made with the belts in place, and the devices intended for varying the belt tension adjusted to the most unfavourable position within their range of adjustment, and also with the belts removed.		N
	Movable parts are placed in the most unfavourable position; nuts and screws with non-circular heads are assumed to be tightened in the most unfavourable position.		N
	The clearances between terminals and accessible metal parts are also measured with the screws or nuts unscrewed as far as possible, but the clearances shall then be not less than 50 % of the value shown in Table 12.		N
	Distances through slots or openings in external parts of insulating material are measured to metal foil in contact with the accessible surface; the foil is pushed into corners and the like by means of the test probe B of IEC 61032:1997, but it is not pressed into openings.		N
	If necessary, a force is applied to any point on internal wiring and bare conductors, other than those of heating elements, to any point on uninsulated metal capillary tubes of thermostats and similar devices, and to the outside of metal enclosures, in an endeavour to reduce the creepage distances and clearances while taking the measurements .		N
	The force is applied by means of the test probe B of IEC 61032:1997, and has a value of: – 2 N for internal wiring and bare conductors and for uninsulated capillary tubes of thermostats and similar devices; – 30 N for enclosures.		N
	For tools having parts with double insulation where there is no metal between basic insulation and supplementary insulation, the measurements are made as though a metal foil were present between the two insulations.		N
	For conductive patterns on printed circuit boards, except at their edges, the values in the table between parts of different potential may be reduced, as long as the peak value of the voltage stress does not exceed: – 150 V per mm with a minimum distance of 0,2 mm, if protected against the deposition of dirt; – 100 V per mm with a minimum distance of 0,5 mm, if not protected against the deposition of dirt.		N

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Clause	**Requirement — Test**	**Result - Remark**	**Verdict**
28.2	Depending on the working voltage, the distance through insulation shall be sufficient:		N
	– For working voltages up to and including 130 V, the distance through insulation between metal parts shall not be less than 1,0 mm, if they are separated by supplementary insulation, and not be less than 1,5 mm, if they are separated by reinforced insulation.		N
	– For working voltages over 130 V up to and including 280 V, the distance through insulation between metal parts shall not be less than 1,0 mm, if they are separated by supplementary insulation, and not be less than 2,0 mm, if they are separated by reinforced insulation.		N
	– For working voltages up to and including 280 V, the distance through reinforced insulation used between windings and accessible metal shall not be less than 1,0 mm .		N
	The required distance through insulation may be achieved through several thicknesses of solid insulation layers that may have intervening air between the layers such that the sum of the thicknesses of the solid insulation equals the required thickness.		N
	This requirement does not apply, if either a) or b) is fulfilled.		N
	a) The insulation is applied in thin sheet form, other than mica or similar scaly material, and consists: – for supplementary insulation, of at least two layers, provided that any one of the layers withstands the electric strength test prescribed for supplementary insulation; – for reinforced insulation, of at least three layers, provided that, when any two of the layers are placed in contact, they withstand the electric strength test prescribed for reinforced insulation. The test voltage is applied between the outer surfaces of the layer, or of the two layers, as applicable.		N
	b) The supplementary insulation or the reinforced insulation is inaccessible and meets the following condition: The insulation, after having been conditioned for seven days (168 h) in an oven maintained at a temperature equal to 50 K greater than the maximum temperature rise determined during the test of Clause 12 withstands an electric strength test as specified in Annex D, this test being made on the insulation both at the temperature occurring in the		N

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	oven, and at approximately room temperature.		
	For optocouplers, the conditioning procedure is carried out at a temperature of 50 K in excess of the maximum temperature rise measured on the optocoupler during the tests of Clause 12 and Clause 18, the optocoupler being operated under the most onerous conditions which occur during these tests.		N
ANNEX B	**MOTORS NOT ISOLATED FROM THE SUPPLY MAINS AND HAVING BASIC INSULATION NOT DESIGNED FOR THE RATED VOLTAGE OF THE TOOL**		P
B.1.1	Motors with working voltage ≤ 42 V		P
B.9.2	Metal parts of motor considered bare live parts		P
B.12.4	Temperature rise of body of motor determined instead of the temperature rise of the windings		P
B.12.5	Temperature rise of the body of the motor in contact with insulating materials did not exceed values in Table 1 for the relevant insulting material	See Table 12.1	N
B.18. 201	Tool operated at rated voltage with the terminals of motor and its capacitors short circuited		P
	Tool operated at rated voltage with the supply to the motor open circuited		N
	Tool operated at rated voltage with shunt resistor open circuited during operation of motor		N
B.21.101	For class I tools with a motor supplied by a rectifier circuit, dc circuit insulated from accessible parts of the tool by double or reinforced insulation		N
ANNEX C	**LEAKAGE CURRENT**		N
C.2	Leakage current measurement of non-operating tool	See Tables C.2A and C.2B	N
C.3	Leakage current measurement of operating tool	See Tables C.3A to C.3D	N
ANNEX D	**ELECTRIC STRENGTH**		N
D.1	Any protective impedance were disconnected		N
	The tools were not connected to the supply		N
	Electric strength is checked by the tests of D.2		N
	For tools with heating elements, test voltages of IEC 60335-1:2010 apply to the heating elements only		N
	Insulation between live parts of motor in accordance with Annex B and its other metal parts not subjected to this test		N

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Clause	**Requirement — Test**	**Result - Remark**	**Verdict**
	Tool in accordance with Annex L, tool is directly connected to the mains or to a non-isolated source		N
	Electronic devices bypassed to enable the test to be conducted		N
D.2	Test duration 1 min		N
	Voltage of substantially sinusoidal waveform, frequency 50 Hz or 60 Hz		N
	Electric strength test, voltages applied .....:	See Table D.2	N
	To distinguish between capacitor reactance current and unacceptable performance, d.c. potential 1,414 times the that for a.c. was used .....:		N
	No flashover or breakdown occurred during the test	See Table D.2	N
ANNEX H	**LOW-POWER CIRCUITS**		N
	Any points closest to the supply at which the maximum power delivered to the variable resistor does not exceed 15 W at the end of 5 s identified as called a low power points .....:		N
ANNEX K	**BATTERY TOOLS AND BATTERY PACKS**		P
K.1	Rated voltage for tools and battery packs ≤75 V d.c.		P
K.5.7	Tests to be done at rated voltage were done with a fully charged battery		P
K.5.201	Peak voltage of any superimposed ripple exceeding 10 % of the average value was included		P
K.5.202	Measurements of lithium-ion cell voltages were made using a filter as specified		P
K.5.203	Test area protected against fire and explosion, and well ventilated		P
K.5.204	Discharging and charging as specified		P
K.5.205	Thermocouples for lithium-ion cell temperature measurement located as specified		P
K.5.206	Currents measured during battery charging are average currents		P
K.5.207	Fully charged batteries used, after resting for ≥ 2 h but ≤ 6 h at an ambient temperature of (20 ± 5) °C		P
K.5.208	Battery consisting of a single cell not subject to special preparations of a cell in a series configuration		N
K.5.209	For series arrangement of parallel clusters of cells, the cluster is treated as single cell for specified tests		P

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Clause	**Requirement — Test**	**Result - Remark**	**Verdict**
K.5.210	End-of-discharge voltages for common cell chemistries observed .....:		P
K.8.3	Battery tools and detachable or separable battery packs marked with additional information		P
	- Business name and address of the manufacturer and, where applicable, its authorised representative:		—
	- Designation of series or type .....:		—
	Battery tools also marked with additional information		P
	- Year of manufacture and a date code identifying at least the month of manufacture .....:		—
	- Designation of the tool .....:		—
	- identification for parts shipped separately for assembly by the end user		—
	Detachable or separable battery packs marked with additional information		P
	- capacity in Ah or mAh ..... :		—
	- type of battery.....:		—
	No misunderstanding by additional markings		P
K.8.4	Markings specified in K.8.1, 8.2 and K.8.3 not on a detachable part of the tool		P
	Markings specified in 8.2 clearly discernible from the outside of the tool		P
	Markings specified in K.8.3 visible with any separable battery pack or detachable battery pack removed		P
	Other markings on the tool visible after removal of a cover		P
K.8.14.1.1	5) Battery tool use and care		P
	6) Service		P
K.8.14.2	e) Instructions for battery tools		P
K.9.1	Construction and enclosure provide adequate protection against electric shock		P
K.9.3	No two conductive, simultaneously accessible parts where the voltage between them is hazardous		N
	Conductive, simultaneously accessible parts provided with protective impedance		N
	Short circuit current between two simultaneously accessible parts (mA) .....:		N
	Capacitance between two simultaneously accessible parts (μF) .....:		N

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Clause	**Requirement – Test**	**Result - Remark**	**Verdict**
K.9.5	Electric strength test of D.2 with 750 V applied to insulating material protecting from electric shock	See Table D.2	N
K.12.1	Tool operated at no-load until maximum temperature reached or battery discharged .....:	See table K.12.1	P
	No operation of protective devices during heating test		P
	Temperature rises met values in Table 2		P
K.12.201	Charging of lithium-ion battery under normal conditions did not exceed specified operating region for charging of the cell		P
	Charging procedure as specified		P
	Voltage, temperature and charging current monitored for all individual cells	See table K.12.201	P
	Test repeated with imbalanced battery	See table K.12.201	P
K.13.1	Thermoplastic materials of relevant enclosure parts sufficiently resistant to heat		P
	Ball-pressure test of IEC 60695-10-2:2003	See Table 13.1	P
K.13.2	Glow-wire test applicable only to external enclosure enclosing the current-carrying parts		N/A
	Non-metallic parts in of detachable or separable battery pack supporting connections that carry ≥0,2 A during charging and those within a distance of 3 mm, subjected to the glow-wire test at 850 °C	See Table 13.2	N/A
K.13.2.2101	Polymeric battery enclosure material around current-carrying parts at least classified V according to IEC 60695-11-10:2013, unless …		P
	… battery pack was tested to K.18.1 a).		P
K.18.1	Risk of fire or electric shock as a result of abnormal operation obviated as far as is practical		P
	No charring or burning of gauze or tissue paper resulted when battery tool and battery pack were subjected to any abnormal operations, tests a) to f)	See Table K.18.1	P
	No explosion during or after the test		P
	Adequate protection against electric shock		P
	Component(s) or conductors(s) that interrupt or limit the discharge current that operated operate during the above tests a) to f) .....:	See Table K.18.1	P
	Test repeated two more times for devices relied upon to pass the test; devices opened the circuit in the same manner		N
	Test repeated with the open-circuited device bridged for devices not relied upon to pass the test		P

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Clause	**Requirement — Test**	**Result - Remark**	**Verdict**
	Protective electronic circuits whose function is relied on to pass a test regarded as providing a SCF and comply with 18.8 with a PL = a	See Table 18.8	N
K.18.8	Li-ion charging systems are covered by K.18.201		P
K.18.201	Risk of fire and explosion as a result of abnormal operation during charging of a lithium-ion battery is obviated as far as is practical		P
	No charring or burning of gauze or tissue paper, no explosion resulted when battery tool and battery pack were subjected to any abnormal conditions a) to d)	See Table K.18.201	P
	The cells did not exceed the upper limit charging voltage by more than 150 mV unless…		P
	…charging system permanently was disabled from recharging the battery		P
	No evident damage to the cell vent to impair compliance with Subclause K.21.202.		P
K.18.202	No risk of fire or explosion when main discharge connections of a series configured, integral Li-ion battery, detachable or separable Li-ion battery pack were shorted under extreme imbalance		P
	All cells fully charged, one cell fully discharged		P
	Main discharge connections of the battery were shorted, resistance ≤10 mΩ		P
	No explosion during or after the test		P
	No charring or burning of the gauze or tissue paper		P
	Component(s) or conductors(s) that interrupt or limit the discharge current that operated operate during the above tests.....:	See Table K.18.202	N
	Test repeated two more times for devices relied upon to pass the test; devices opened the circuit in the same manner		P
	Test repeated with the open-circuited device bridged		N
	Protective electronic circuits whose function is relied on to pass a test regarded as providing a SCF and comply with 18.8 with a PL = a	See Table 18.8	N
K.18.203	No risk of fire or explosion during abusive overcharging of batteries comprised of cells other than the Li-ion type		P
	Battery was charged during 1,25 h at a rate of 10 times the C5 rate for the battery		P
	No explosion during or after the test		P
	No charring or burning of the gauze or tissue paper		P

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Clause	**Requirement — Test**	**Result - Remark**	**Verdict**
K.19.6	Marking with rated no-load speed required, measured no-load speed of the spindle did not exceed 110 % of the rated no-load speed		P
	No-load speed measured after - operated for 5 min at no-load - replacing the battery with a fully charged battery - operating for 1 min at no-load		P
K.19.201	Not possible to install a detachable or separable battery pack in reverse polarity		P
K.19.202	Li-ion battery enclosure designed to safely release gases generated as a result of venting	See Table K.19.202	P
	Total area of the openings in the enclosure allowing gases to pass without obstruction is ≥ 20 mm²; or…		P
	… pressure drop within enclosure was tested, no rupture occurred		P
K.20.1	Battery tools and battery packs have adequate mechanical strength and withstand tests of 20.2 and K.20.3.1 or K.20.3.2 and		P
	- did not catch fire or explode		P
	- met requirements of clauses K.9, K.19 and either K.18.1 (f) or K.28.1 after tests of 20.2 and 28.1		P
	Li-ion battery tools and battery packs, after the test of K.20.3.1 or K.20.3.2, - did not have an open circuit voltage below 90 % of the voltage measured immediately prior to the test		P
	- demonstrated normal discharging and recharging after the test		P
	- showed no damage to the cell vent impairing compliance with K.21.202		P
K.20.3.1	Adequate mechanical strength after drop tests on a concrete surface from a height of 1 m	See Table K.20.3.1	P
	Test repeated with the battery pack removed from the tool		P
	Test repeated on the battery pack by itself		P
	The test was repeated with each attachment or combination of attachments		P
K.20.3.2	Impact test with 50 mm, 0,55 kg smooth steel sphere for battery-operated transportable tools.....	See Table K.20.3.2	P
	travel of the sphere was 1,3 m		P
	Damage (except to a guard) accepted, tool became incapable of normal operation		P
	Test repeated separately on detachable or separable battery packs with a mass ≥3 kg		P

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Clause	**Requirement — Test**	**Result - Remark**	**Verdict**
	Additional drop test on detachable or separable battery packs with a mass <3 kg		P
K.21.17.1.2	The number of cycles is 6 000		N
K.21.201	Tool will not accept general purpose batteries as an energy source for their primary function		P
K.21.202	Venting of lithium-ion cells, if relied on for safety, not adversely obstructed		P
K.21.203	Unsuitable connector types not used for user accessible interfaces between elements of a Li-ion battery system		P
K.23.1.10	Power switches have adequate breaking capacity and present no electrical or mechanical failure		P
	50 cycles of making and breaking the locked output mechanism current		P
K.23.1.201	Power switches withstood, without excessive wear or other harmful effect, the mechanical, electrical, and thermal stresses occurring in normal use		P
	6000 cycles of operation making and breaking the no-load of the tool at a fully charged battery		P
K.23.201	Battery cells comply with IEC 62133		P
K.23.202	Rechargeable battery cells not of lithium-metal type		P
K.24.201	External flexible cable or cord of battery tools with separable battery packs have anchorages such that the conductors are relieved from strain, including twisting, where they are connected within the tool, and protected from abrasion		P
K.28.1	Creepage distances and clearances not less than the values in millimetres shown in Table K.1.....:	See Table 28.1	N
	Smaller clearance and creepage distances for parts of different polarity accepted, shorting of the two parts did not result in the tool starting		N
	For parts with a hazardous voltage between them, the sum total of the measured distances between each of these parts and their nearest accessible surface is not less than 1,5 mm clearance and 2,0 mm creepage (Fig. K.1) .....:		N
	Creepage distances and clearances measured as indicated in Annex A		N
	Distances through slots or openings in external parts of insulating material measured to metal foil in contact with the accessible surface		N
	Foil pushed into corners and the like by means of test probe B of IEC 61032:1997, except not pressed into openings		N

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Clause	**Requirement – Test**	**Result - Remark**	**Verdict**
	The sum total of distances measured between parts operating at hazardous voltage and accessible surfaces determined by measuring the distance from each part to the accessible surface		N
	Distances added together to determine the sum total (see Figure K.1)		N
	One of the distances was 1,0 mm or greater (see Annex A, cases 1 to 10)		N
	Force applied by means of test probe B of IEC 61032:1997 at the following values:		N
	– 2 N for bare conductors		N
	– 30 N for enclosures		N
	Means provided for securing the tool to a support considered to be accessible		N
ANNEX L	**BATTERY TOOLS AND BATTERY PACKS PROVIDED WITH MAINS CONNECTION OR NON-ISOLATED SOURCES**		P
L.1	Rated voltage for battery pack ≤250 V a.c. (single phase) or d.c. mains source and ≤75 V d.c. battery source		P
	Rated voltage for battery pack ≤75 V d.c.		P
L.5.7	Tests to be done at rated voltage were done with a fully charged battery		P
L.5.201	Peak voltage of any superimposed ripple exceeding 10 % of the average value was included		P
L.5.202	Measurements of lithium-ion cell voltages were made using a filter as specified		P
L.5.203	Test area protected against fire and explosion, and well ventilated		P
L.5.204	Discharging and charging as specified		P
L.5.205	Thermocouples for lithium-ion cell temperature measurement located as specified		P
L.5.206	Currents measured during battery charging are average currents		P
L.5.207	Fully charged batteries used, after resting for ≥ 2 h but ≤ 6 h at an ambient temperature of (20 ± 5) °C		P
L.5.208	Battery consisting of a single cell not subject to special preparations of a cell in a series configuration		N
L.5.209	For series arrangement of parallel clusters of cells, the cluster is treated as single cell for specified tests		P
L.5.210	End-of-discharge voltages for common cell chemistries observed .....:		P

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Clause	**Requirement — Test**	**Result - Remark**	**Verdict**
L.8.1	Non-isolated sources that can supply a tool, or tool that can be supplied directly from the mains, marked with as required by the standard:		N
	Rated voltage(s) or voltage range(s), (V) .....:		—
	Symbol for nature of supply or frequency (Hz) .....:		—
	Rated input, (W) or rated current (A).....:		—
	Symbol for class II .....:		—
L.8.3	Tools and detachable or separable battery packs marked with additional information		P
	- Business name and address of the manufacturer and, where applicable, its authorised representative:		—
	- Designation of series or type .....:		—
	Tools also marked with additional information		P
	- Year of manufacture and a date code identifying at least the month of manufacture .....:		—
	- Designation of the tool.....:		—
	- identification for parts shipped separately for assembly by the end user		—
	Detachable or separable battery packs marked with additional information		P
	- capacity in Ah or mAh ..... :		—
	- type of battery.....:		—
	No misunderstanding by additional markings		P
L.8.4	Markings of L.8.1, 8.2 and L.8.3 not on a detachable part of the tool		P
	Markings of 8.2 clearly discernible from outside the tool		P
	Markings of L.8.3 visible with any separable or detachable battery pack removed		P
	Other markings may be visible after removing cover		P
	Indications for switches and controls placed on or in vicinity of components		P
	Not placed on parts which can be repositioned		P
	Not positioned such that making the marking is misleading		P
L.8.14.1.1	5) Battery tool use and care		P
	6) Service		P
L.8.14.2	e) Instructions for battery tools		P

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Clause	**Requirement — Test**	**Result - Remark**	**Verdict**
L.9	Construction and enclosure provide adequate protection against electric shock		P
	Tools connected to the mains or supplied by a non-isolated source.		P
	Tool also evaluated with the battery pack removed when removal without the use of a tool was possible		P
L.9.201	There are no two conductive simultaneously accessible parts where the voltage between them is hazardous, except when provided with protective impedance		N
	Short circuit current between two simultaneously accessible parts (mA) .....:		N
	Capacitance between two simultaneously accessible parts (μF) .....:		N
L.10	Applied only when tool is directly connected to mains, or to a non-isolated source		P
L.11	Applied only when tool is directly connected to mains, or to a non-isolated source		P
	Test on tool capable of charging the battery while performing its function conducted while charging a discharged battery pack		P
L.12	Applied only when tool directly connected to mains, or to a non-isolated source		P
	Test on tool capable of charging the battery while performing its function conducted while charging a previously discharged battery pack with the charger connected		P
	Tool operated at no-load until maximum temperature reached or battery discharged .....:	See Table L.12	P
	Test repeated, allowing the battery pack to charge while the tool was not operating		P
L.12.201	Charging of lithium-ion battery under normal conditions did not exceed specified operating region for charging of the cell		P
	Charging procedure as specified		P
	Voltage, temperature and charging current monitored for all individual cells	See Table L.12.201	P
	Test repeated with imbalanced battery		P
L.13.1	Applied only when tool directly connected to mains, or to a non-isolated source	See Table 13.1	P
	Tool capable of charging the battery while performing its function also evaluated with charger connected to the mains		P

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Clause	**Requirement — Test**	**Result - Remark**	**Verdict**
	Tool also evaluated with battery power alone when more unfavourable temperatures may result		P
L.13.2	Non-metallic parts in of detachable or separable battery pack supporting connections that carry ≥0,2 A during charging and those within a distance of 3 mm, subjected to the glow-wire test at 850 °C	See Table 13.2	P
L.14	Applied only when tool directly connected to mains, or to a non-isolated source		P
L.16	Applied only when tool directly connected to mains, or to a non-isolated source		P
L.17	Applied only when tool directly connected to mains, or to a non-isolated source		P
	Tools not capable of continuous operation operated under battery power for the duration of the test, except evaluated for electric strength with their charger connected		P
L.18	Applied only when tool directly connected to mains, or to a non-isolated source, except L.18.8 and L.18.201 to L.18.204,		P
L.18.8	Applied only to charging systems other than Li-ion		N
L.18.201	Risk of fire or electric shock as a result of abnormal operation obviated as far as is practical		N
	No charring or burning of gauze or tissue paper resulted when battery tool and battery pack were subjected to any abnormal operations, tests a) to f)	See Table L.18.201	N
	No explosion during or after the test		N
	Adequate protection against electric shock		N
	Component(s) or conductors(s) that interrupt or limit the discharge current that operated operate during the above tests a) to f) .....:	See Table L.18.201	N
	Test repeated two more times for devices relied upon to pass the test; devices opened the circuit in the same manner		N
	Test repeated with the open-circuited device bridged		N
	Protective electronic circuits whose function is relied on to pass a test regarded as providing a SCF and comply with 18.8 with a PL = a	See Table 18.8	N
L.18.202	Risk of fire and explosion as a result of abnormal operation during charging of a lithium-ion battery is obviated as far as is practical		P
	No charring or burning of gauze or tissue paper, no explosion resulted when battery tool and battery pack were subjected to any abnormal conditions a) to d)	See Table L.18.202	P

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Clause	**Requirement — Test**	**Result - Remark**	**Verdict**
	The cells did not exceed the upper limit charging voltage by more than 150 mV unless…		P
	…charging system permanently was disabled from recharging the battery		P
	No evident damage to the cell vent to impair compliance with Subclause K.21.202.		P
L.18.203	No risk of fire or explosion when main discharge connections of a series configured, integral Li-ion battery, detachable or separable Li-ion battery pack were shorted under extreme imbalance		P
	All cells fully charged, one cell fully discharged		P
	Main discharge connections of the battery were shorted, resistance ≤10 mΩ		P
	No explosion during or after the test		P
	No charring or burning of the gauze or tissue paper		P
	Component(s) or conductors(s) that interrupt or limit the discharge current that operated operate during the above tests.....:	See Table L.18.203	P
	Test repeated two more times for devices relied upon to pass the test; devices opened the circuit in the same manner		P
	Test repeated with the open-circuited device bridged		P
	Protective electronic circuits whose function is relied on to pass a test regarded as providing a SCF and comply with 18.8 with a PL = a	See Table 18.8	N
L.18.204	No risk of fire or explosion during abusive overcharging of batteries comprised of cells other than the Li-ion type		P
	Battery was charged during 1,25 h at a rate of 10 times the C5 rate for the battery		P
	No explosion during or after the test		P
	No charring or burning of the gauze or tissue paper		P
L.19.201	Not possible to connect a battery pack in reverse polarity		P
L.19.202	Li-ion battery enclosure designed to safely release gases generated as a result of venting	See table L.19.202	P
	Total area of the openings in the enclosure allowing gases to pass without obstruction is ≥ 20 mm^2; or…		P
	… pressure drop within enclosure was tested, no rupture occurred		P
L.20	Applied only when tool directly connected to mains, or to a non-isolated source, except L.20.201 and L.20.202		P

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Clause	**Requirement — Test**	**Result - Remark**	**Verdict**
L.20.201	Battery tools with its battery pack attached have adequate mechanical strength and withstand tests of L.9, L.19, L.28.1 and either L.18.201 f) or L.28.201, and		P
	- did not catch fire or explode		P
	- demonstrated normal discharging and recharging after the test		P
	- showed no damage to the cell vent impairing compliance with L.21.202		P
L.20.202	For hand-held battery tools, L.20.202.1 applies; for transportable battery tools, L.20.202.2 applies		P
L.20.202.1	Adequate mechanical strength after drop tests on a concrete surface from a height of 1 m	See Table L.20.202.1	P
	Test repeated with the battery pack removed from the tool		P
	Test repeated on the battery pack by itself		P
	The test was repeated with each attachment or combination of attachments		P
L.20.202.2	Impact test with 50 mm, 0,55 kg smooth steel sphere for battery-operated transportable tools.....:	See Table L.20.202.2	P
	travel of the sphere was 1,3 m		P
	Damage (except to a guard) accepted, tool became incapable of normal operation		P
	Test repeated separately on detachable or separable battery packs with a mass ≥3 kg		P
	Additional drop test on detachable or separable battery packs with a mass <3 kg		P
L.21	Applied only when tool directly connected to mains, or to a non-isolated source, except L.21.201 and L.21.202		P
L.21.201	Tool will not accept general purpose batteries as an energy source for their primary function		P
L.21.202	Venting of lithium-ion cells, if relied on for safety, not adversely obstructed		P
L.21.203	Unsuitable connector types not used for user accessible interfaces between elements of a Li-ion battery system		P
L.22	Applied only when tool directly connected to mains, or to a non-isolated source		P
L.23	Components		P
L.23.1.10	Applied only to power switches of tools capable of performing their intended operation when connected to the mains or to a non-isolated source		N

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Clause	**Requirement — Test**	**Result - Remark**	**Verdict**
L.23.1.10.201	Switches controlling the primary operating means of the tool, except as indicated in L.23.1.10, have adequate breaking capacity and presented no electrical or mechanical failure		N
L.23.1.10.202	Power switches withstood, without excessive wear or other harmful effect, the mechanical, electrical, and thermal stresses occurring in normal use		P
	6000 cycles of operation making and breaking the no-load of the tool at a fully charged battery		P
L.23.201	Battery cells comply with IEC 62133		P
L.23.202	Rechargeable battery cells not of lithium-metal type		P
L.24.1	Also applied to the flexible cord between a non-isolated power source and the tool		P
L.24.3	Also applied to the flexible cord between a non-isolated power source and the tool		P
L.24.4	This subclause applied, except flexible cord provided between a non-isolated power source and the tool not provided with a plug that can be connected directly to the mains		P
L.24.5	Not applied to flexible cord provided between a non-isolated power source and the tool		P
L.24.20	Requirements of this Subclause applied, except the flexible cord between a non-isolated power source and the tool not provided with an appliance inlet that can allow direct connection to mains		P
L.24.201	External flexible cable and cord have anchorages such that the conductors are relieved from strain, including twisting, where they are connected within the tool, and protected from abrasion		P
L.25	Not applied to interconnecting cords		N
L.26	Applied to the tool directly connected to the mains or to a non-isolated source		P
L.28.1	Applied when tool is directly connected to the mains or to a non-isolated source		P
	Battery packs connected to the tool during the evaluation		P
	Tool also evaluated with the battery pack removed when the removal could be accomplished without the use of a tool		P
	Creepage distances and clearances of IEC 60335-1: 2010 applied as applicable		N
L.28.201	Creepage distances and clearances not less than the values in millimetres shown in Table L.1		N

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Clause	**Requirement – Test**	**Result - Remark**	**Verdict**
	Smaller clearance and creepage distances for parts of different polarity accepted, shorting of the two parts did not result in the tool starting		N
	For parts having a hazardous voltage between them, the sum of the measured distances between each of these parts and their nearest accessible surface is not less than 1.5 mm clearance and 2.0 mm creepage (Fig. L.1)		N
	Creepage distances and clearances measured as indicated in Annex A		N
	Distances through slots or openings in external parts of insulating material measured to metal foil in contact with the accessible surface		N
	Foil pushed into corners and the like by means of test probe B of IEC 61032:1997, except not pressed into openings		N
	The sum total of distances measured between parts operating at hazardous voltage and accessible surfaces determined by measuring the distance from each part to the accessible surface		N
	Distances added together to determine the sum total (see Figure L.1)		N
	One of the distances was 1,0 mm or greater (see Annex A, cases 1 to 10)		N
	Force applied by means of test probe B of IEC 61032:1997 at the following values:		N
	– 2 N for bare conductors		N
	– 30 N for enclosures		N
	Means provided for securing the tool to a support considered to be accessible		N

9.1	**TABLE: Protection against access to live parts**			N/A
Measurement between relevant parts and poles of supply source	Rated voltage U (V)	Measured voltage (V)	Measured current (A)	Measured capacitance (µF)
Supplementary information:				

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Clause	**Requirement — Test**	**Result - Remark**	**Verdict**

11	**TABLE: Input data under no-load conditions**				**N/A**
Input deviation of/at:	**Rated P (W) or I (A)**	**Measured P (W) or I (A)**	**Ratio (%)**	**Required ratio (%)**	**Remark**
				110	
				110	
				110	
Supplementary information:					

12.1A	**TABLE: Temperature rise measurements under the conditions of 12.2 to 12.5**		**P**
	Test voltage (V)..... :	21×1.06	—
	Ambient temperature, t_1 (°C) ..... :	25.0	—
	Ambient temperature, t_2 (°C) ..... :	/	—
	Operating time (min, s)..... :	30	—
	No Load Speed (min^{-1})..... :	/	—
	Input Wattage (W) ..... :	/	—
	Input current (A) ..... :	1	—
	Torque (Nm) ..... :	80%	—

Thermocouple Locations	**Temperature rise measured (°C)**	**Temperature rise limit (°C)**
Stator winding (thermocouple)	/	/
Stator winding (S_1)R-R	/	/
Stator winding (S_2)R-R	/	/
Rotor winding R-R	/	/
Stator Laminations(Motor body)	/	/
Enclosure inside	30.5	77
Enclosure outside	28.9	75
Grip area (i.e. Handle, gear housing)	26.9	--
Brushholder	/	/
Brushholder lead	/	/
Power supply lead	/	/
Internal wiring	30.2	--
Capacitor	31.5	105
Printed circuit board	31.2	130
Switch	29.5	--
Supplementary information:		

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Clause	**Requirement – Test**	**Result - Remark**	**Verdict**

12.1B	**TABLE: Heating test, resistance method**		**N/A**
	Test voltage (V) .....:		**—**
	Ambient, t_1 (°C) .....:		**—**
	Ambient, t_2 (°C) .....:		**—**

Temperature rise of winding	**R_1 (Ω)**	**R_2 (Ω)**	**ΔT measured (K)**	**ΔT Limit (K)**	**Insulation class**
Stator (1)					
Stator (2)					
Rotor (2)					
Supplementary information:					

13.1	**TABLE: Ball Pressure Test of Thermoplastics**		**N/A**
Allowed impression diameter (mm) .....:		2,0	—

Object/ Part No./ Material	Manufacturer / trademark	Test temperature (°C)	Impression diameter (mm)
Supplementary information:			

13.2	**TABLE: Resistance to heat and fire - Glow wire tests**							**P**
Object/ Part No./ Material	**Manufacturer / trademark**	**Glow wire test (GWT); (°C)**						**Verdict**
		550	**650**		**750**		**850**	
			te	**ti**	**te**	**ti**		
Enclosure	/	Y						P

Object/ Part No./ Material	**Manufacturer / trademark**	**Glow-wire flammability index (GWFI), °C**				**GW ignition temp. (GWIT), °C**		**Verdict**
		550	**650**	**750**	**850**	**675**	**775**	

EN 62841-1			
Clause	**Requirement — Test**	**Result - Remark**	**Verdict**

The test specimen passed the glow wire test (GWT) with no ignition [(t_e – t_i) ≤ 2s] (Yes/No) :	Y
If no, then surrounding parts passed the needle-flame test of annex E (Yes/No) ..... :	--
The test specimen passed the test by virtue of most of the flaming material being withdrawn with the glow-wire (Yes/No)? .....:	--
Ignition of the specified layer placed underneath the test specimen (Yes/No) .....:	--
Supplementary information: 550 °C GWT not relevant (or applicable) to parts of material classified at least HB40 or if relevant HBF The GWIT pre-selection option, the 850 °C GWFI pre-selection option, and the 850 °C GWT are not relevant (or applicable) for attended appliances.	

16	**TABLE: Overload Protection of Transformers and Associated Circuits**		N/A
Test voltage.....:			—
Ambient temperature (°C) .....:			—
Input current (A) / Input Wattage (W) ..... :			—
Applied short-circuit or overload ..... :			—
Measurement at:	Temperature rise (K)	Allowed Limit (K)	
Transformer winding (thermocouple)			
Transformer winding (T_1)R-R			
Transformer winding (T_2)R-R			
Transformer Lamination			
Internal wiring			
Capacitor			
Printed circuit board			
SELV circuits			
Supplementary Information:			

18.6.1	**TABLE: Fault Condition Tests**		P
	Ambient temperature (°C) ..... :	24.1	—
	Fuse-link Current (A) ..... :	/	—

EN 62841-1			
Clause	**Requirement — Test**	**Result - Remark**	**Verdict**

Component	Fault Condition	Test Voltage (V)	Test Duration *	Comment/Result Test repeated Yes/No**
U1	Short	21Vdc	30 min	Unit shut down, no hazards.

Supplementary Information:
* Tests were continued until
- a protective device operates, or
- until steady conditions are established or
- an open circuit occurs.

** Test was repeated on a second sample due to an intentionally weak part permanently open-circuited to terminate the test.

18.8.1 R	**TABLE: Performance levels of Safety Critical Functions**		N/A
Type and purpose of SCF	Min. PL determined based on:[1,2]	Min. PL	Actual PL
Power switch – prevent unwanted switch-on for tools with $M_R \leq 25$ Nm measured in accordance with 19.102		a	
Power switch – prevent unwanted switch-on for tools with $M_R > 25$ Nm measured in accordance with 19.102		b	
Power switch – provide desired switch-off for tools with $M_R \leq 25$ Nm measured in accordance with 19.102		b	
Power switch – provide desired switch-off for tools with $M_R > 25$ Nm measured in accordance with 19.102		c	
Power switch – provide desired switch-off for tools that require bracing in accordance with 8.14.1.101.		Shall be evaluated using the fault conditions of 18.6.1 without the loss of this SCF	
Provide desired direction of rotation for tools that do not require bracing in accordance with 8.14.1.101		Not an SCF	
Provide desired direction of rotation for tools that require bracing in accordance with 8.14.1.101		c	
Any electronic control to pass the test of 18.3		a	

EN 62841-1			
Clause	**Requirement — Test**	**Result - Remark**	**Verdict**

For tools with a rated no-load speed of less than 3500 min^{-1}, prevent output speed from exceeding 150 % of rated no-load speed as measured in 19.6		a	
For tools with a rated no-load speed of 3500 min^{-1} or greater, prevent output speed from exceeding 130 % of rated no-load speed as measured in 19.6		a	
Prevent exceeding thermal limits as in 18.4		a	
Prevent self-resetting as required in 23.3 for tools with $M_R \leq 25$ Nm measured in accordance with 19.102		a	
Prevent self-resetting as required in 23.3 for tools with $M_R > 25$ Nm measured in accordance with 19.102		b	
Limit the torque to comply with 19.102		c	
Prevent unwanted lock-on of the power switch function for tools with $M_R \leq 25$ Nm measured in accordance with 19.102		b	
Prevent unwanted lock-on of the power switch function for tools with $M_R > 25$ Nm measured in accordance with 19.102		c	
Supplementary Information: [1] Relevant part of IEC 62841-2, IEC 62841-3 or IEC 62841-4 or; if no such part existent, ISO 13849-1 using Annex E as a guide [2] For safety critical functions not listed in Table 4 of IEC 62841-1 and provided by electronic circuits, PL values were determined using the methods of ISO 13849-1.			

23.1	**TABLE: Critical components information**				P
Object / part No.	**Manufacturer/ trademark**	**Type / model**	**Technical data**	**Standard**	**Mark(s) of conformity[1]**
Overload protector of motor	Interchangeable	Interchangeable	120°C	EN 60730-1 EN 60730-2-22	VDE
Switch	Interchangeable	Interchangeable	AC250V 7.5(6)A,5E4	EN 61058-1	CE
Enclosure material	Interchangeable	Interchangeable	PA	EN 62841-1	Tested with appliance
Battery charger	Interchangeable	TZ-C03AE	Input :100-240V AC , 50Hz,1A Output :DC21V, 1A	EN IEC 62368	CE

EN 62841-1			
Clause	**Requirement – Test**	**Result - Remark**	**Verdict**

Supplementary information:

[1)] Provided evidence ensures the agreed level of compliance. See OD-2039.

24.1	**TABLE: Length of supply cord**			N/A
Manufacturer of Cable	Cable type	Nominal cross-section used (mm²)	Length of supply cord measured (m)	
Supplementary information:				

24.5	**TABLE: Nominal cross-section area of supply cord**			N/A
Rated current (A)[1]:		Current measured during clause 12ff.		Nominal cross-section required per
Manufacturer of Cable	**Cable Type**	**Nominal cross-section used**		
Supplementary information: [1] Current measured during test of clause 12.1, if no current rating marked.				

24.11	**TABLE: Flexing and lifting**				N/A
Weight of tool (kg):		> 10 000 flexings, sample turned about			
Weight attached to cable or cord (kg):		Cord guard slipped out after 10 completed 1 s lifts (Yes/No):			
Manufacturer of Cable	Cable type	No. of strands (total)	No. of strands (broken)	Deviation in %	
Supplementary information:					

24.12	**TABLE: Cord guard**					N/A
Cable manufacturer	Cable type	Overall Ø of cord (mm)	Cord guard length min. (mm)	Cord guard length meas. (mm)	Mass attached (g)	Radius of curvature (mm)
Supplementary information:						

24.13	**TABLE: Cord anchorage**					N/A
Manufacturer of Cable	Cable type	Cord is pulled 25 times at (N)	Cord is twisted for 1 min at (Nm)	Cord damaged	Longitudinal displacement	Conductors movement
Supplementary information: -						

27.1	**TABLE: Torque Test for screws and nuts**	**P**

EN 62841-1			
Clause	**Requirement — Test**	**Result - Remark**	**Verdict**

Threaded part identification	Thread diameter (mm)	Column number (I, II, or III)	Applied torque (Nm)	Number of cycles (5 or 10)
Screw of enclosure	2,8	II	0,5	10
Screw of battery pack	2,8	II	0,5	10
Screw for fixed motor	3,0	II	0,5	10
Supplementary information:				

28.1	TABLE: Clearance And Creepage Distance Measurements					N/A
clearance cl and creepage distance dcr at/of:	**Up (V)**	**U r.m.s. (V)**	**Required cl (mm)**	**cl (mm**	**required dcr (mm)**	**dcr (mm**
Supplementary information:						

28.2	TABLE: Distance Through Insulation Measurements				N/A
Distance through insulation dti at/of:	**U r.m.s. (V)**	**Test voltage (V)**	**Required dti (mm)**	**dti (mm)**	
Supplementary information:					

C.2A	TABLE: Leakage Current of the non-operating tool as per clause 14.1				N/A
Points of application	Test voltage (rated V)	Freq. (Hz)	Selector Switch Position	Allowed leakage current (mA)	Measured leakage (mA)
Supplementary Information:					

C.2B	TABLE: Leakage Current of the non-operating tool as per clause 14.4				N/A
Points of application	Test voltage (rated V)	Freq. (Hz)	Selector Switch Position	Allowed leakage current (mA)	Measured leakage (mA)
Supplementary Information:					

C.3A	TABLE: Leakage Current of the operating tool as per clause 12.1	N/A

EN 62841-1			
Clause	**Requirement — Test**	**Result - Remark**	**Verdict**

Points of application	Test voltage (1.06 X rated V)	Freq. (Hz)	Selector Switch Position (ON/OFF[1])	Allowed leakage current (mA)	Measured leakage (mA)
Supplementary Information:					

C.3B	TABLE: Leakage Current of the operating tool as per clause 14.3				N/A
Points of application	Test voltage (rated V)	Freq. (Hz)	Selector Switch Position (ON/OFF[1])	Allowed leakage current (mA)	Measured leakage (mA)
Supplementary Information:					

C.3C	TABLE: Leakage Current of the operating tool as per clause 18.5.1				N/A
Points of application	Test voltage (rated V)	Freq. (Hz)	Selector Switch Position (ON/OFF[1])	Allowed leakage current (mA)	Measured leakage (mA)
Supplementary Information:					

C.3D	TABLE: Leakage Current of the operating tool as per clause 18.5.4				N/A
Points of application	Test voltage (rated V)	Freq. (Hz)	Selector Switch Position (ON/OFF[1])	Allowed leakage current (mA)	Measured leakage (mA)
Supplementary Information:					

D.2	TABLE: Dielectric Strength		N/A
Test voltage applied between:	**Test during or after clause**	**Test potential applied (V)**	**Breakdown / flashover (Yes/No)**
- windings and metal core of the motor field over **basic insulation**	12.6	1250	
- commutator and metal core of the motor armature over **basic insulation**	12.6	1250	
- metal core and motor armature spindle of the motor armature over **supplementary insulation**	12.6	2500	
- commutator and motor armature spindle over **reinforced insulation**	12.6	3750	

EN 62841-1			
Clause	**Requirement — Test**	**Result - Remark**	**Verdict**

- between live parts and other metal parts over **basic insulation**	14.1	1250	
- between inaccessible metal parts and accessible parts over **supplementary insulation**	14.1	2500	
- between live parts and accessible parts over **reinforced insulation**	14.1	3750	
- accessible metal parts in class I tools and the supply cord wrapped with metal foil	14.1	1250	
- accessible metal parts in class II tools and the supply cord wrapped with metal foil	14.1	1750	
- between live parts and other metal parts over **basic insulation**	14.2.2	1250	
- between inaccessible metal parts and accessible parts over **supplementary insulation**	14.2.2	2500	
- between live parts and accessible parts over **reinforced insulation**	14.2.2	3750	
- live parts and accessible parts over **basic insulation**	14.3	1250	
- live parts and accessible parts over **reinforced insulation**	14.3	3750	
- live parts and accessible parts over **basic insulation**	14.4	1250	
- live parts and accessible parts over **reinforced insulation**	14.4	3750	
- between live parts and other metal parts over **basic insulation**	17.2 and 17.3	937,5	
- between inaccessible metal parts and accessible parts over **supplementary insulation**	17.2 and 17.3	1875	
- between live parts and accessible parts over **reinforced insulation**	17.2 and 17.3	2812,5	
- live parts and accessible parts over **basic insulation**	18.3 and 18.4	1250	
- live parts and accessible parts over **reinforced insulation**	18.3 and 18.4	3750	
- live parts and accessible parts not grounded, if the tool does not operate anymore	18.5.1	1500	
- live parts and accessible parts not grounded, if the tool still operates	18.5.1	2500	
- commutator segments and armature shaft in series motors with class II armature construction	18.5.2	1500	
- live parts and accessible parts not grounded, if any winding is open circuited	18.5.4	1500	
- live parts and accessible parts not grounded, if no windings are open circuited	18.5.4	2500	

EN 62841-1			
Clause	**Requirement — Test**	**Result - Remark**	**Verdict**

- live parts and accessible parts over **basic insulation**	20.2 to 20.4	1250	
- live parts and accessible parts over **reinforced insulation**	20.2 to 20.4	3750	
- between the handles and grasping surfaces in contact with foil and the output shaft of the tool	20.5	1250	
- between live parts and other metal parts over **basic insulation**	21.12	937,5	
- between inaccessible metal parts and accessible parts over **supplementary insulation**	21.12	1875	
- between live parts and accessible parts over **reinforced insulation**	21.12	2812,5	
- shafts of operating knobs, handles, levers etc. and their insulating covering wrapped in metal foil	21.29	1250	
- live parts and accessible parts over **basic insulation**	22.6	1250	
- live parts and accessible parts over **reinforced insulation**	22.6	3750	
- basic insulation	28.2.b)	1250	
- supplementary insulation	28.2.b)	2500	
- reinforced insulation	28.2.b)	3750	
- over insulation protecting from electric shock	K.9.5	750	
Supplementary information:			

K.12.1	**TABLE: Normal Temperature Test for Battery Tool**		**P**
Ambient temperature (°C) .....:		24.5	—
Measurement at:		Temperature rise (K)	Allowed Limit (K)
Enclosure, outside, gripping surface		21.5	40
Enclosure , outside, near motor		27.4	60
Enclosure outside, gear housing		17.8	60
Enclosure, inside, near motor		38.9	Ref.
Enclosure, inside, near heat sink		32.4	80
Internal wiring		12.7	45
Switch body		13.2	30
Supplementary Information: Status of overload protector at end of test [ ] No change [ ] Opened during the Test [ ] N/A			

K.18.1	**TABLE: Battery Tool Abnormal Operation**	P

EN 62841-1			
Clause	**Requirement – Test**	**Result - Remark**	**Verdict**

	Resistance applied (max. 10 mΩ)	Protective device operated during first test?	Test repeated 2 more times with device in place?	Test repeated 1 more time with device bridged?	Explosion, charring or burning of test materials?
a) Terminals of detachable battery pack with exposed terminals shorted	1,2	No	No	Yes	No
b) Motor terminals shorted	0,5	Yes	Yes	Yes	No
c) Motor rotor locked	1,4	Yes	Yes	Yes	No
Supplementary Information:					

K.18.8.1 R	**TABLE: Performance levels of Safety Critical Functions**		**N/A**
Type and purpose of SCF	Min. PL determined based on:[1,2]	Min. PL	Actual PL
Power switch – prevent unwanted switch-on for tools with $M_{R,max} \leq 25$ Nm measured in accordance with 19.102		a	
Power switch – prevent unwanted switch-on for tools with $M_{R,max} > 25$ Nm measured in accordance with 19.102		b	
Power switch – provide desired switch-off for tools with $M_{R,max} \leq 25$ Nm measured in accordance with 19.102		a	
Power switch – provide desired switch-off for tools with $M_{R,max} > 25$ Nm measured in accordance with 19.102		c	
Power switch – provide desired switch-off for tools that require bracing in accordance with 8.14.1.101.		c	
Provide desired direction of rotation for tools that do not require bracing in accordance with 8.14.1.101		Not an SCF	
Provide desired direction of rotation for tools that require bracing in accordance with 8.14.1.101		b	
For tools with a rated no-load speed of less than 3500 min^{-1}, prevent output speed from exceeding 150 % of rated no-load speed as measured in 19.6		a	
For tools with a rated no-load speed of 3500 min^{-1} or greater, prevent output speed from exceeding 130 % of rated no-load speed as measured in 19.6		a	

EN 62841-1			
Clause	**Requirement — Test**	**Result - Remark**	**Verdict**

Prevent self-resetting as required in 23.3 for tools with $M_{R,max} \leq 25$ Nm measured in accordance with 19.102		a	
Prevent self-resetting as required in 23.3 for tools with $M_{R,max} > 25$ Nm measured in accordance with 19.102		b	
Limit the torque to comply with 19.102		c	
Prevent unwanted lock-on of the power switch function for tools with $M_{R,max} \leq 25$ Nm measured in accordance with 19.102		a	
Prevent unwanted lock-on of the power switch function for tools with $M_{R,max} > 25$ Nm measured in accordance with 19.102		c	

Supplementary Information:
[1] Relevant part of IEC 62841-2, IEC 62841-3 or IEC 62841-4 or; if no such part existent, ISO 13849-1 using Annex E as a guide

[2] For safety critical functions not listed in Table 4 of IEC 62841-1 and provided by electronic circuits, PL values were determined using the methods of ISO 13849-1.

K.18.201	**TABLE: Lithium-ion charging systems – Abnormal Conditions**				P
Abnormal conditions	Explosion occurred?	Charring or burning of test materials?	Upper limit charging voltage not exceeded by >150 mV[1)]	Charging system permanently disabled?[2)]	Cell vent damaged?
a) Components in the charging system faulted as in 18.6.1 b) to f)	Yes	Yes	Yes	No	Yes
b) One cell 50% charged in a fully discharged battery	Yes	Yes	Yes	No	Yes
c) Charging of a series configured battery with all cells 50% charged, one cell shorted	Yes	Yes	Yes	No	Yes

Supplementary Information:
One of conditions [1)] or [2)] is sufficient to achieve compliance with this subclause.

L.18.201	**TABLE: Battery Tool Abnormal Operation**			**N/A**
Abnormal conditions	Explosion occurred?	Charring or burning of test materials?	Protector Operated?	Test repeated 3 more times?
a) Terminals of detachable battery pack with exposed terminals shorted				
b) Motor terminals shorted				
c) Motor rotor locked				

EN 62841-1			
Clause	**Requirement — Test**	**Result - Remark**	**Verdict**

d) Cord between battery tool and separable battery pack shorted				
e) Cord provided the tool and the charger shorted				
f) Any two uninsulated parts of opposite polarity in battery tools shorted				
Supplementary Information:				

L.18.202	**TABLE: Lithium-ion charging systems – Abnormal Conditions**				P
Abnormal conditions	Explosion occurred?	Charring or burning of test materials?	Upper limit charging voltage not exceeded by >150 mV[1)]	Charging system permanently disabled?[2)]	Cell vent damaged ?
a) Components in the charging system faulted as in 18.6.1 b) to f)	Yes	Yes	Yes	No	Yes
b) One cell 50% charged in a fully discharged battery	Yes	Yes	Yes	No	Yes
c) Charging of a series configured battery with all cells 50% charged, one cell shorted	Yes	Yes	Yes	No	Yes

EN 62841-1			
Clause	Requirement – Test	Result – Remark	Verdict

Attachment No.1:

ATTACHMENT 1: TO TEST REPORT IEC 62841-1

EUROPEAN GROUP DIFFERENCES AND NATIONAL DIFFERENCES

Electric Motor-Operated Hand-Held, Transportable Tools and Lawn and Garden Machinery - Safety - Part 1: General requirements

Differences according to	:	EN 62841-1:2015 + A11:2022
Attachment Form No.	:	EU_GD_IEC62841_1F
Attachment Originator	:	DEKRA Certification B.V.
Master Attachment	:	2023-05-30

	CENELEC COMMON MODIFICATIONS (EN)		–
8	**Markings and Instructions**		–
8.4	Replace the 2nd paragraph with the following:		–
	Markings specified in 8.2 and 8.3 are clearly discernible from the outside of the tool.		P
	Other markings on the tool may be visible after removal of a cover, provided that the location of the markings is readily accessible.		P
8.14	The words "Original instructions" appear on the language version(s) verified by the manufacturer or his authorised representative.		P
	Where no "Original instructions" exist in the official language(s) of the country where the tool is to be used, a translation into that/those language(s) is provided by the manufacturer or his authorised representative or by the person bringing the tool into the language area in question.		P
	The translations bear the words "Translation of the original instructions", and they are accompanied by a copy of the "Original instructions".		P
8.12	Markings easily legible		P
	Markings withstood durability test: - 15 s with water soaked cloth - 15 s with petroleum spirit soaked cloth		P
	Signs are in contrast to their background, clearly legible from a distance of not less than 500 mm		P
	Effect of normal use taken into account		P
	Adhesive backing durable, meets requirements of Annex ZB or…	See Annex ZB	P
	… withstands specified tests	See tables 8.12 A - D in report covering IEC 62841-1:2014	P

EN 62841-1			
Clause	Requirement – Test	Result – Remark	Verdict
8.14.2 Za)	The noise emission, which is measured in accordance with I.2		P
	A-weighted sound pressure level L_{pA} and its uncertainty K_{pA}, where L_{pA} exceeds 70 dB(A) L_{pA} [dB(A)] : K_{pA} [dB(A)] :	L_{pA}: 43.2 dB K_{pA}:3dB	P
	Where L_{pA} does not exceed 70 dB(A), this fact is indicated		P
	A-weighted sound power level L_{WA} and its uncertainty K_{WA}, where the A-weighted sound pressure level L_{pA} exceeds 80 dB(A); L_{WA} [dB(A)] : K_{WA} [dB(A)] :	K_{WA}: 50.2 dB K_{WA}:3dB	P
	peak C-weighted instantaneous sound pressure value LpCpeak, where this exceeds 63 Pa (130 dB in relation to 20 µPa) L_{pCpeak} (dB) : K_{pCpeak} (dB) :	$L_{pCpeak:}$ 89.3 dB K_{pCpeak}: 8 dB	P
	The vibration total value and its uncertainty which is measured in accordance with I.3.		P
	When the vibration total value exceeds 2,5 m/s², its value is given in the instructions. Work mode - vibration emission value a (m/s²)….: Uncertainty K (m/s²)……..:		N
	When the vibration total value does not exceed 2,5 m/s², this is stated.		P
	Information that the declared vibration total value has been measured in accordance with a standard test method and may be used for comparing one tool with another		P
	Information that the declared vibration total value may also be used in a preliminary assessment of exposure.		P
	A warning that the vibration emission during actual use of the power tool can differ from the declared total value depending on the ways in which the tool is used		P
	A warning of the need to identify safety measures to protect the operator that are based on an estimation of exposure in the actual conditions of use (taking account of all parts of the operating cycle such as the times when the tool is switched off and when it is running idle in addition to the trigger time).		P

18	**Abnormal operation**	P

EN 62841-1			
Clause	Requirement – Test	Result – Remark	Verdict
18.8.1	In Table 4, replace the table footnote by the following: * Performance levels are to be specified in the relevant part of EN 62841-2, EN 62841-3 or EN 62841-4.		P
	Delete the 5th paragraph and the subsequent NOTE 3.		P

21	**Construction**		**–**
21.18.1	delete the 2nd paragraph.		P
21.18.1.Z1	Unless hand-held tools are equipped with a momentary power switch without lock-on device, voltage recovery following an interruption of the supply do not give rise to a hazard.		P
	The relevant part of EN 62841-2 specifies if this subclause applies and gives specific requirements.		P
21.18.2.1	Unless transportable tools are equipped with a momentary power switch without lock-on device, voltage recovery following an interruption of the supply do not give rise to a hazard.		P
	The relevant part of EN 62841-3 specifies if this subclause applies and gives specific requirements.		P
21.Z1	Noise reduction of tools as an integral part of the design process achieved by particularly applying measures at source to control noise, such as example EN ISO 11688-1:2009		P
	Success of the applied noise reduction measures assessed based on the actual noise emission values, measured in accordance with I.2, in relation to other machines of the same type with comparable non acoustical technical data		P
21.Z2	Vibration at the handles kept as low as possible without unduly affecting the performance or the ergonomics (weight, handling, etc.) of the tool.		P
	Vibration reduced by the application of engineering measures as given in CR 1030-1:1995		P
	Success of the applied vibration measures is assessed by comparing the vibration levels for the tool, measured in accordance with I.3, with those for other tools of the same type and with a comparable specification and performance.		P

ANNEX E	**Methods of applying ISO 13849-1 to power tools**		**–**
	(Void)		--

ANNEX I	**Measurement of noise and vibration emissions**	**–**

EN 62841-1			
Clause	Requirement – Test	Result – Remark	Verdict
	Replace the title of Annex I by the following **Annex I – (normative)**		P
I.2	Noise test code (grade 2)		P
I.2.Z1	Noise reduction	See 21.Z1	–
I.2.1	General		–
	The noise emission determined by using a machine which has design and technical specifications replicating the machine concerned.		P
	The overall noise can be divided into the pure machine noise and the noise generated from the processed workpiece.		P
	The load conditions for particular tools are therefore specified in the relevant part of IEC 62841-2, IEC 62841-3 or IEC 62841-4.		P
I.2.2	Sound power level measured according to ISO 3744		P
I.2.2.2	Hand-held power tools		P
	For all hand-held power tools, the sound power level is determined by using a hemispherical / cylindrical measurement surface according to Figure I.2.		P
I.2.2.3	For all transportable power tools, the sound power level is determined by using a cubic measurement surface according to Figure I.3.		N
I.2.2.4	The sound power level of lawn and garden machinery is determined as specified in the relevant part of IEC 62841-4.		P
I.2.3	Emission sound pressure level determination		–
I.2.3.1	The A-weighted emission sound pressure level of hand-held tools at the work station LpA according to ISO 11203:2009 with LpA = L_{WA} −Q , in dB where Q = 8, in dB.		P
	If required, LpCpeak is measured at each of the five measurement positions specified in I.2.2		P
I.2.3.2	The A-weighted emission sound pressure level of transportable tools at the work station, LpA, is determined according to ISO 11201, grade 2.		P
	If required, the C-weighted peak emission sound pressure level LpCpeak is measured at the same operator's position as the A-weighted sound pressure level LpA.		P
I.2.3.3	The emission sound pressure level of lawn and garden machinery is determined as specified in the relevant part of IEC 62841-4.		P
I.2.4	Installation and mounting conditions of the power tools during noise tests		–

EN 62841-1			
Clause	Requirement – Test	Result – Remark	Verdict
	The power tool under test is new and equipped with accessories which affect the acoustic properties, as recommended by the manufacturer.		N
	Prior to commencing testing, the power tool (including any required ancillary equipment) is set up in a stable condition in accordance with the manufacturer's instructions for safe use.		P
	A hand-held tool is held by the operator or suspended in such a way as to correspond to normal use, as specified in the relevant part of IEC 62841-2		P
	A transportable tool is so positioned, either placed on the test bench of Figure I.1		N
	Lawn and garden machinery is used and positioned as specified in the relevant part of IEC 62841-4.		P
I.2.5	Operating conditions		–
	Tools are tested under the two operating conditions "no-load" or "load" as appropriate for the type of tool and specified in the relevant part of IEC 62841-2, IEC 62841-3 or IEC 62841-4.		P
I.2.6	Measurement uncertainties		–
	Uncertainties according to standard determined, recorded and reported		P
I.2.7	Information and deviations are recorded.		P
I.2.8	Information to be reported		P
	- reference to this noise test code / basic standard		P
	- description of the power tool;		P
	- description of mounting and operating conditions		P
	Sound power level L_{WA} (dB(A))….....:		P
	Sound pressure level L_{PA} (dB(A))….....:		P
	C-weighted peak emission sound pressure level L_{pCpeak} (dB).....:		P
I.2.9	Declaration and verification of noise emission values		P
	Sound power level L_{WA} (dB(A))….....:	60 dB	P
	Sound pressure level L_{pA} (dB(A))….....:	65 dB	P
	C-weighted peak emission sound pressure level L_{pCpeak} (dB).....:	100 dB	P
I.3	Vibration		–
I.3.Z1	Vibration reduction	See 21.Z2	P
I.3.1	Vibration measurement – General		P

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Clause	Requirement – Test	Result – Remark	Verdict
	Details for particular types of tools are given in the relevant part of IEC 62841-2, IEC 62841-3 or IEC 62841-4.		P
	The vibration total value may be determined by using the measurements from a machine which has design and technical specifications replicating the machine concerned.		P
I.3.2	Symbols		P
I.3.3	Characterization of vibration		P
I.3.3.1	Direction of measurement		P
	Directions may be defined in the relevant part of IEC 62841-2, IEC 62841-3 or IEC 62841-4.		P
	If not defined the three orthogonal directions X, Y and Z as shown in Figure I.4. are related		P
I.3.3.2	Location of measurement		P
	The measurement positions for particular types of tools are specified in the relevant part of IEC 62841-2, IEC 62841-3 or IEC 62841-4.		P
I.3.3.3	Magnitude of vibration		P
I.3.3.4	Combination of vibration directions		P
I.3.4	Instrumentation requirements		P
	The vibration measurement equipment is in accordance with ISO 8041.		P
	Instrumentation for measuring other parameters whose characteristics are not covered by ISO 8041, is specified in the relevant part of IEC 62841-2, IEC 62841-3 or IEC 62841-4.		P
I.3.4.2	Transducers		N
I.3.5	Testing and operating conditions of the tool		P
I.3.5.1	Replace the 4th paragraph with the following:		P
	When the test procedure is not provided in a relevant part of EN 62841-2, EN 62841-3 or EN 62841-4, an operating condition is specified that is reproducible and representative of the noisiest operation in typical usage of the machine.		P
	The vibration test may simulate a single phase of a task or a working cycle, consisting of a set of operations where the operator is being exposed to vibration.		P
	However, the operating condition for the noise emission test is, if practicable, also used for the vibration test.		P
I.3.5.2	Attachment, workpiece and task		P

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Clause	Requirement – Test	Result – Remark	Verdict
	Details for task and workpiece are given in the relevant part of IEC 62841-2, IEC 62841-3 or IEC 62841-4.		P
I.3.5.3	Operating conditions		P
	The relevant part of IEC 62841-2, IEC 62841-3 or IEC 62841-4 describes the modes of operation and the calculation of the declared emission value.		P
I.3.5.4	Operator		P
I.3.6	Measurement procedure and validity		P
I.3.6.1	Reported vibration values		P
	Details are specified in the relevant part of IEC 62841-2, IEC 62841-3 or IEC 62841-4.		P
	Work mode - vibration emission value a (m/s^2)….:		P
	Uncertainty K (m/s^2)……...:	1 m/s^2	P
I.3.6.2	Declaration of the vibration total value		P
	If required by the relevant part of IEC 62841-2, IEC 62841-3 or IEC 62841-4, the work mode description corresponding to the vibration emission is stated next to each declared value.		P
	Work mode - vibration emission value a (m/s^2)….:		P
	Uncertainty K (m/s^2)……...:	1 m/s^2	P
I.3.7	Measurement report		P
	The report includes the following information:		P
	a) reference to this standard		P
	b) specification of the machine		P
	c) attachments or accessories;		P
	d) operating and testing conditions		P
	e) measuring institution		P
	f) date of measurement		P
	g) instrumentation		P
	h) position and fastening of transducers, measuring directions and individual vibration values when relevant		P
	i) the arithmetic mean total vibration ah, for each operator the total vibration value ahv and the three single axes weighted acceleration values ahw. It is good practice to report all the measured values		P
	j) the uncertainty K of the vibration total value ah.		P

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Clause	Requirement – Test	Result – Remark	Verdict
	Any deviations from the vibration test code in this standard is reported together with the technical justification for such deviations.		P

ANNEX K	**Battery tools and battery packs**		**P**
K8.14.2 Z1	For battery tools with integral battery: instruction, how the integral battery can be removed safely from the tool after the tool's end of life, and information about the type of battery such as Li-Ion, NiCd and NiMH.		P

ANNEX L	**Battery tools and battery packs provided with mains connection or non-isolated sources**		**P**
K8.14.2 Z1	For battery tools with integral battery: instruction, how the integral battery can be removed safely from the tool after the tool's end of life, and information about the type of battery such as Li-Ion, NiCd and NiMH.		P
ANNEX ZB	**Durability requirements for adhesive labels**		**–**
ZB.1	This annex covers adhesive-attached labels for use as permanent nameplates or markers		P
ZB.2	Performance		–
ZB.2.1	Labels applied or bonded to representative test surfaces and exposed to the applicable conditions described in ZB.5 show permanence and legibility as per Table ZB.1.		P
	Visual examination The labels are viewed with normal vision from a distance of (500 ± 50) mm		P
	A label shall adhere to the test surface without any significant curling or loosening around the perimeter greater than 10 % of the label area, or other indication of loss of adhesion such as wrinkles or bubbles. It shall not excessively craze, shrink more than 10 % of the label area or slip from its original position on the test panel more than 5 mm.		P
	Overlamination, if present, shows no separation, excessive darkening or shrinkage of more than 10 % of the label area		P
	Printing legible, no significant deterioration of legibility such as fading or bleeding; significant change in print colours to be noted		P

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Clause	Requirement – Test	Result – Remark	Verdict
	Legibility test Printed surfaces of labels are rubbed with thumb or finger back and forth ten times with a downward force of approximately 18 N and then examined for legibility as in the visual examination.		P
	Subsurface printed labels and labels in which printing is protected by an overlamination are not subject to the legibility test		P
	Printing legible, no significant deterioration or blurring of legibility		P
	Defacement test Labels are scraped back and forth ten times across printed areas and edges, with a downward force of between 7,2 N and 9 N using the edge of a 1,65 mm to 2,5 mm thick steel blade held at a right angle to the test surface, the portion of the blade contacting the test surface having a radius of curvature of 25 mm to 33 mm and the edges of the blade being rounded to a radius of 0,41 mm ± 0.08 mm		P
	Label, including overlamination or overprint coating, if present, remains in place and is not torn, uplifted, or otherwise damage		P
	Scratching or defacement of unprotected printing, either text or background, is not considered a noncompliance.		P
	Adhesion test (see ZB.6) Test conducted if it is possible to remove test strips from surfaces		P
	If removal as described in ZB.6 is not possible because of breaking, tearing, or excessive rigidity of the label material, adhesion is determined by attempting to remove the entire sample by hand.		P
	Average quantitative adhesion value not less than 0,088 N/mm width at any point		P
	Adhesion not less than 0,0175 N/mm at any point		P
	In case it is not possible to separate test strips from the surface, sample shows good adhesion to the surface when removal by hand is attempted		P
ZB.2.2	If after any exposure condition the test surface excessively warps, bubbles, deteriorates, melts, chips, or otherwise renders it impossible to determine compliance of the **label** with the requirements of this Annex, the evaluation of the sample applied to the test surface is considered to be inconclusive.		P

EN 62841-1			
Clause	Requirement – Test	Result – Remark	Verdict
ZB.2.3	Samples are representative of the construction of the label to be tested. Significant construction variables such as top-surface or subsurface printing; top coating; face stock; overlamination or adhesive thickness range; partial adhesive coverage; differing types or colours of similar face stock or adhesive (for example, clear, pigmented, or metallized); and alternative printing processes and inks (including floodcoating for subsurface printed constructions) are represented in the samples provided.		P
ZB.2.4	The minimum recommended sample size is 50 mm × 50 mm		P
ZB.3	Test surfaces		–
ZB.3.1	Test surface panels provided for each material on which the samples are to be tested		P
	Panels are essentially flat, smooth, and rigid, and measure approximately 75 mm x 280 mm		P
	Larger panels that can be cut, or smaller panels, if sufficient in number, may be used.		P
	If samples are investigated for use on a curved surface, curved surfaces or tubing of representative radius are provided.		N
	When samples are investigated for use on a textured surface, panels of the specific textured surface are provided.		P
ZB.3.2	Test surfaces is cleaned as described in ZB.3.3 to ZB.3.4, before the samples are applied		P
ZB.3.3	Test panel is repeatedly wiped with cheesecloth (bleached cotton gauze) dampened with denatured ethyl alcohol or isopropanol until it appears clean; surface then wiped once more, with the dampened cheesecloth turned to expose a clean area, and then allowed to dry in air for at least 1 min		P
ZB.3.4	If alcohol affects the surface or is not considered the solvent of choice for a particular test surface:		P
	– An alternative solvent that does not affect the surface or leave a film is used; or		N
	– A detergent and water solution is used, after which the surface is thoroughly rinsed with demineralized water, wiped with clean dry cheesecloth, and allowed to dry in air for 1 h		P
ZB.4	Application of labels to surfaces		–
ZB.4.1	Two or more samples of a particular construction are applied to one or more panels of a test surface material for each exposure.		P
	Separate panels used for each exposure; number of samples applied to a panel may vary, depending upon sample size, and panel size		P

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Clause	Requirement – Test	Result – Remark	Verdict
ZB.4.2	Samples applied to the test surface panels are stored at (23 ± 5) °C and a relative humidity of 50 % ± 20 % until they are subjected to the applicable exposure conditions.		P
ZB.5	Exposure conditions		–
ZB.5.1	Labels subjected to each of the conditions given in Table ZB.2: – 72 h in a standard atmosphere (as received); – 24 h in a standard atmosphere followed by immersion in demineralized water for (48 ± 0,5) h at (23 ± 2) °C (water immersion); – 24 h in a standard atmosphere followed by (240 ± 1) h in an air-circulating oven at the test temperature corresponding to the maximum temperature rating (elevated temperature); – 24 h in a standard atmosphere followed by (7 ± 0,25) h in a cold box maintained at the temperature (±2) °C corresponding to the minimum temperature rating (low temperature)		P
ZB.5.2	Test temperatures applicable to the maximum temperature rating are given in Table ZB.3 :		–
ZB.5.3	Labels are conditioned for at least 24 h in a standard atmosphere of (23 ± 2) °C and a relative humidity of 50 % ± 10 %		P
	Samples are then immersed in IRM903 lubricating oil for (48 ± 0,5) h		P
	After being immersed, samples are evaluated in accordance with the water immersion exposure in Table ZB.2 for compliance with the requirements in Table ZB.1 except that label panels removed from the lubricating oil are permitted to drain up to 5 min before being evaluated		P
	When exposure to the oil should be avoided, the legibility test (see Table ZB.1) is conducted using a thin, smooth-surfaced latex or nitrile rubber glove		P
Z.6	Adhesion test		–
	Samples tested as specified		P

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Pictures

Fig.1

Fig.2

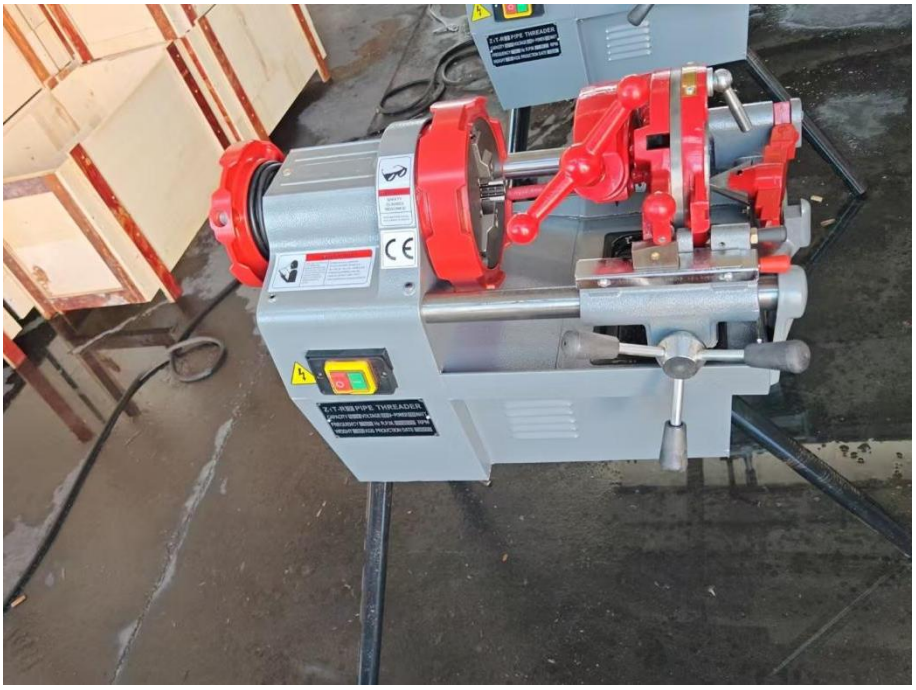

Fig.3

Fig.4

Fig.5

Fig.6

===End of the report===