

INTERNATIONAL STANDARD

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**Electric motor-operated hand-held tools, transportable tools and lawn and garden machinery – Safety –
Part 2-1: Particular requirements for hand-held drills and impact drills**

**Outils électroportatifs à moteur, outils portables et machines pour jardins et pelouses – Sécurité –
Partie 2-1: Exigences particulières pour les perceuses portatives et les perceuses à percussion**



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INTERNATIONAL STANDARD

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Electric motor-operated hand-held tools, transportable tools and lawn and garden machinery – Safety –
Part 2-1: Particular requirements for hand-held drills and impact drills

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Partie 2-1: Exigences particulières pour les perceuses portatives et les perceuses à percussion

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

ELECTRIC MOTOR-OPERATED HAND-HELD TOOLS, TRANSPORTABLE TOOLS AND LAWN AND GARDEN MACHINERY – SAFETY –**Part 2-1: Particular requirements for hand-held drills and impact drills****FOREWORD**

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International Standard IEC 62841-2-1 has been prepared by IEC technical committee 116: Safety of motor-operated electric tools.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
116/321/FDIS	116/330/RVD

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

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

This Part 2-1 is to be used in conjunction with the first edition of IEC 62841-1 (2014).

This Part 2-1 supplements or modifies the corresponding clauses in IEC 62841-1, so as to convert it into the IEC Standard: Particular requirements for hand-held drills and impact drills.

Where a particular subclause of Part 1 is not mentioned in this Part 2-1, that subclause applies as far as relevant. Where this standard states “addition”, “modification” or “replacement”, the relevant text in Part 1 is to be adapted accordingly.

The following print types are used:

- requirements: in roman type;
- *test specifications: in italic type;*
- notes: in small roman type.

The terms defined in Clause 3 are printed in **bold typeface**.

Subclauses, notes and figures which are additional to those in Part 1 are numbered starting from 101.

A list of all parts of the IEC 62841 series, under the general title: *Electric motor-operated hand-held tools, transportable tools and lawn and garden machinery – Safety*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific document. At this date, the document will be

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

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It is the recommendation of the committee that the content of this publication be adopted for implementation nationally not earlier than 36 months from the date of publication.

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ELECTRIC MOTOR-OPERATED HAND-HELD TOOLS, TRANSPORTABLE TOOLS AND LAWN AND GARDEN MACHINERY – SAFETY –

Part 2-1: Particular requirements for hand-held drills and impact drills

1 Scope

This clause of Part 1 is applicable, except as follows:

Addition:

This part of IEC 62841 applies to hand-held **drills** and **impact drills**, including **diamond core drills**. This standard also applies to **drills** that can be used for driving screws by attaching screwdriver bits.

This standard does not apply to rotary hammers, even if they can be used as a **drill**.

NOTE 101 Rotary hammers are covered by IEC 62841-2-6.

2 Normative references

This clause of Part 1 is applicable, except as follows:

Addition:

ISO 185:2005, *Grey cast irons – Classification*
<https://standards.iteh.ai/catalog/standards/sist/be69c4da-5046-4018-b342-387a0dee59a8/iec-62841-2-1-2017>

ISO 630-2:2011, *Structural steels – Part 2: Technical delivery conditions for structural steels for general purposes*

3 Terms and definitions

This clause of Part 1 is applicable, except as follows:

Additional definitions:

3.101

drill

tool equipped with either a typical three jaw chuck or a machine taper, specifically designed to bore holes in various materials such as metal, plastics, wood, etc.

Note 1 to entry: Besides drill bits, it is possible that other **accessories** such as bits for deburring and screwdriving are used with **drills**.

3.102

impact drill

tool equipped with a chuck specifically designed to bore holes in concrete, stone and other materials, being similar in appearance and construction, to a **drill**, but which has a built-in percussion system which gives an axial percussion movement to rotating output spindle

Note 1 to entry: Some **impact drills** have a device for rendering the percussion system inoperative, so that they can be used as a conventional **drill**.

Note 2 to entry: Besides drill bits, it is possible that other **accessories** such as bits for deburring and screwdriving are used with **impact drills**.

3.103**diamond core drill**

drill or **impact drill** designed to be equipped with a diamond core drill bit with or without a **liquid system** to drill into materials such as concrete or brick, see Figure I.103

4 General requirements

This clause of Part 1 is applicable.

5 General conditions for the tests

This clause of Part 1 is applicable, except as follows:

5.17 Addition:

The mass of the tool includes the drill chuck and the auxiliary handle, if any.

6 Radiation, toxicity and similar hazards

This clause of Part 1 is applicable.

7 Classification

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This clause of Part 1 is applicable.

8 Marking and instructions

[IEC 62841-2-1:2017](https://standards.iteh.ai/catalog/standards/sist/be69c4da-5046-4018-b342-387a0dee59a8/iec-62841-2-1-2017)

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This clause of Part 1 is applicable, except as follows:

8.1 Addition:

Drills and **impact drills** shall be marked with the following:

- **rated no-load speed.**

8.3 Addition:

Chucks of **drills** and **impact drills** shall be marked with the maximum capacity of the chuck.

8.14.1 Addition:

The additional safety instructions as specified in 8.14.1.101 shall be given. This part may be printed separately from the “General Power Tool Safety Warnings”.

8.14.1.101 Drill safety warnings**1) Safety instructions for all operations**

- Wear ear protectors when impact drilling.** *Exposure to noise can cause hearing loss.*

NOTE 1 The above warning applies only to **impact drills** and is omitted for **drills**.

- Use the auxiliary handle(s).** *Loss of control can cause personal injury.*

NOTE 2 The above warning applies only to tools that are provided with auxiliary handle(s).

- c) **Brace the tool properly before use.** *This tool produces a high output torque and without properly bracing the tool during operation, loss of control may occur resulting in personal injury.*

NOTE 3 The above warning applies only for tools with a maximum output torque greater than 100 Nm measured in accordance with 19.102.

- d) **Hold the power tool by insulated gripping surfaces, when performing an operation where the cutting accessory may contact hidden wiring or its own cord.** *Cutting accessory contacting a "live" wire may make exposed metal parts of the power tool "live" and could give the operator an electric shock.*

NOTE 4 For **drills** that can also be used as screwdrivers, the words "or fasteners" are added after "cutting accessory".

2) Safety instructions when using long drill bits

- a) **Never operate at higher speed than the maximum speed rating of the drill bit.** *At higher speeds, the bit is likely to bend if allowed to rotate freely without contacting the workpiece, resulting in personal injury.*
- b) **Always start drilling at low speed and with the bit tip in contact with the workpiece.** *At higher speeds, the bit is likely to bend if allowed to rotate freely without contacting the workpiece, resulting in personal injury.*
- c) **Apply pressure only in direct line with the bit and do not apply excessive pressure.** *Bits can bend causing breakage or loss of control, resulting in personal injury.*

8.14.2 a) Additional items:

- 101) For **diamond core drills**: maximum diamond core bit diameter;
- 102) For tools with a maximum output torque greater than 100 Nm measured in accordance with 19.102: instructions on how to brace the tool;
- 103) For applications which produce a considerable amount of dust, such as impact and diamond core drilling: instruction on how to collect the dust.

9 Protection against access to live parts

This clause of Part 1 is applicable.

10 Starting

This clause of Part 1 is applicable.

11 Input and current

This clause of Part 1 is applicable.

12 Heating

This clause of Part 1 is applicable, except as follows:

12.2.1 Replacement:

Drills and impact drills are operated continuously until thermal equilibrium is reached with the impact mechanism, if any, disengaged, while the torque applied to the spindle is 80 % of the torque necessary to attain **rated input** or **rated current**.

12.5 Addition:

For **impact drills**, the temperature-rise limit specified for the external enclosure does not apply to the enclosure of the impact mechanism.

13 Resistance to heat and fire

This clause of Part 1 is applicable.

14 Moisture resistance

This clause of Part 1 is applicable.

15 Resistance to rusting

This clause of Part 1 is applicable.

16 Overload protection of transformers and associated circuits

This clause of Part 1 is applicable.

17 Endurance

This clause of Part 1 is applicable, except as follows:

17.2 Replacement for **impact drills**:

[IEC 62841-2-1:2017](https://standards.iteh.ai/catalog/standards/sist/be69c4da-5046-4018-b342-38fa0cc92a8/iec-62841-2-1-2017)

An **impact drill** is operated intermittently with no-load and, if the impact mechanism can be engaged and disengaged at will, the impact mechanism shall remain disengaged 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. The speed is adjusted to the highest value of the highest range.

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.

During the test, the tool is placed in three different positions, the operating time, at each voltage, being approximately 4 h for each position.

NOTE 101 The change of position is made to prevent abnormal accumulation of carbon dust in any particular place. Examples of the three positions are horizontal, vertically up and vertically down.

The same tool is then mounted vertically in a test apparatus. The apparatus is designed to apply sufficient axial force to the tool, through a resilient medium that absorbs impacts and vibration, to ensure steady operation of the impact mechanism. An example of a test apparatus is shown in Figure 101. The tool is then operated at **rated voltage** for four periods of 6 h each, the interval between these periods being at least 30 min; if the impact mechanism can be engaged and disengaged at will, the impact mechanism shall remain engaged.

During these tests, the tool is operated intermittently, each cycle comprising a period of operation of 30 s and a rest period of 90 s during which the tool remains switched off.

The tool may be switched on and off by means of a switch other than that incorporated in the tool.

*During these tests, 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.*

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.

During these tests, overload protection devices incorporated in the tool shall not activate.

NOTE 102 Monitoring of external temperatures will help avoid mechanical failures.

18 Abnormal operation

This clause of Part 1 is applicable, except as follows:

18.8 Replacement of Table 4:

Table 4 – Required performance levels

Type and purpose of SCF	Minimum performance level (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	b
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.	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
Prevent output speed from exceeding 130 % of rated no-load speed without accessories mounted	a
Prevent exceeding thermal limits as in 18.4	a
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	b
Prevent unwanted lock-on of the power switch function for tools with $M_{R,max} > 25$ Nm measured in accordance with 19.102	c

19 Mechanical hazards

This clause of Part 1 is applicable, except as follows:

19.1 Addition:

*The test with probe B of IEC 61032:1997 does not apply to the chuck and any **accessory** that may be inserted.*

19.101 Chuck keys shall be so designed that they drop out of position when released. This requirement does not exclude the provision of clips for holding the key in place when not in use; metal clips fixed to the flexible cable or cord are not allowed.

Compliance is checked by inspection and manual test.

The key is inserted in the chuck and, without tightening, the tool is turned such that the key is facing down. The key shall fall out within 2 s.

19.102 Handles

19.102.1 General

The design of the handle(s) shall be such that the operator can control the static stalling torque during the operation of the tool. Depending on the handle design, the stalling torque shall not exceed the relevant maximum values as indicated in Figures 104 to 107.

Figure 102 illustrates, for various handle designs, the location “S” where the operator naturally grasps the **power switch**. For **power switch** designs without a natural grasping location, “S” shall indicate the least favourable position on the **power switch** for the reactionary torque measurement. This location “S” is used in Figures 104 to 107 to determine the moment arm for the torque calculation.

Figure 103 illustrates, for various auxiliary handle with flange designs, the location “F” where the operator naturally grasps the handle at the flange. This location “F” is used in Figures 106 and 107 to determine the moment arm for the torque calculation.

Compliance is checked by the tests specified in 19.102.2 and 19.102.3 and by the calculations in Figures 104 to 107.

19.102.2 Test equipment

The test equipment used for the test of 19.102.3 shall meet the following requirements a) to g):

- a) The torque transducer and the rotational angle sensor shall continuously monitor the torque and the rotation produced by the output spindle of the tool during the test of 19.102.3.
- b) The output of the torque transducer shall be connected to an oscilloscope or other data acquisition equipment capable of displaying the torque vs. time graph of the tool's output during the test of 19.102.3.
- c) The torque transducer shall be rated to measure a torque of at least 150 % of the static stalling torque of the tool or slip torque of an overload clutch (M_R) with a measurement accuracy of ± 1 %.
- d) The rotational angle shall be measured with an accuracy of $\pm 2^\circ$.
- e) The data acquisition equipment used for measuring the torque signal during the test shall have a sampling rate of at least 15 kHz, but the bandwidth shall be limited by a first order low pass filter with a cut-off frequency of $(1 \pm 0,1)$ kHz to minimise the effect of transients.

- f) The joint that is connected to the tool during the test shall be capable of stalling the tool over a rotational angle of 30° to 60°. The joint that fulfils this requirement shall be a torsional element or other such device that remains in equilibrium during the test.
- g) A regulated power supply that is connected to the tool during the test shall be capable of providing the **rated voltage** and **rated frequency** provided on the tool's nameplate (e.g. 120 V AC, 60 Hz). It shall also be suitably sized such that the voltage drop during the test shall not deviate from the **rated voltage** or the upper limit of the **rated voltage range** by more than 7 %.

Compliance is checked by inspection and by measurement.

19.102.3 Test procedure

Prior to the test, the sample is operated for at least 5 min at no-load.

All measurements are made with the tool sample running in the forward position.

The sample is connected to the measurement fixture and is fixed during the test. The measurement is conducted by using seven trial measurements of the same sample, each trial conducted as follows

- 1) *Energize the tool to the full "on" position as quickly as possible and allow the joint to be tightened until it comes to a complete stop.*
- 2) *Record the measured output torque.*
 - a) *For tools without a mechanical overload clutch, the output torque is determined by either i) or ii):*
 - i) *For signals that are stable for a minimum of 2 ms after the initial peak (if present), the output torque value is determined by measuring over the stable region for an interval T not exceeding 100 ms. If there is variation during this interval, the average value shall be used. See Figure 108.*
 - ii) *For signals that are not stable for a minimum of 2 ms after the initial peak, the output torque value shall be the r.m.s. value of the signal over the rotation from off until peak torque is achieved. See Figure 109.*

*If the tool employs an **electronic circuit(s)** that affects the output torque in the above test, the output torque shall be either:*

- *when all functions affecting the output torque are considered **SCFs** and are evaluated according to 18.8, the applicable value of i) or ii) above with all functions affecting the output torque enabled; or*
- *when all functions affecting the output torque are not evaluated as **SCFs** according to 18.8, the greatest applicable value of i) or ii) above with*
 - *all functions affecting the output torque enabled;*
 - *each function affecting the output torque disabled, tested for one trial. If the output torque is greater than the value with all functions enabled, the test resulting in the greatest output torque value is conducted for an additional two trials, where each trial may use a new sample.*

NOTE 1 Torque signals can exhibit a transient peak with a relatively stable signal following the peak. The stable signal can exhibit relatively slow change due to, for example, heating of the windings. The stable signal can also exhibit periodic signal variation due to torque ripple. Averaging over this stable period provides a meaningful torque value. The transient peak and the stable region are not always present.

- b) *For tools with a mechanical overload clutch:*

The output torque is determined by the peak value of the first peak that occurs after starting the trial. Later peaks, even if they appear to have greater values, are not taken into account. See Figure 110.

- 3) *Before the next trial, disconnect the spindle from the test fixture and operate the tool under no-load for a minimum of 3 s. Allow the tool to cool for a minimum of 2 min before the next trial.*

M_R is computed as the average of five of the measurements from each of the seven trials, with the highest and lowest measurement eliminated. The standard deviation of the five measurements shall also be computed and shall be less than 5 %. If it is not, then the fixture shall be adjusted to achieve the required repeatability. In cases where an **electronic circuit** that affects the torque is disabled, M_R is computed as an average of the three trials in 19.102.3, item 2) a), last bullet.

NOTE 2 It is recognized that disabling functions that affect the torque can result in a test where the tool is permanently impaired after the test.

20 Mechanical strength

This clause of Part 1 is applicable.

21 Construction

This clause of Part 1 is applicable, except as follows:

21.18.1.1 Addition:

Tools with a maximum output torque greater than 100 Nm shall not be provided with a lock-on device.

Compliance is checked by measurement in accordance with 19.102 and inspection.

For tools with a maximum output torque of 100 Nm or less, a **power switch** lock-on device, if any, shall be located outside the grasping area, or so designed that it is not likely to be unintentionally locked on by the user's hand during intended left- or right-handed operation. This grasping area is considered to be the contact area between either hand and the tool while the index finger of that hand is resting on the **power switch** actuator of the tool.

*Compliance is checked by inspection or, for a **power switch** with a lock-on device within the grasping area, by the following test.*

*With the **power switch** in the "on" position, the lock-on device shall not be actuated by a straight edge 25 mm long when the straight edge is pushed down on the lock-on device. The straight edge shall be oriented in any direction and shall be applied to bridge the surface of the lock-on device and any surface adjacent to the lock-on device.*

21.35 This subclause is not applicable.

NOTE 101 Dust collection is covered in 8.14.2 a) 103).

22 Internal wiring

This clause of Part 1 is applicable.

23 Components

This clause of Part 1 is applicable, except as follows:

23.3 *Replacement of the first paragraph:*