National Standard of Canada

CSA C22.2 No. 62841-2-6:22

Electric motor-operated hand-held tools, transportable tools and lawn and garden machinery — Safety — Part 2-6: Particular requirements for hand-held hammers

(IEC 62841-2-6:2020, MOD)

Note: *For brevity, this Standard will be referred to as "CSA C22.2 No. 62841-2-6" throughout.*

MARCH 28, 2022

This national standard is based on publication IEC 62841-2-6, First Edition (2020).

Prepared by
International Electrotechnical Commission

Reviewed by

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First Edition
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Commitment for Amendments

This standard is issued jointly by the Canadian Standards Association (operating as "CSA Group") and Underwriters Laboratories Inc. (UL). Comments or proposals for revisions on any part of the standard may be submitted to CSA Group or UL at anytime. Revisions to this standard will be made only after processing according to the standards development procedures of CSA Group and UL. CSA Group and UL will issue revisions to this standard by means of a new edition or revised or additional pages bearing their date of issue.

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This Standard is subject to review within five years from the date of publication, and suggestions for its improvement will be referred to the appropriate committee. The technical content of IEC and ISO publications is kept under constant review by IEC and ISO. To submit a proposal for change, please send the following information to inquiries@csagroup.org and include "Proposal for change" in the subject line: Standard designation (number); relevant clause, table, and/or figure number; wording of the proposed change; and rationale for the change.

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This ANSI/UL Standard for Safety consists of the First Edition. The most recent designation of ANSI/UL 62841-2-6 as an American National Standard (ANSI) occurred on March 28, 2022. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, Title Page (front and back), or the Preface. The National Difference Page and IEC Foreword are also excluded from the ANSI approval of IEC-based standards.

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CONTENTS

PREFACE

This is the harmonized CSA Group and UL standard for Electric motor-operated hand-held tools, transportable tools and lawn and garden machinery – Safety – Part 2-6: Particular requirements for hand-held hammers. It is the First edition of CSA C22.2 No. 62841-2-6, and the First edition of UL 62841-2-6.

This harmonized standard is based on IEC Publication 62841-2-6: First edition, Electric motor-operated hand-held tools, transportable tools and lawn and garden machinery – Safety – Part 2-6: Particular requirements for hand-held hammers, issued July 2020. IEC publication 62841-2-6 is copyrighted by the IEC.

This harmonized standard was prepared by CSA Group and Underwriters Laboratories Inc. (UL). The efforts and support of the International Harmonization Committee (IHC) for the adoption of the IEC series of Standards for Hand-Held, Motor-Operated, and Transportable Tools and Lawn and Garden Machinery are gratefully acknowledged.

This standard is considered suitable for use for conformity assessment within the stated scope of the standard.

This standard was reviewed by the CSA Subcommittee on Safety of Hand-Held Motor-Operated Electric Tools, under the jurisdiction of the CSA Technical Committee on Consumer and Commercial Products and the CSA Strategic Steering Committee on Requirements for Electrical Safety, and has been formally approved by the CSA Technical Committee. This standard has been developed in compliance with Standards Council of Canada requirements for National Standards of Canada. It has been published as a National Standard of Canada by CSA Group.

Application of Standard

Where reference is made to a specific number of samples to be tested, the specified number is to be considered a minimum quantity.

Note: Although the intended primary application of this standard is stated in its scope, it is important to note that it remains the responsibility of the users of the standard to judge its suitability for their particular purpose.

CSA C22.2 No. 62841-2-6 is to be used in conjunction with the first edition of CAN/CSA-C22.2 No. 62841-1. The requirements for hand-held hammers are contained in this Part 2-6 Standard and CAN/CSA-C22.2 No. 62841-1. Requirements of this Part 2-6 Standard, where stated, amend the requirements of CAN/CSA-C22.2 No. 62841-1. Where a particular subclause of CAN/CSA-C22.2 No. 62841-1 is not mentioned in CSA C22.2 No. 62841-2-6, the CAN/CSA-C22.2 No. 62841-1 subclause applies.

UL 62841-2-6 is to be used in conjunction with the first edition of UL 62841-1. The requirements for hand-held hammers are contained in this Part 2-6 Standard and UL 62841-1. Requirements of this Part 2-6 Standard, where stated, amend the requirements of UL 62841-1. Where a particular subclause of UL 62841-1 is not mentioned in UL 62841-2-6, the UL 62841-1 subclause applies.

Level of Harmonization

This standard adopts the IEC text with editorial national differences.

This standard is published as an equivalent standard for CSA Group and UL.

An equivalent standard is a standard that is substantially the same in technical content, except as follows: Technical national differences are allowed for codes and governmental regulations as well as those recognized as being in accordance with NAFTA Article 905, for example, because of fundamental climatic,

geographical, technological, or infrastructural factors, scientific justification, or the level of protection that the country considers appropriate. Presentation is word for word except for editorial changes.

All national differences from the IEC text are included in the CSA Group and UL versions of the standard. While the technical content is the same in each organization's version, the format and presentation may differ.

Reasons for Differences From IEC

Differences from the IEC are being added in order to address safety and regulatory situations present in Canada and the U.S.

Interpretations

The interpretation by the standards development organization of an identical or equivalent standard is based on the literal text to determine compliance with the standard in accordance with the procedural rules of the standards development organization. If more than one interpretation of the literal text has been identified, a revision is to be proposed as soon as possible to each of the standards development organizations to more accurately reflect the intent.

IEC Copyright

For CSA Group, the text, figures, and tables of International Electrotechnical Commission Publication 62841-2-6, Standard for Electric motor-operated hand-held tools, transportable tools and lawn and garden machinery – Safety – Part 2-6: Particular requirements for hand-held hammers, copyright 2020, are used in this standard with the consent of the International Electrotechnical Commission. The IEC Foreword is not a part of the requirements of this standard but is included for information purposes only.

NATIONAL DIFFERENCES

National Differences from the text of International Electrotechnical Commission (IEC) Publication 62841-2-6, Electric motor-operated hand-held tools, transportable tools and lawn and garden machinery – Safety – Part 2-6: Particular requirements for hand-held hammers, copyright 2020, are indicated by notations (differences) and are presented in bold text. The national difference type is included in the body.

There are five types of National Differences as noted below. The difference type is noted on the first line of the National Difference in the standard. The standard may not include all types of these National Differences.

DR – These are National Differences based on the **national regulatory requirements**.

D1 – These are National Differences which are based on **basic safety principles and requirements**, elimination of which would compromise safety for consumers and users of products.

D2 – These are National Differences from IEC requirements based on existing **safety practices**. These requirements reflect national safety practices, where empirical substantiation (for the IEC or national requirement) is not available or the text has not been included in the IEC standard.

DC – These are National Differences based on the **component standards** and will not be deleted until a particular component standard is harmonized with the IEC component standard.

DE – These are National Differences based on **editorial comments or corrections**.

Each national difference contains a description of what the national difference entails. Typically one of the following words is used to explain how the text of the national difference is to be applied to the base IEC text:

Addition / Add - An addition entails adding a complete new numbered clause, subclause, table, figure, or annex. Addition is not meant to include adding select words to the base IEC text.

Modification / Modify - A modification is an altering of the existing base IEC text such as the addition, replacement or deletion of certain words or the replacement of an entire clause, subclause, table, figure, or annex of the base IEC text.

Deletion / Delete - A deletion entails complete deletion of an entire numbered clause, subclause, table, figure, or annex without any replacement text.

No Text on This Page

FOREWORD

INTERNATIONAL ELECTROTECHNICAL COMMISSION

ELECTRIC MOTOR-OPERATED HAND-HELD TOOLS, TRANSPORTABLE TOOLS AND LAWN AND GARDEN MACHINERY – SAFETY – Part 2-6: Particular requirements for hand-held hammers

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and nongovernmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.

2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.

3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.

4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.

5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.

6) All users should ensure that they have the latest edition of this publication.

7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.

8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.

9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 62841-2-6 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
116/459/FDIS	116/466/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 publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

This Part 2-6 is to be used in conjunction with IEC 62841-1:2014.

This Part 2-6 supplements or modifies the corresponding clauses in IEC 62841-1, so as to convert it into the IEC Standard: Particular requirements for hand-held hammers.

Where a particular subclause of Part 1 is not mentioned in this Part 2-6, 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 in 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 publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

• reconfirmed,

• withdrawn,

• replaced by a revised edition, or

• amended.

NOTE The attention of National Committees is drawn to the fact that equipment manufacturers and testing organizations may need a transitional period following publication of a new, amended or revised IEC publication in which to make products in accordance with the new requirements and to equip themselves for conducting new or revised tests.

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.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

101DV DE *Modification: Add the following to the IEC Foreword:*

The numbering system in the standard uses a space instead of a comma to indicate thousands and uses a comma instead of a period to indicate a decimal point. For example, 1 000 means 1,000 and 1,01 means 1.01.

102DV DE *Modification: Add the following to the IEC Foreword:*

For this Standard, all references to "Part 1" refer to CAN/CSA-C22.2 No. 62841-1 and UL 62841-1.

No Text on This Page

ELECTRIC MOTOR-OPERATED HAND-HELD TOOLS, TRANSPORTABLE TOOLS AND LAWN AND GARDEN MACHINERY – SAFETY – Part 2-6: Particular requirements for hand-held hammers

1 Scope

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

Addition:

This part of IEC 62841 applies to hand-held hammers.

Tools covered by this document include **percussion hammers** and **rotary hammers**, including **rotary hammers** with the capability to rotate only with the percussion system disengaged (drill only mode).

This document does not apply to drills and impact drills.

NOTE 101 Drills and impact drills are covered by IEC 62841-2-1.

This document does not apply to tools that are designed exclusively for driving fasteners, such as palm nailers.

2 Normative references

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

Addition:

EN 206:2013, *Concrete. Specification, performance, production and conformity*
EN 206:2013/AMD1:2016

3 Terms and definitions

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

Addition:

3.101
percussion hammer
tool equipped with a built-in percussion system where the impact energy is not dependent on the feed force applied by the operator and has no capability of rotational motion

Note 1 to entry: **Percussion hammers** are also known as chisel hammers, hammers, breakers, concrete breakers and picks.

3.102
rotary hammer
tool capable of rotational motion and equipped with a built-in percussion system where the impact energy is not dependent on the feed force applied by the operator (**rotary hammer** mode) and additionally, may have one or more of the following modes:

a) with rotational motion disengaged (percussion only mode)

b) with the percussion system disengaged (drill only mode)

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 auxiliary handle and all parts of an integrated (i.e. nondetachable) dust extraction device, if any. A detachable dust extraction device is not included in the mass of the tool.

6 Radiation, toxicity and similar hazards

This clause of Part 1 is applicable.

7 Classification

This clause of Part 1 is applicable.

8 Marking and instructions

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

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 Hammer safety warnings

1) Safety instructions for all operations

a) **Wear ear protectors.** *Exposure to noise can cause hearing loss.*

b) **Use auxiliary handle(s), if supplied with the tool.** *Loss of control can cause personal injury.*

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 101 The above warning applies only for rotary hammers 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 102 For **rotary hammers** that can also be used as screwdrivers, the words "or fasteners" are added after "cutting accessory".

2) Safety instructions when using long drill bits with rotary hammers

NOTE 103 The warnings in this section apply only to rotary hammers.

a) **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.*

b) **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)** *Addition:*

101) For tools with a maximum output torque greater than 100 Nm measured in accordance with 19.102: instructions on how to brace the tool;

102) Instructions for assembling any **attachments** that are supplied with the tool;

103) For tools provided with a dust extraction device: instruction on how to collect the dust;

104) For tools with detachable dust collection device: information on which dust collection device may be used.

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:*

*The tool is operated intermittently for 30 cycles or until thermal equilibrium is reached, whichever is achieved first, each cycle comprising a period of continuous operation of 30 s and a rest period of 90 s with the tool switched off, the tool loaded during the periods of operation by means of a brake adjusted so as to attain **rated input** or **rated current**.*

During the test, the hammer mechanism is disengaged or removed.

12.5 *Addition:*

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:*

***Rotary hammers** with drill only mode are operated intermittently at no-load with the impact mechanism disengaged for 12 h at a supply 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 1 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.

*Following the above test (if applicable), all hammers, including **rotary hammers** with drill only mode, are mounted vertically down in a test apparatus designed to apply an axial force ensuring steady operation of the impact mechanism to the hammer through a resilient medium. An example of a test apparatus is shown in Figure 101.*

*The hammers are then operated at **rated voltage**, for four periods of 6 h each, the interval between these periods being at least 30 min. For **rotary hammers** with drill only mode, the impact mechanism is engaged.*

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.

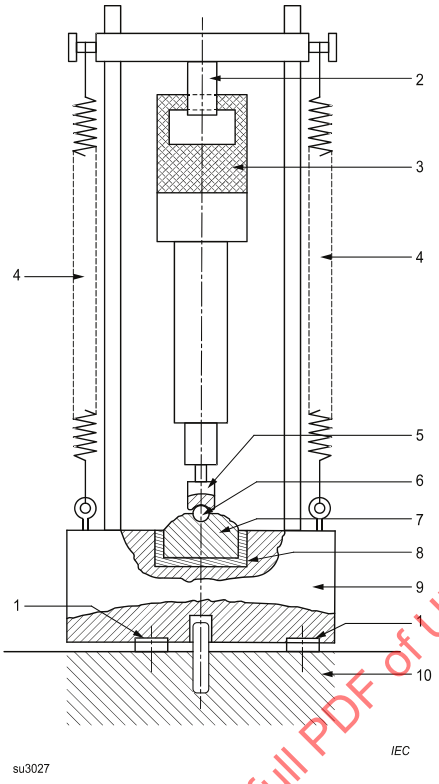
During these tests, replacement of the carbon brushes is allowed, and the tool is oiled and greased as in ***normal use****. If the impact mechanism fails mechanically during the test without causing an* ***accessible part*** *to become live, it may be replaced by a new one.*

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 2 Monitoring of external temperatures will help avoid mechanical failures.

Dimensions in millimetres



Key

1 resilient material to absorb vibration and prevent resonance

2 yoke, adapted to suit the grip of the tool

3 sample

4 mechanical or pneumatical springs applying a force to the sample

5 punch

6 hardened steel ball with diameter 38 mm

7 hardened steel transfer plate of mass M_2 and diameter D

8 synthetic rubber disk or material having similar properties, Shore hardness 70° to 80°, thickness 6 mm to 7 mm, fitting closely in cavity

9 steel base at mass M_1, with circular cavity having a diameter 1 mm greater than that of the transfer plate

10 ground support such as a concrete block being large and solid enough to ensure the stability of the test apparatus during the test

Rated input of tool W	D Diameter of transfer plate mm	M_1 Minimum mass of steel base kg	M_2 Mass of transfer plate kg	M_3 Total mass of punch and shank kg
Up to and including 700	100	90	1,0 to 1,25	0,7
Over 700 up to and including 1 200	140	180	2,25 to 2,81	1,4
Over 1 200 up to and including 1 800	180	270	3,8 to 4,75	2,3
Over 1 800 up to and including 2 500	220	360	6,0 to 7,5	3,4

Figure 101

Example of a testing apparatus

18 Abnormal operation

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

18.8 *Replacement of Table 4 by the following:*

Table 4
Required performance levels

Type and purpose of SCF	Minimum performance level (PL)
Power switch – provide desired switch-off for **rotary hammers** in **rotary hammer** mode and drill only mode 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***
Power switch – provide desired switch off for **percussion hammers** or for **rotary hammers** in percussion only mode	Not an **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 **rotary hammers** that require bracing in accordance with 8.14.1.101	c
Any electronic control to pass the test of 18.3	a
Any speed limiting device	Not an **SCF**
Prevent exceeding thermal limits as in 18.4	a
Limit the torque to comply with 19.102	c
Power switch – prevent unwanted switch-on for **rotary hammers** in **rotary hammer** mode and drill only mode with $M_R \leq 25$ Nm in accordance with 19.102	a
Power switch – prevent unwanted switch-on for **rotary hammers** in **rotary hammer** mode and drill only mode with $M_R > 25$ Nm in accordance with 19.102	b
Power switch – prevent unwanted switch-on for **percussion hammers** or for **rotary hammers** in percussion only mode	Not an **SCF**
Power switch – provide desired switch-off for **rotary hammers** in **rotary hammer** mode and drill only mode with $M_R \leq 25$ Nm in accordance with 19.102	b
Power switch – provide desired switch-off for **rotary hammers** in **rotary hammer** mode and drill only mode with $M_R > 25$ Nm in accordance with 19.102	c
Prevent unwanted lock-on of the **power switch** function for **rotary hammers** in **rotary hammer** mode and drill only mode with $M_R \leq 25$ Nm in accordance with 19.102	b
Prevent unwanted lock-on of the **power switch** function for **rotary hammers** in **rotary hammer** mode and drill only mode with $M_R > 25$ Nm in accordance with 19.102	c
Prevent unwanted lock-on of the **power switch** function for **percussion hammers** or for **rotary hammers** in percussion only mode	Not an **SCF**
Prevent self-resetting as required in 23.3 for **rotary hammers** in **rotary hammer** mode and drill only mode with $M_R \leq 25$ Nm in accordance with 19.102	a
Prevent self-resetting as required in 23.3 for **rotary hammers** in **rotary hammer** mode and drill only mode with $M_R > 25$ Nm in accordance with 19.102	b

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.

19.6 This subclause of Part 1 is not applicable.

19.101 Chuck keys shall be so designed that they drop easily 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 on rotary hammers

19.102.1 General

The design of the handle(s) on **rotary hammers** 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 Figure 102 to Figure 105.

Figure 106 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 Figure 102 to Figure 105 to determine the moment arm for the torque calculation.

Figure 107 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 Figure 104 and Figure 105 to determine the moment arm for the torque calculation.

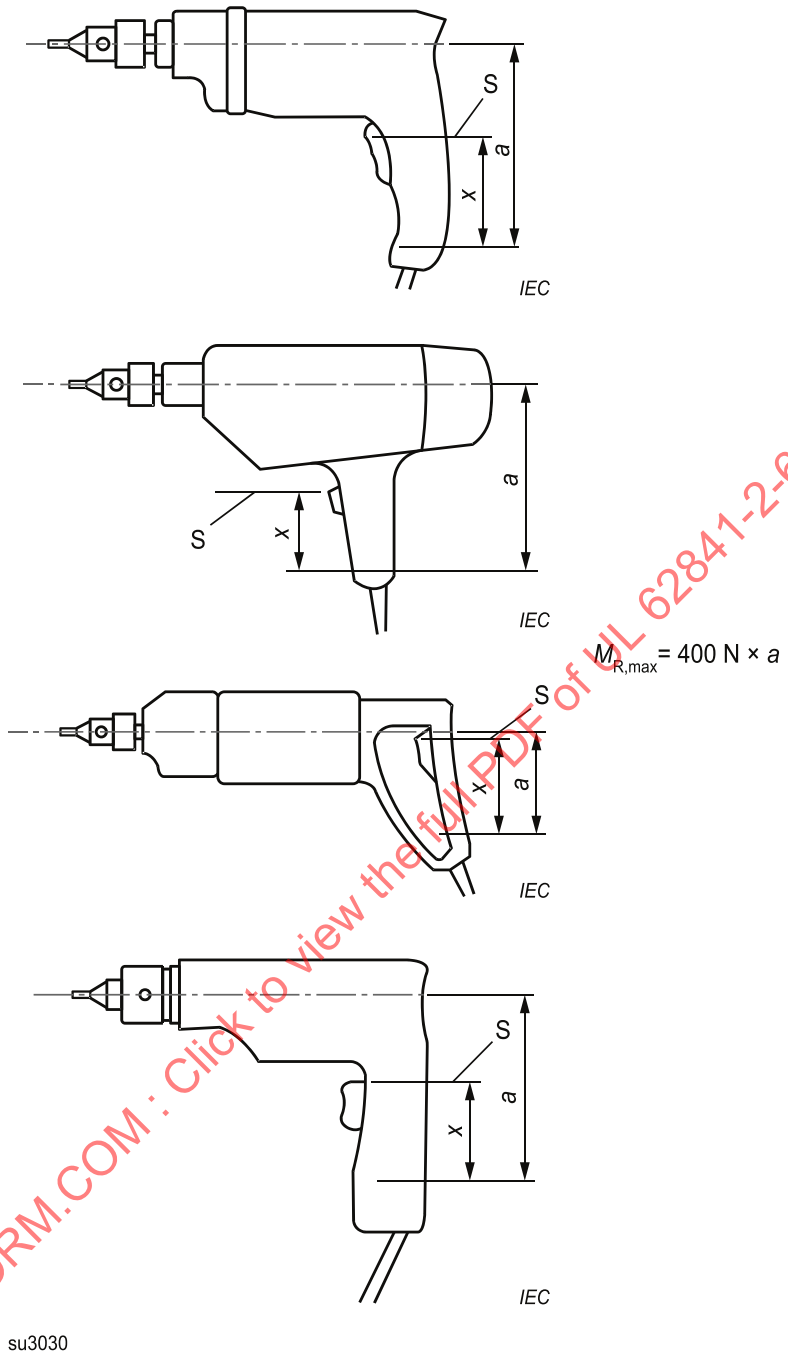
For **rotary hammers** with the ability to operate in percussion only mode and provided with a stick-type auxiliary handle without flange, the determination of the relevant length "a" for the moment arm is illustrated in Figure 108.

NOTE 101 Stick type auxiliary handles on **rotary hammers** that can operate in percussion only mode are typically designed without a flange barrier. A flange could prevent ergonomic use in the chiselling application where the flange would interfere with the hand of the operator. The measurement of "a" in Figure 108 accommodates this type of tool.

Compliance is checked by the tests specified in 19.102.2 and 19.102.4 and by the calculations in Figure 102 to Figure 105 and Figure 108.

19.102.1DV D1 ***Modification: Replace the fifth paragraph of Clause 19.102.1 of the Part 2 with the following:***

Compliance is checked by the tests specified in Clauses 19.102.2 to 19.102.4 and by the calculations in Figure 104 to Figure 107.



Key

S location of the hand on the **power switch** where the operator naturally grasps and/or the least favourable position on the **power switch** for the reactionary torque measurement

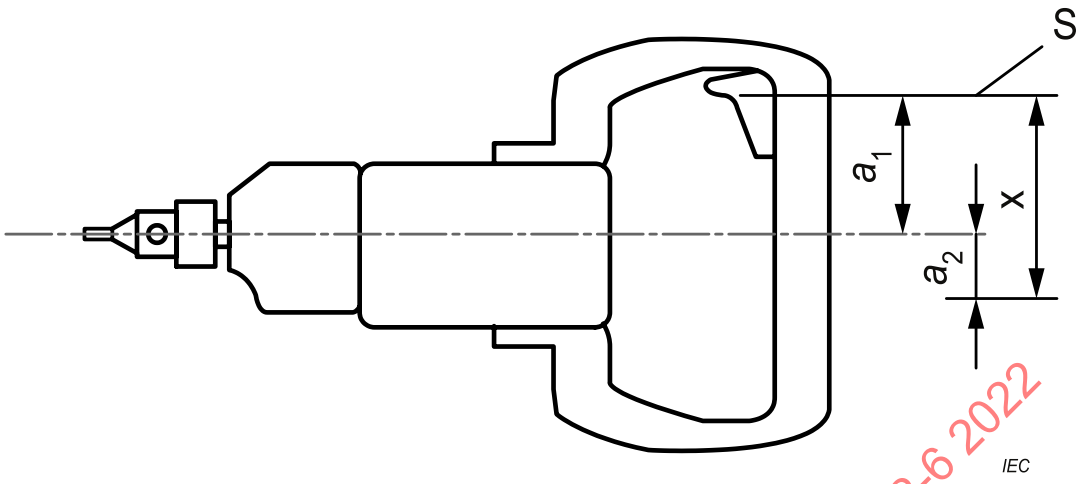
x measurement point that is 80 mm or the remaining length of the handle, whichever is less, from "S" in the direction of where the hand grasps the tool

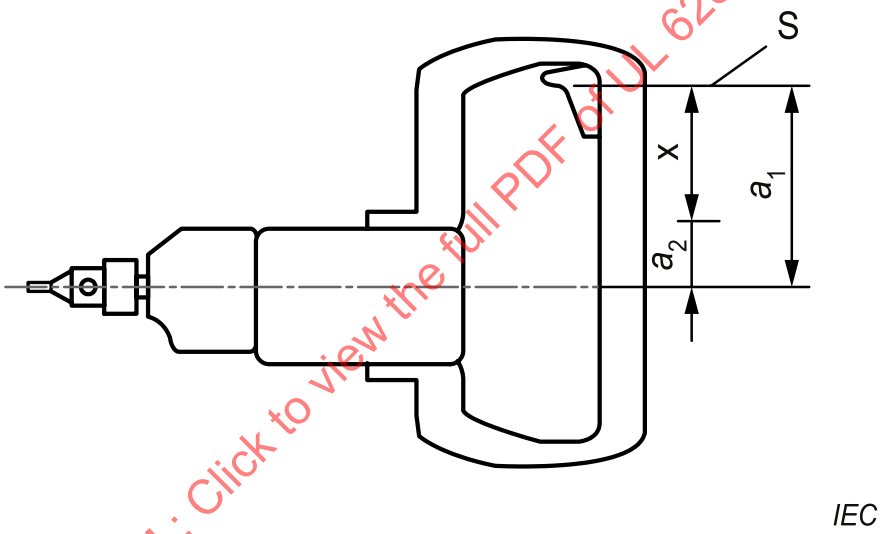
a lever arm distance

$M_{R,max}$ maximum reaction torque

Figure 102

Reaction torque measurement of single handle tools (1)





Choose whichever is greater:

$M_{R,max}$ = 400 N × a_1

or

$M_{R,max}$ = 400 N × a_2

Key

S location of the hand on the **power switch** where the operator naturally grasps and/or the least favourable position on the **power switch** for the reactionary torque measurement

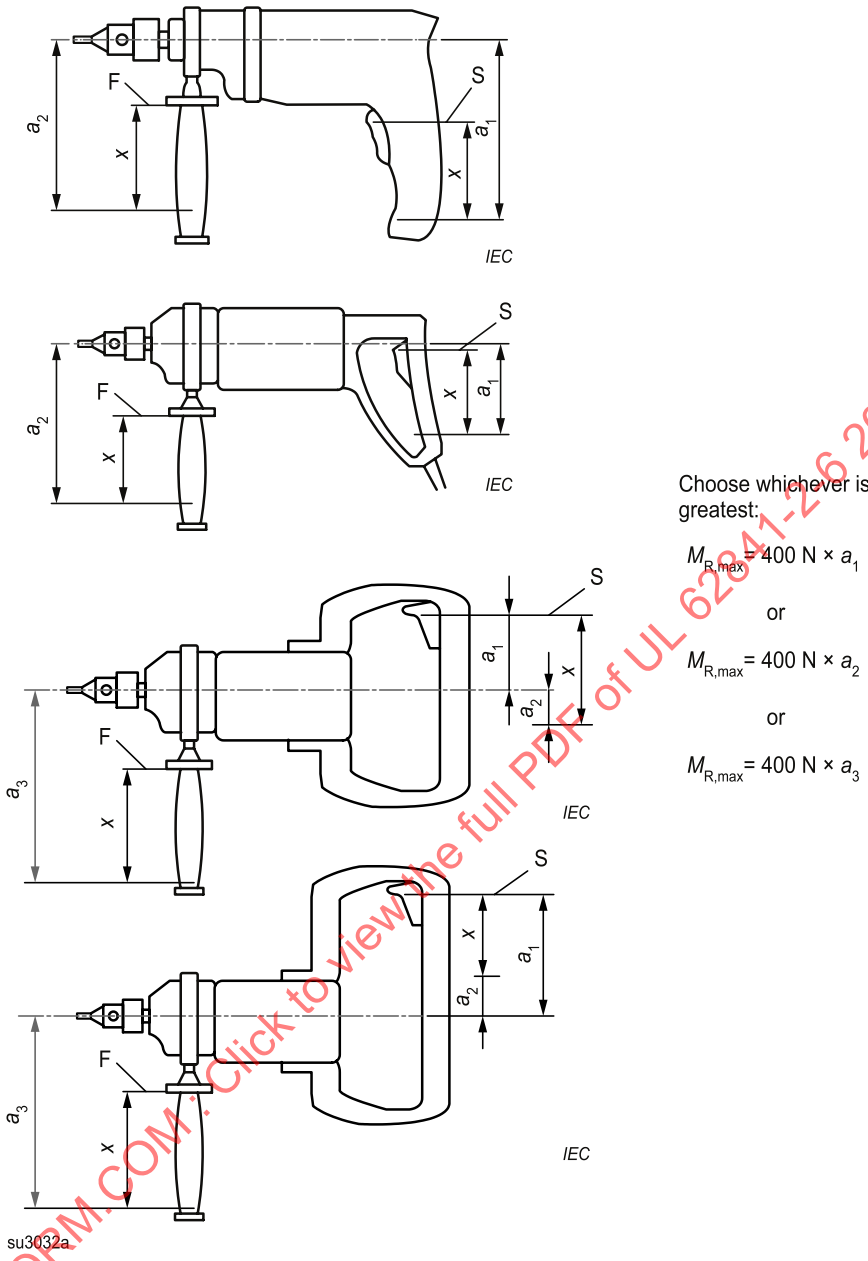
x measurement point that is 80 mm or the remaining length of the handle, whichever is less, from "S" in the direction of where the hand grasps the tool

a_1, a_2 lever arm distances

$M_{R,max}$ maximum reaction torque

Figure 103

Reaction torque measurement of single handle tools (2)



Key

S location of the hand on the **power switch** where the operator naturally grasps and/or the least favourable position on the **power switch** for the reactionary torque measurement

F location of the hand on the flange where the operator naturally grasps

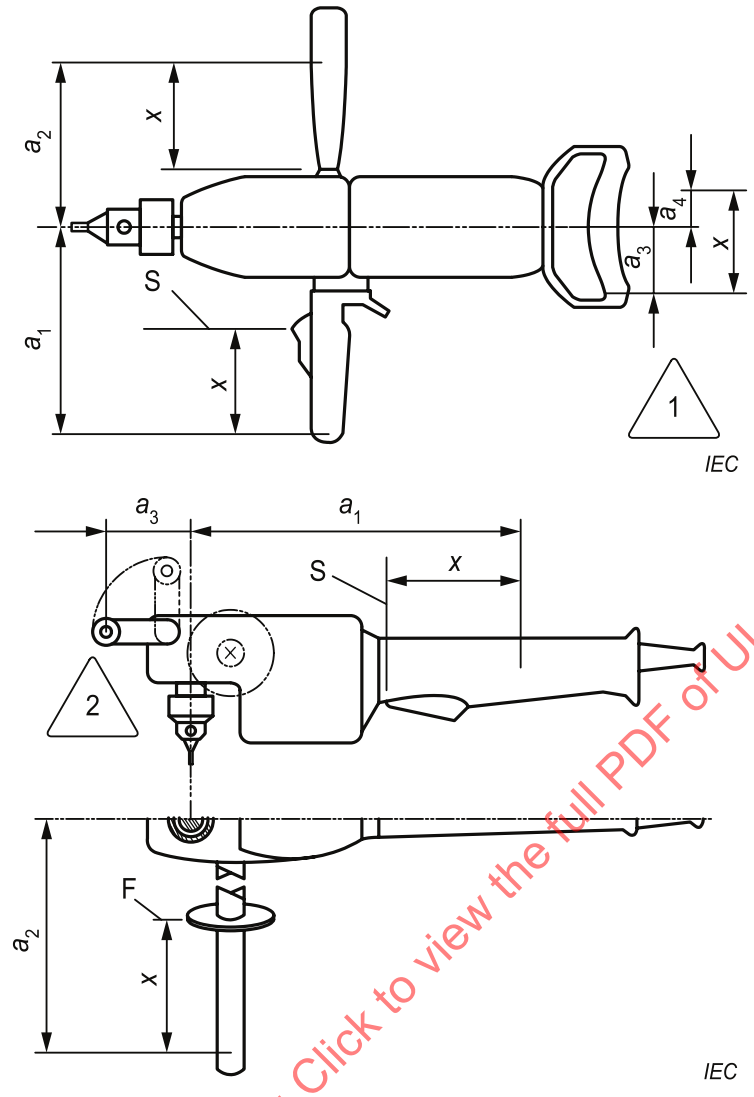
x measurement point that is 80 mm or the remaining length of the handle, whichever is less, from "S" or "F" in the direction of where the hand grasps the tool

a_1, a_2, a_3 lever arm distance

$M_{R,max}$ maximum reaction torque

Figure 104

Reaction torque measurement of multi handle tools (1)



Choose whichever is greatest:

$M_{R,max} = 400\ N \times a_1$

or

$M_{R,max} = 400\ N \times a_2$

or

$M_{R,max} = 400\ N \times a_3$

or

$M_{R,max} = 400\ N \times a_4$

Key

1 the value of a_3 or a_4 is used only if the handle can be locked in position and is referenced for use in 8.14.2 b) 6)

2 measure from a point on the centre line of the grasping surface that offers the greatest mechanical advantage

S location of the hand on the **power switch** where the operator naturally grasps and/or the least favourable position on the **power switch** for the reactionary torque measurement

F location of the hand on the flange where the operator naturally grasps

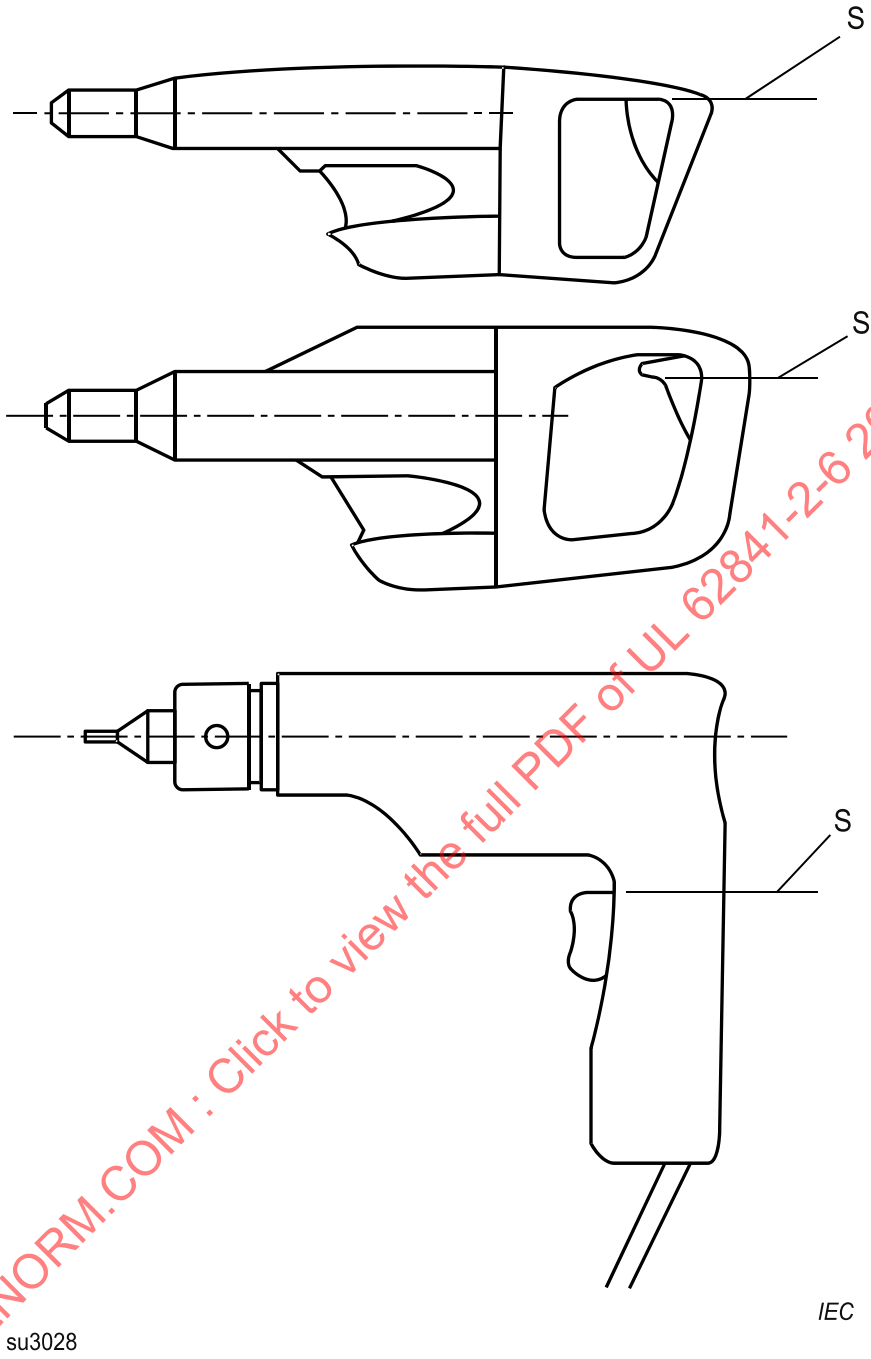
x measurement point that is 80 mm or the remaining length of the handle, whichever is less, from "S" or "F" in the direction of where the hand grasps the tool

a_1, a_2, a_3, a_4 lever arm distances

$M_{R,max}$ maximum reaction torque

Figure 105

Reaction torque measurement of multi handle tools (2)



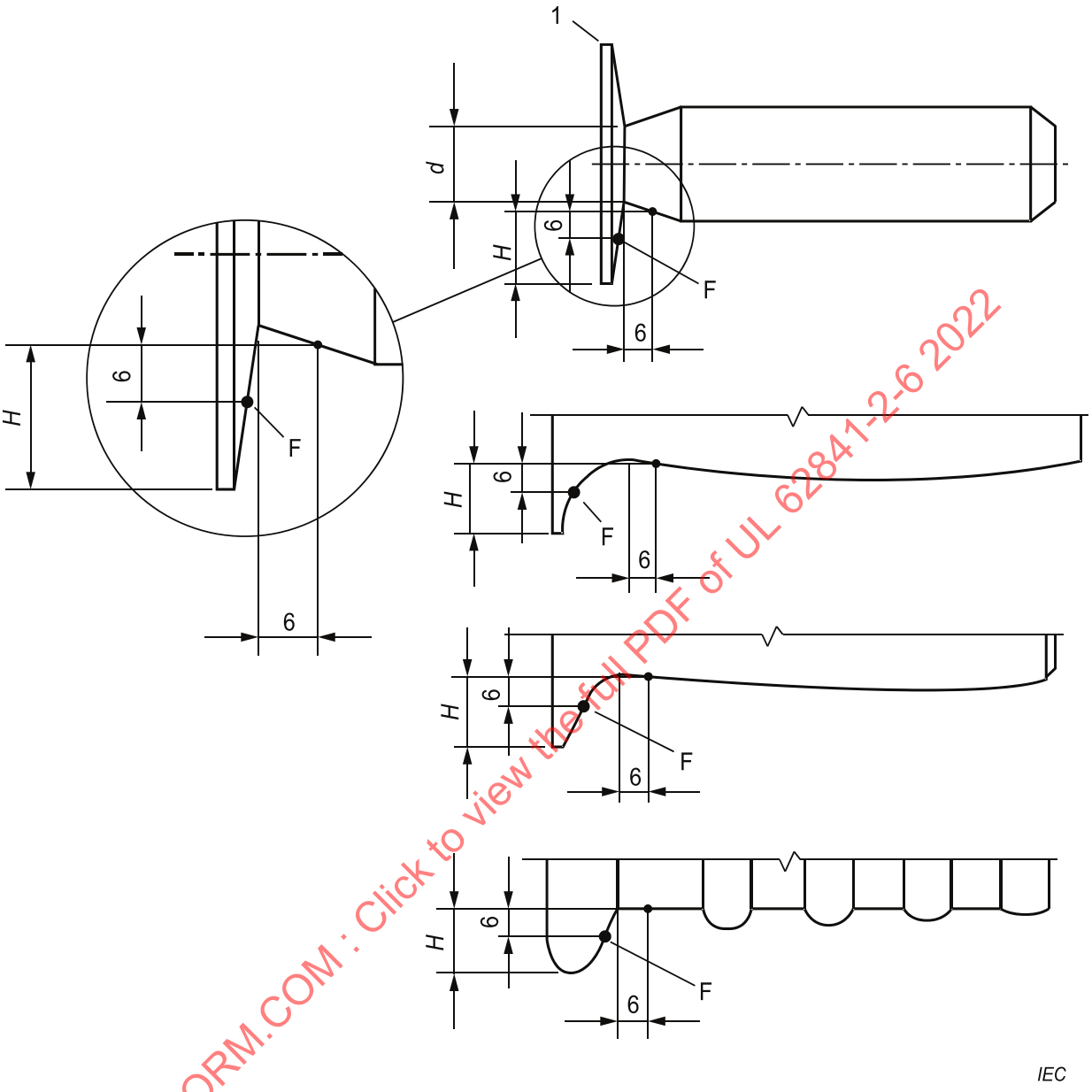
Key

S location of the hand on the **power switch** where the operator naturally grasps and/or the least favourable position on the **power switch** for the reactionary torque measurement

Figure 106

Locating point "S" on different power switch and handle designs

Dimensions in millimetres



Key

1 flange

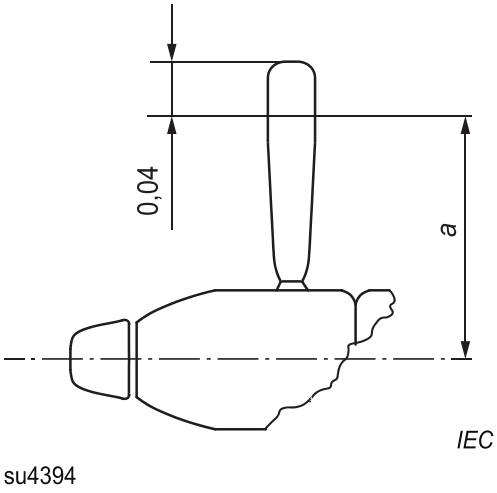
F location of the hand on the flange where the operator naturally grasps

d minor diameter

H height of the flange

Figure 107

Locating point "F" on different flange designs



$M_{R,max}$ = 400 N × a

Key

a lever arm distance

$M_{R,max}$ maximum reaction torque

Figure 108

Measurement of length a for stick-type auxiliary handles without flange used on rotary hammers that can also operate in percussion only mode

19.102.2 Test equipment

The test equipment used for the test of 19.102.4 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 19.102.4.

b) The output of the torque transducer shall be connected to an oscilloscope or other data acquisition equipment capable of displaying the torque versus time graph of the tool's output during the test of 19.102.4

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 ±2°.

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 ± 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 to determine tool configuration

This test is only applicable for tools that employ (an) ***electronic circuit(s)*** *that affect(s) the output torque in the test of 19.102.4.*

Prior to the test, any device or circuit that slows the rate of increase of the motor speed at initial startup (e.g. soft start) is disabled.

Prior to each measurement, the sample is operated for at least 5 min at no-load. After each 5 min operation period, the measurement shall be conducted within 20 min.

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 tool configuration for the test of 19.102.4 shall be either:

– when all functions affecting the output torque are considered ***SCF****s and are evaluated according to 18.8, all functions affecting the output torque are enabled; or*

*– when all functions affecting the output torque are not evaluated as **SCF**s according to 18.8, the configuration that results in the greatest output torque for one trial of the test of 19.102.4 through steps 1) and 2) as specified below:*

- *all functions affecting the output torque enabled; or*
- *each function affecting the output torque disabled one at a time.*

19.102.3DV D2 *Modification: Replace Clause 19.102.3 of the Part 2 with the following:*

Assessment to determine tool configuration

This assessment is only applicable for tools that employ (an) electronic circuit(s) that affect(s) the output torque in the test of 19.102.4.

Prior to each measurement, the sample is operated for at least 5 min at no-load. After each 5 min operation period, the measurement shall be conducted within 20 min.

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.

For tools with a soft start function, the test of 19.102.4 through steps 1) and 2) is conducted on the sample with the soft start function enabled and then repeated with the soft start function disabled. If analysis shows that the tool will not operate with the soft start function disabled, then the test with the soft start function disabled is not conducted. For tools employing electronically commutated motors, the configuration that results in the greatest output torque shall be used for the test of 19.102.4.

For tools other than those employing electronically commutated motors, when all functions affecting the test value of the output torque, except for any soft start function, are not evaluated as SCFs according to 18.8 (e.g. current limit and stall detection), the tool configuration for the test of 19.102.4 shall be the configuration that results in the greatest output torque for one trial of the test of 19.102.4 through steps 1) and 2) as specified below:

– all functions affecting the output torque enabled; or

– each function not evaluated as an SCF affecting the output torque disabled one at a time.

19.102.4 Test procedure

If applicable, the sample is configured as specified in 19.102.3.

Prior to the test, any device or circuit that slows the rate of increase of the motor speed at initial startup (e.g. soft start) is disabled.

Prior to the test, the sample is operated for at least 5 min at no-load. After the 5 min operation period, the test shall be conducted within 20 min.

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 109.

ii) For signals that are not stable for a minimum of 2 ms after the initial peak, the output torque value shall be the RMS value of the signal over the rotation from off until peak torque is achieved. See Figure 110.

NOTE 101 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:

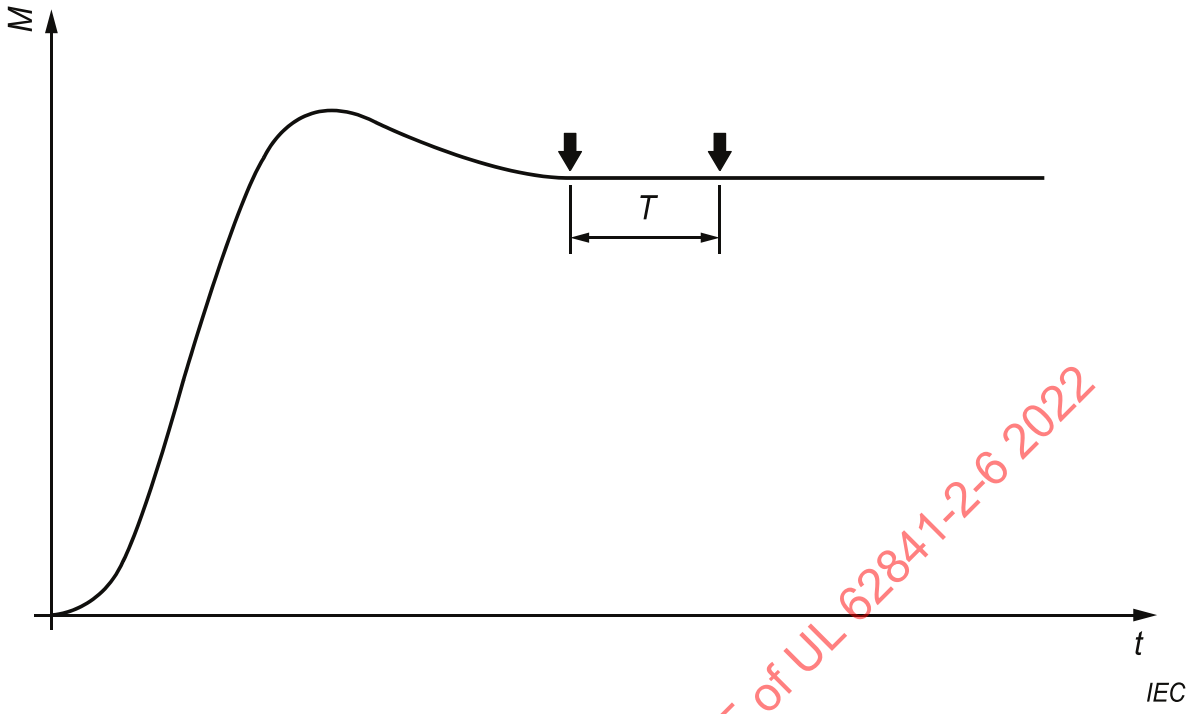
The output torque is determined by the peak value of the first peak that occurs after starting the trial. Later peaks, even if they appear to have greater values, are not taken into account. See Figure 111.

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.

NOTE 102 It is recognized that disabling functions that affect the torque can result in a test where the tool is permanently impaired after the test.

19.102.4DV D1 *Modification: Delete the second paragraph of Clause 19.102.4 of the Part 2.*



Key

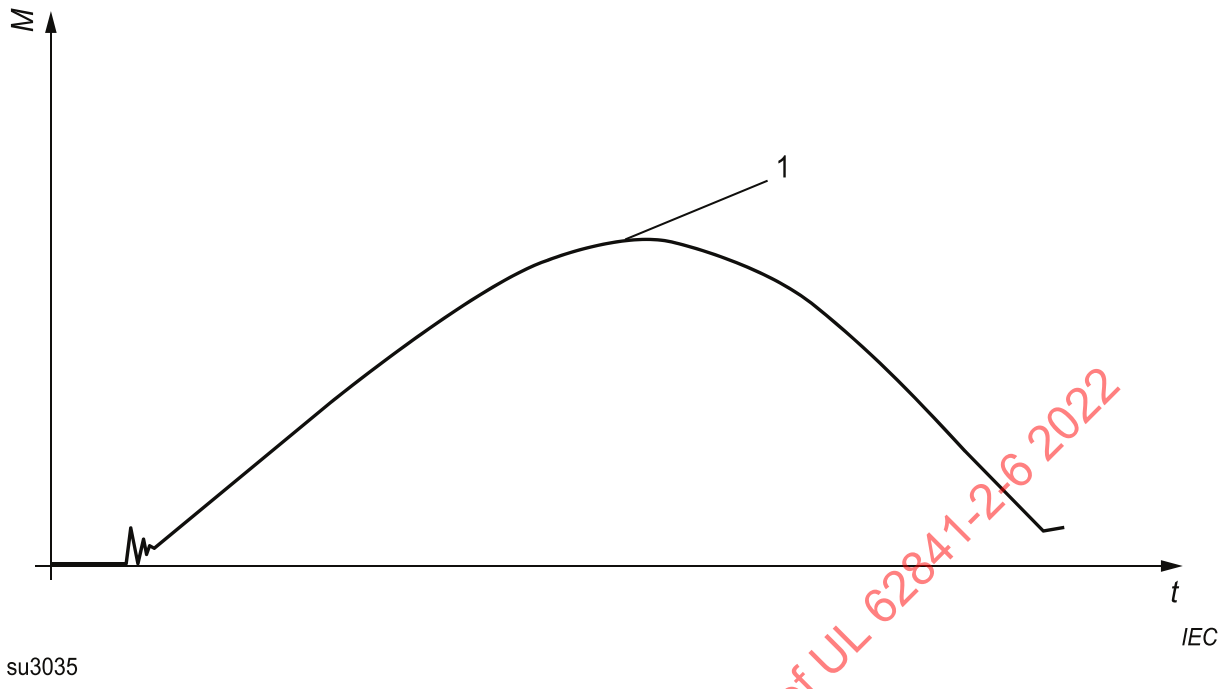
M torque

t time

T measurement interval in stable region, 2 ms < *T* < 100 ms

Figure 109

Example torque of a tool with a stable signal region



Key

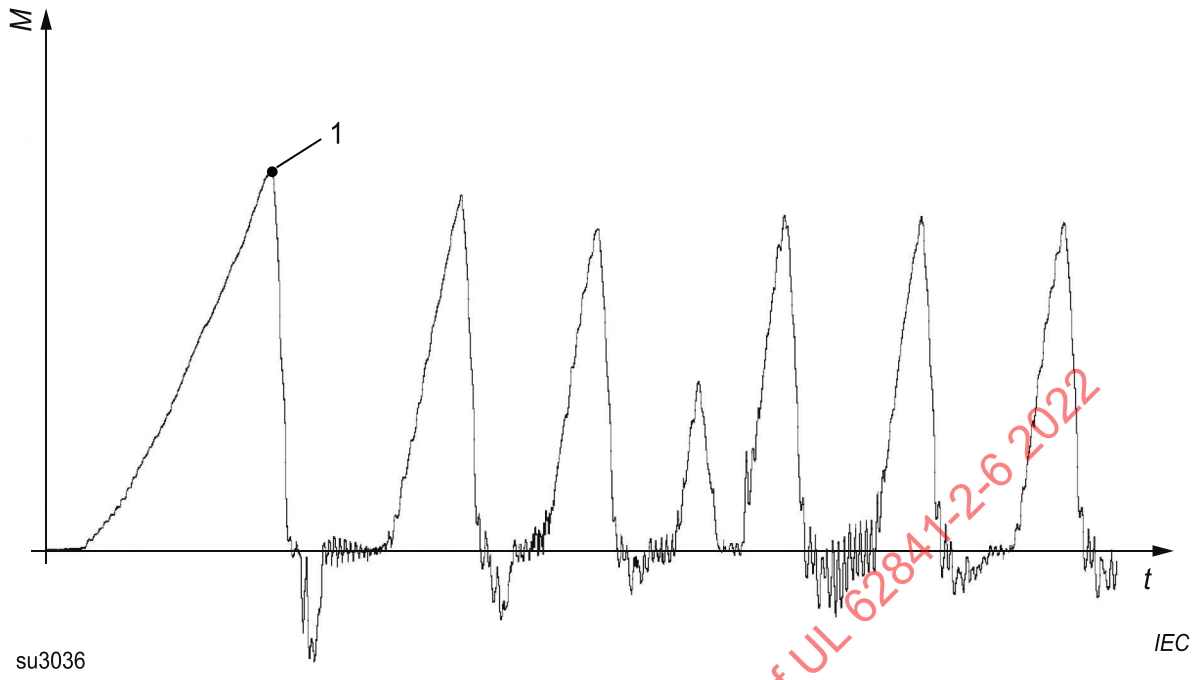
1 peak torque

M torque

t time

Figure 110

Example torque of a tool without a stable signal region



Key

1 first peak

M torque

t time

Figure 111

Example torque of a tool with an overload clutch

20 Mechanical strength

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

20.3.1 *Addition:*

The test as specified in Part 1 is applied to hammers with a mass of 10 kg or less.

Hammers exceeding a mass of 10 kg are subjected to three impacts that result from the tool being tipped over to strike a concrete surface. The tool is tipped with the longest ***accessory*** *recommended by the manufacturer except when the overall height of the tool including the* ***accessory*** *is greater than 1,5 m. In this case, the tool is tested with an* ***accessory*** *such that the overall height of the tool including the* ***accessory*** *is (1,5 ± 0,1) m. The tool is positioned in an upright position with the tip of the* ***accessory*** *resting on a concrete surface. The tool is then tipped in three different directions on to the concrete surface.*

20.5 *Addition:*

The impact as specified in Part 1 is applied to hammers with a mass of 10 kg or less.

For hammers exceeding a mass of 10 kg, the impacts on each handle and each recommended grasping surface are carried out by the tool being tipped over to strike a concrete surface. The tool is tipped with the longest ***accessory*** *recommended by the manufacturer except when the overall height of the tool including*

*the **accessory** is greater than 1,5 m. In this case, the tool is tested with an accessory such that the overall height of the tool including the **accessory** is (1,5 ± 0,1) m.*

21 Construction

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

21.18.1 *Addition:*

Power switches other than **momentary power switches** are permitted for

– **percussion hammers**; and

– **rotary hammers**, while operating in percussion only mode, if applicable.

21.18.1.1 *Addition:*

Rotary hammers 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.*

21.18.1.2 This subclause of Part 1 is not applicable.

21.30 *Replacement of the second paragraph:*

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. The flange may be omitted if the area that may be contacted by the side of the hand against the surface of the tool is insulated from parts that may become live by the output shaft. This insulated area shall extend by at least 25 mm around all of the cross-section of the handle near the tool surface.

21.35 This subclause of Part 1 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:

23.1.11 *Addition:*

The Note is not applicable for **percussion hammers** or for **rotary hammers** in percussion only mode.

23.3 *Replacement of the first paragraph:*

For **rotary hammers** in drill only mode and **rotary hammer** mode, protection devices or circuits that switch off the tool shall be of the non-self-resetting type unless the tool is equipped with a **momentary power switch** with no provision for being locked in the "on" position.

24 Supply connection and external flexible cords

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

24.4 *Replacement of the first and second paragraphs:*

Supply cords shall not be lighter than heavy polychloroprene sheathed flexible cable (code designation 60245 IEC 66) or equivalent.

24.11 *Replacement of item a):*

*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; plus

– the mass of the detachable dust collection device in accordance with 8.14.2 a) 104), if any, with the greatest mass

*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.*

25 Terminals for external conductors

This clause of Part 1 is applicable.

26 Provision for earthing

This clause of Part 1 is applicable.

27 Screws and connections

This clause of Part 1 is applicable.

28 Creepage distances, clearances and distances through insulation

This clause of Part 1 is applicable.

Annexes

The annexes of Part 1 are applicable except as follows.

Annex I
(informative)

Measurement of noise and vibration emissions

NOTE In Europe (EN 62841-2-6), Annex I is normative.

I.2 Noise test code (grade 2)

This clause of Part 1 is applicable except as follows:

I.2.2.2 Hand-held power tools

Additional subclauses:

I.2.2.2.101 Percussion hammers

The sound power level shall be determined by using a hemispherical measurement surface according to Figure I.101. The location of the six microphone positions distributed on the surface of the hemisphere of radius *r* are listed in the form of Cartesian coordinates in Table I.101.

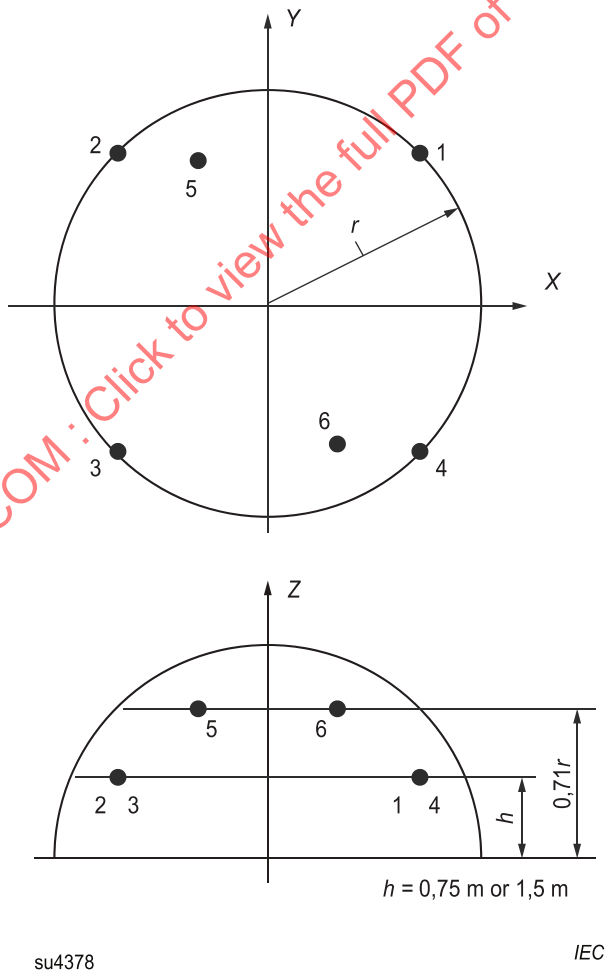


Figure I.101

Positions of microphones for the hemispherical measurement surface

Table I.101
Coordinates of the six microphone positions

Number of microphone	*x/r*	*y/r*	Mass of equipment < 10 kg Radius *r* = 2 m	Mass of equipment ≥ 10 kg Radius *r* = 4 m
			z	*z*
1	0,7	0,7	0,75 m	1,5 m
2	– 0,7	0,7	0,75 m	1,5 m
3	– 0,7	– 0,7	0,75 m	1,5 m
4	0,7	– 0,7	0,75 m	1,5 m
5	– 0,27	0,65	0,71 *r*	0,71 *r*
6	0,27	– 0,65	0,71 *r*	0,71 *r*

The A-weighted sound power level, L_{WA}, shall be calculated, in accordance with ISO 3744, as follows:

$$L_{WA} = \overline{L_{pfA}} + 10\,\mathrm{l}(\frac{S}{S_0})\ \mathrm{dB}$$

With $\overline{L_{pfA}}$ determined from

$$\overline{L_{pfA}} = 10\,\mathrm{lg}\left[\frac{1}{6}\sum_{i=1}^{6} 10^{0,1L'_{pA,i}}\right] - K_{1A} - K_{2A}$$

where

$\overline{L_{pfA}}$ is the A-weighted surface sound pressure level according to ISO 3744;

$L_{p'A,i}$ is the A-weighted sound pressure level measured at the i-th microphone position, in decibels;

K_{1A} is the background noise correction, A-weighted;

K_{2A} is the environmental correction, A-weighted;

S is the area of the measurement surface, in m^2;

$S_0 = 1\ m^2$.

Percussion hammers shall be measured on a reflecting surface of concrete or non-porous asphalt. For open test sites with a hard, flat ground surface, such as asphalt or concrete, and with no sound-reflecting objects within a distance from the source equal to three times the greatest distance from the source centre to the lower measurement points, it is assumed that the environmental correction is less than or equal to 0,5 dB and therefore negligible.

For the hemispherical measurement surface, the area S of the measurement surface is calculated as follows:

$$S = 2\pi r^2,\ \mathrm{in}\ m^2$$

where r is the radius of the hemisphere as given in Table I.101.

I.2.2.2.102 Rotary hammers

For rotary hammers, I.2.2.2 of Part 1 applies.

I.2.4 Installation and mounting conditions of the power tools during noise tests

I.2.4.101 **Percussion hammers** are fixed in vertical position to the test equipment described in I.2.5.101.

I.2.4.102 **Rotary hammers** are held by the operator for drilling vertically down in accordance with I.2.5.102.

I.2.5 Operating conditions

Addition:

The temperature requirements of 5.6 are not applicable.

For **battery** operated tools, the tests are conducted with the lightest **battery** in accordance with K.8.14.2 e) 2).

I.2.5.101 Percussion hammers

Percussion hammers shall be coupled during the test run to a tool embedded in a cube-shaped concrete block placed in a concrete pit, sunk into the ground.

The block shall be in the shape of a cube (600 ± 2) mm long at the edge and as regular as possible; it shall be made of reinforced concrete and thoroughly vibrated in layers of up to 200 mm to avoid excessive sedimentation.

The quality of the concrete shall correspond to C 50/60 of EN 206:2013.

The cube shall be reinforced by 8 mm-diameter steel rods without ties, each rod being independent of the other; the design concept is illustrated in Figure I.102.

NOTE 101 For **percussion hammers** with high impact energy, it is possible that the quality of the concrete, the steel rods and the design concept illustrated in Figure I.102 will need to be altered in order to withstand the resulting high loads.

The support tool shall be sealed into the block and shall consist of a rammer of no less than 178 mm or no more than 220 mm diameter and a tool chuck component identical to that normally used with the appliance being tested. Its upper end protruding above the screening slab (see dimension "*X*" in Figure I.103) shall be as short as possible, while allowing for a sufficient distance between the tool chuck and the screening slab (key item 2 in Figure I.103).

The exposed part of the support tool between the tool chuck and the screening slab shall be covered by noise absorbing material.

Suitable treatment shall be carried out to integrate the two components of the support tool. The support tool shall be fixed in the block so that the bottom of the rammer is 300 mm from the upper face of the block (see Figure I.102).

The block shall remain mechanically sound, particularly at the point where the support tool and the concrete meet. Before and after each test, it shall be established that the tool sealed in the concrete block is integrated with it.

The cube shall be set in a pit cemented throughout, covered by a screening slab of at least 100 kg/m^2, as indicated in Figure I.103, so that the upper surface of the screening slab is flush with the ground. To avoid any parasitic noise, the block shall be insulated against the bottom and the sides of the pit by elastic blocks, the cut-off frequency of which shall not be more than half the striking rate of the appliance tested, expressed as strokes per second.

The opening in the screening slab through which the tool chuck component passes shall be as small as possible and sealed by a flexible sound-proof joint.

All speed setting devices shall be adjusted to the highest value.

The **percussion hammer** is tested under load, connected to the support tool. The feed force applied to the hammer by an appropriate fixture shall be sufficient to achieve stable operation.

Dimensions in metres

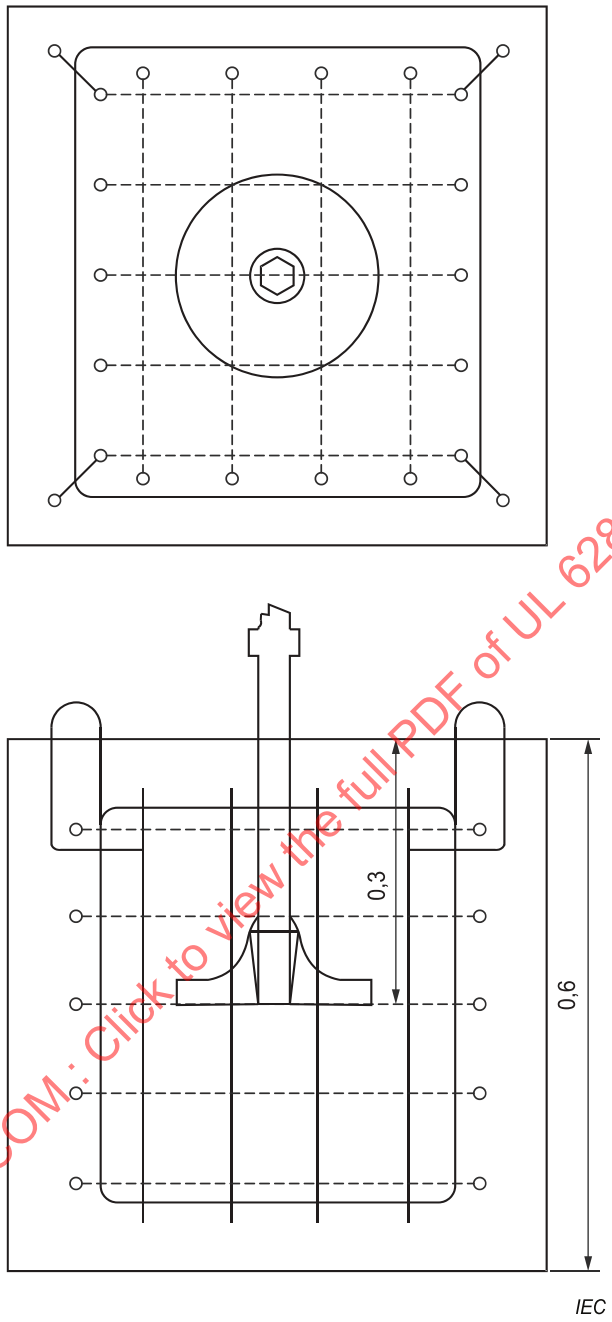
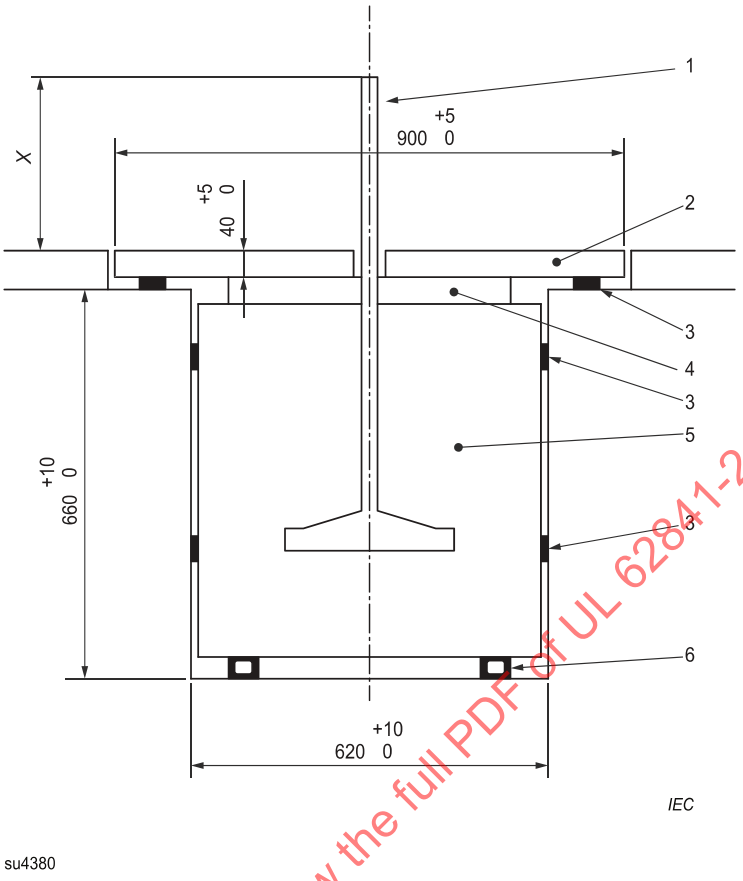


Figure I.102

Test block and example of rebar configuration

Dimensions in metres



Key

1 support tool
2 screening slab
3 elastic joints
4 absorbent foam
5 concrete block
6 elastic supports

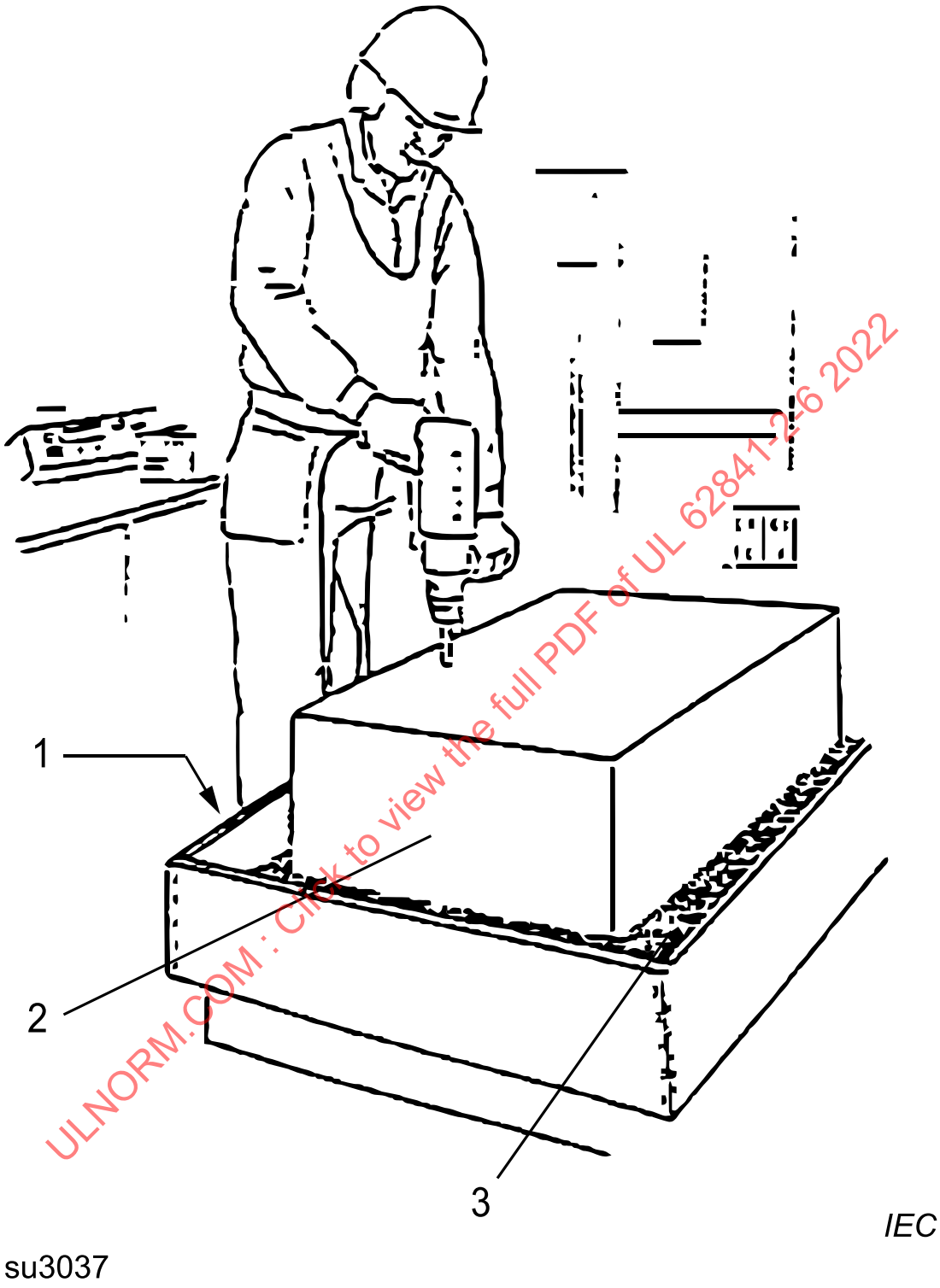
Figure I.103

Testing device

I.2.5.102 Rotary hammers

For **rotary hammers**, the speed setting shall be that recommended by the manufacturer for the drill bit size defined for the test for hammer drilling in concrete.

Rotary hammers are tested under load as shown in Figure I.104 and in accordance with the conditions shown in Table I.102.



Key

1 operator standing on a device for measuring the force applied to the tool

2 concrete block

3 resilient material

Figure I.104

Application of load

Table I.102
Noise test conditions for rotary hammers

Orientation	Drilling vertically down into a concrete block complying with the specifications in Table I.103 and having the minimum dimensions 500 mm x 500 mm and 200 mm in height and supported on resilient material. The concrete block, its support and the tool shall be so oriented that the geometric centre of the tool is 1 m above the reflecting plane. The centre of the concrete block shall be located under the top microphone. For consistency of results the drilled holes are blind holes. If the drill bit breaks through, reducing the depth of the hole slightly is a method to avoid this.
Tool bit	New drill bit as recommended by the manufacturer for hammer drilling in concrete and of the size defined in Table I.105. For battery tools, the mass of the tool to select the drill bit is the mass without any **detachable battery pack** or **separable battery pack** attached to the tool.
Feed force	The feed force applied to the tool shall be sufficient to ensure stable operation with good performance.
Test cycle	Measurement starts when the drill bit has reached a depth equal to its diameter and stops when the depth of hole according to Table I.105 has been reached and before the drill bit is removed from the hole.

NOTE 101 In general, stable operation with good performance is achieved by increasing the feed force by a minimum of 30 N after the **rotary hammer** has stopped bouncing and is operating smoothly.

Table I.103
Concrete specifications

Minimum compressive strength (after at least 28 days)	Largest particle size of aggregate [a] mm
40 N/mm^2	Within a range of 32 to 40
[a] The aggregate fraction distribution shall be aligned to the largest particle size of the aggregate. Very hard aggregates such as flint or granite and very soft aggregates such as limestone shall not be used.	

NOTE 102 In some parts of the world, concrete with a minimum compressive strength of 40 N/mm^2 after 28 days is readily available. In other parts of the world, it is possible that readily available concrete will take longer than 28 days to achieve a minimum compressive strength of 40 N/mm^2.

NOTE 103 A more detailed example of a concrete formulation that fulfils the requirements of Table I.103 is shown in Table I.104.

Table I.104
Detailed example of a concrete formulation that fulfils the requirements of Table I.103

Cement	Water	Aggregate [b]	
		1 844 kg	
		Particle size mm	Fraction %
330 kg [a]	183 l [a]	0 to 2	38 ± 3
		0 to 8	50 ± 5
		0 to 16	80 ± 5
		0 to 32	100
Compressive strength after 28 days to be 40 N/mm^2.			
[a] The water/cement mass ratio shall be (0,55 ± 0,02) (the mass tolerance of cement and water is +10 % to enable the concrete manufacturer to ensure compressive strength with local cement). [b] Very hard aggregates as flint or granite and very soft aggregates as limestone shall not be used.			

Table I.105
Drill bit size

Tool mass without any supply cord or battery (as applicable) kg	≤ 3,5	> 3,5 ≤ 5	> 5 ≤ 7	> 7 ≤ 10	> 10 ≤ 18	> 18
Diameter of drill bit mm	10	16	20	25	32	40
Usable length of drill bit [a] mm	100		200		250	
Depth of hole mm	80		180		180	
[a] If the manufacturer does not produce the specified length, the next larger available length shall be used.						

I.3 Vibration

This clause of Part 1 is applicable except as follows:

I.3.3.2 Location of measurement

Addition:

Figure I.105 and Figure I.106 show the positions for different types of hammers.

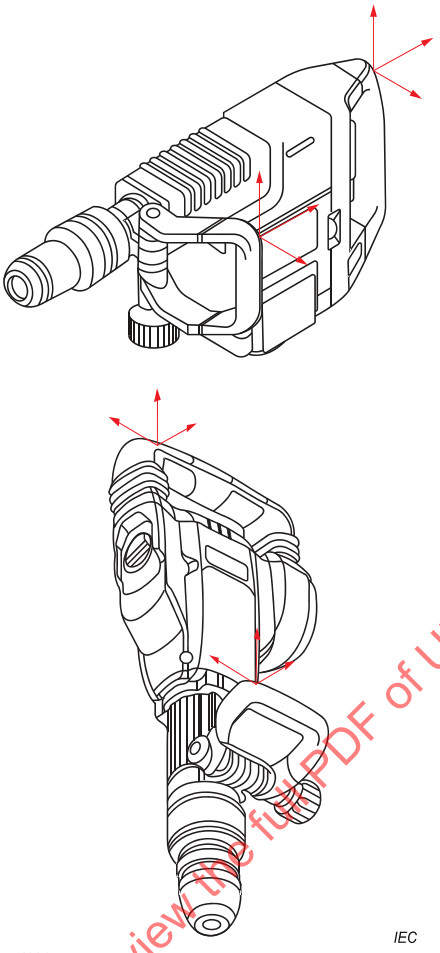


Figure I.105

Positions of transducers for percussion hammers

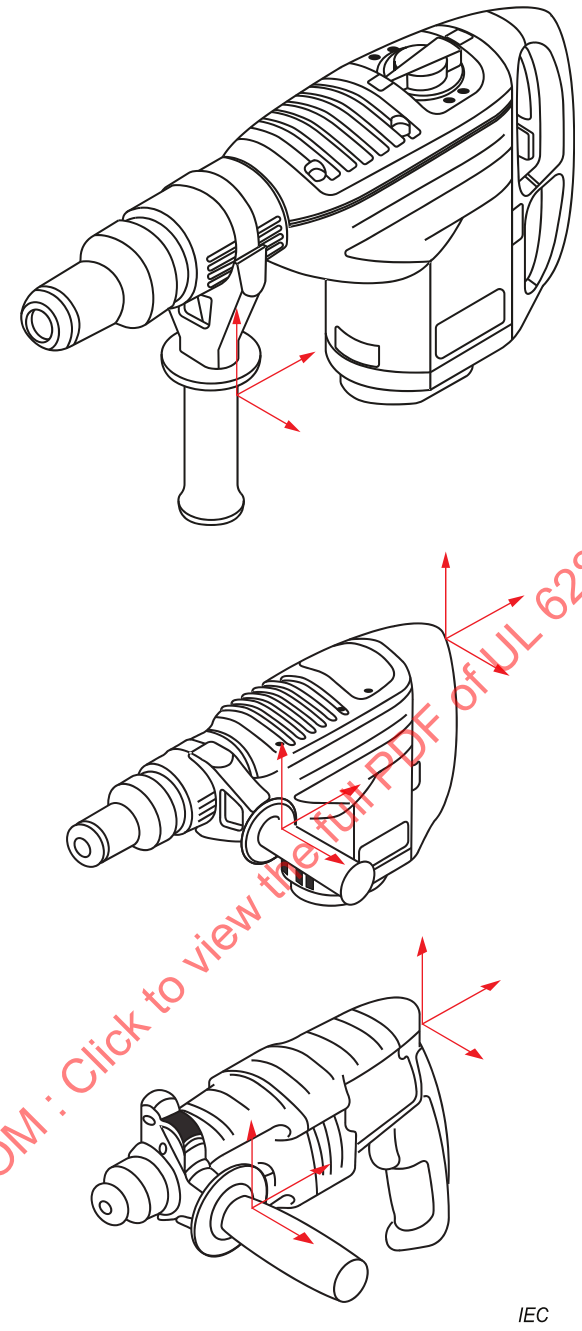


Figure I.106

Positions of transducers for rotary hammers

I.3.5.1 General

Addition:

For battery operated tools, the tests are conducted with the lightest battery in accordance with K.8.14.2 e) 2) that has a sufficient capacity to

– operate the tool as specified in Table I.106 for at least 5 min; or

– complete fifteen measurements as specified in Table I.107.

I.3.5.3 Operating conditions

Addition:

If **rotary hammers** have a separate percussion only mode`, they shall be tested both in the percussion only and in the **rotary hammer** mode according to I.3.5.3.101 and I.3.5.3.102.

NOTE The vibrations in the drill only mode are expected to be always lower than those for hammer drilling. Therefore, vibration values in the drill only mode are covered by the declared values for hammer drilling and their separate measurement is not required.

I.3.5.3.101 Hammers with percussion only mode

Percussion hammers and **rotary hammers** with a percussion only mode are first tested under load in the loading device shown in Annex AA and in accordance with the conditions shown in Table I.106, all speed setting devices adjusted to the highest value.

Annex AA specifies all details of the loading device depending on the size of the hammer and its connection end.

Table I.106
Vibration test conditions for percussion hammers under load

Orientation	Operating vertically in the loading device as shown in Figure AA.1 which is mounted on a ground support such as a concrete block. The ground support shall be large and solid enough to ensure the stability of the loading device during the test. To avoid negative effects on the measurement results, the inserted tool shall be aligned in the middle of the bushing without contact to the bushing.
Tool bit	Stamper as shown in Figure AA.1, item 1, and in Figure AA.2 to Figure AA.5.
Feed force	The feed force applied to the tool shall cover a feed force range of 80 N. The first measurement is made at "first stable operation". For machines where the highest force of the 80 N range would block the anti-vibration system, the feed force range is reduced to 60 N. Four subsequent measurements are conducted, where the feed force is increased in equal increments for each following measurement, so that the last measurement is done at the upper end of the feed force range. "First stable operation" is achieved by increasing the feed force to the point where the hammer has just stopped bouncing and is operating smoothly. The tool weight alone may be sufficient to achieve "first stable operation" without additional feed force (e.g. heavy concrete breakers). The feed force shall be shared equally to the handles.
Grip force	Grip forces as in normal long term use shall be applied. Excessive grip force shall be avoided.
Test cycle	Measurement starts when the relevant feed force is adjusted and stops after a minimum of 8 s.

In addition, the hammers are equipped with a typical bull point chisel and tested five times under "no load" for a minimum of 8 s each, by lifting the hammer up so that its weight is totally supported by the hands of the operator.

The no load measurements may be done in rotation with the load measurements or as a separate test sequence.

I.3.5.3.102 Rotary hammers

For **rotary hammers**, the speed setting shall be that recommended by the manufacturer for the drill bit size defined for the test for hammer drilling in concrete.

Rotary hammers are tested under load as shown in Figure I.104 and in accordance with the conditions shown in Table I.107.

Table I.107
Vibration test conditions for rotary hammers

Orientation	Drilling vertically down into a concrete block having the formulation specified in Table I.103 and having the minimum dimensions 500 mm x 500 mm and 200 mm in height and supported on resilient material. For consistency of results the drilled holes should be blind holes. If the drill bit breaks through, the depth of the hole may be reduced slightly to avoid this.
Tool bit	New drill bit as recommended by the manufacturer for hammer drilling in concrete and of the size defined in Table I.105. For battery tools, the mass of the tool to select the drill bit is the mass without any **detachable battery pack** or **separable battery pack** attached to the tool.
Feed force	The feed force applied to the tool shall cover a feed force range of 80 N. The first measurement is made at "first stable operation". For machines where the highest force of the 80 N range would block the anti-vibration system, the feed force range is reduced to 60 N. Four subsequent measurements are conducted, where the feed force is increased in equal increments for each following measurement, so that the last measurement is done at the upper end of the feed force range. "First stable operation" is achieved by increasing the feed force to the point where the hammer has just stopped bouncing and is operating smoothly. The tool weight alone may be sufficient to achieve "first stable operation" without additional feed force (e.g. heavy **rotary hammers**). The feed force shall be shared equally to the handles.
Grip force	Grip forces as in normal long term use shall be applied. Excessive grip force shall be avoided.
Test cycle	Measurement starts when the drill bit has contact to the concrete block, and stops when the depth of the hole according to Table I.105 has been reached and before the drill bit is removed from the hole.

I.3.6.1 Reported vibration value

Replacement:

Three series of five consecutive tests shall be carried out using a different operator for each series. If it can be shown that the vibration is not affected by operator characteristics, it is acceptable to perform all 15 measurements with one operator only.

The measurements are made in three axes and the results of each direction shall be combined using Equation (I.3) to obtain the vibration total value a_{hv}.

The measurement result a_h shall be determined as the arithmetic mean of vibration total values over the tests and operators.

If more than one operating mode was measured, the result a_h for each operating mode applicable shall be reported:

$a_{h,HD}$ = mean vibration "hammer drilling" in accordance with I.3.5.3.102;

$a_{h,CH}$ = mean vibration "chiselling" on loading device in accordance with I.3.5.3.101;

$a_{h,NL}$ = mean vibration "no load" in accordance with I.3.5.3.101;

$a_{h,CHeq} = [0,2\ (a_{h,NL})^2 + 0,8\ (a_{h,CH})^2]^{0,5}$

= equivalent chiselling value (representing time contents of 20 % with no load and 80 % with full load).

I.3.6.2 Declaration of the vibration total value

Addition:

The vibration total value of the handle with the highest emission and the uncertainty *K* shall be declared:

– for **rotary hammers** without percussion only mode
the value of $a_{h,HD}$, with the work mode description "hammer drilling into concrete";

– for **rotary hammers** with percussion only mode
the value of $a_{h,HD}$, with the work mode description "hammer drilling into concrete" and the value of $a_{h,Cheq}$, with the work mode description "chiselling";

– for **percussion hammers**
the value of $a_{h,Cheq}$, with the work mode description "chiselling".

I.3.7 Measurement report

Replacement of item d):

d) operating and testing conditions (voltage, current, feed force applied for each measurement, the force applied to the stamper due to vacuum for air-cooling, speed setting, duration and number of test runs, etc.);

Annex K
(normative)

Battery tools and battery packs

All clauses of the main body of this Part 2-6 apply unless otherwise specified in this annex. If a clause is stated in this annex, its requirements replace the requirements of the main body of this Part 2-6 unless otherwise specified.

K.8.14.1.101 *Replacement of item 1) d):*

d) **Hold the power tool by insulated gripping surfaces, when performing an operation where the cutting accessory may contact hidden wiring.** *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 102 For **rotary hammers** that can also be used as screwdrivers, the words "or fasteners" are added after "cutting accessory".

K.12.1 *Addition:*

The temperature-rise limit specified for the external enclosure does not apply to the enclosure of the impact mechanism.

K.12.2.1 This subclause of Part 2-6 is not applicable.

K.12.5 This subclause of Part 2-6 is not applicable.

K.17.2 This subclause of Part 2-6 is not applicable.

K.18.8 *Replacement of Table 4:*

Table 4
Required performance levels

Type and purpose of SCF	Minimum Performance Level (PL)
Power switch − provide desired switch-off for tools that require bracing in accordance with 8.14.1.101	c
Power switch – provide desired switch off for **percussion hammers** or for **rotary hammers** in percussion only mode	Not an **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 **rotary hammers** that require bracing in accordance with 8.14.1.101	b
Any speed limiting device	Not an **SCF**
Limit the torque to comply with 19.102	c
Power switch – prevent unwanted switch-on for **rotary hammers** in **rotary hammer** mode and drill only mode with $M_R \leq 25$ Nm in accordance with 19.102	a
Power switch – prevent unwanted switch-on for **rotary hammers** in **rotary hammer** mode and drill only mode with $M_R > 25$ Nm in accordance with 19.102	b
Power switch – prevent unwanted switch-on for **percussion hammers** or for **rotary hammers** in percussion only mode	Not an **SCF**
Power switch – provide desired switch-off for **rotary hammers** in **rotary hammer** mode and drill only mode with $M_R \leq 25$ Nm in accordance with 19.102	a

Table 4 Continued on Next Page

Table 4 Continued

Type and purpose of SCF	Minimum Performance Level (PL)
Power switch – provide desired switch-off for **rotary hammers** in **rotary hammer** mode and drill only mode with M_R > 25 Nm in accordance with 19.102	c
Prevent unwanted lock-on of the **power switch** function for **rotary hammers** in **rotary hammer** mode and drill only mode with M_R ≤ 25 Nm in accordance with 19.102	a
Prevent unwanted lock-on of the **power switch** function for **rotary hammers** in **rotary hammer** mode and drill only mode with M_R > 25 Nm in accordance with 19.102	c
Prevent unwanted lock-on of the **power switch** function for **percussion hammers** or for **rotary hammers** in percussion only mode	Not an **SCF**
Prevent self-resetting as required in 23.3 for **rotary hammers** in **rotary hammer** mode and drill only mode with M_R ≤ 25 Nm in accordance with 19.102	a
Prevent self-resetting as required in 23.3 for **rotary hammers** in **rotary hammer** mode and drill only mode with M_R > 25 Nm in accordance with 19.102	b

K.19.102.1 General

The design of the handle(s) on **rotary hammers** 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 Figure 102 to Figure 105.

Figure 106 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 Figure 102 to Figure 105 to determine the moment arm for the torque calculation.

Figure 107 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 Figure 104 and Figure 105 to determine the moment arm for the torque calculation.

For **rotary hammers** with the ability to operate in percussion only mode and provided with a stick type auxiliary handle without flange, the determination of the relevant length a for the moment arm is illustrated in Figure 108.

NOTE 101 Stick type auxiliary handles on **rotary hammers** that can operate in percussion only mode are typically designed without a flange barrier. A flange could prevent ergonomic use in the chiselling application where the flange would interfere with the hand of the operator. The measurement of a in Figure 108 accommodates this type of tool.

Compliance is checked by the tests specified in K.19.102.2 and K.19.102.4 and by the calculations in Figure 102 to Figure 105 and Figure 108.

K.19.102.1DV D1 ***Modification: Replace the fifth paragraph of Clause K19.102.1 of the Part 2 with the following:***

Compliance is checked by the tests specified in Clauses K.19.102.2 to K.19.102.4 and by the calculations in Figure 104 to Figure 107.

K.19.102.2 Test equipment

The test equipment used for the test of K.19.102.4 shall meet the following requirements a) to f):

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 K.19.102.4.

b) The output of the torque transducer shall be connected to an oscilloscope or other data acquisition equipment capable of displaying the torque versus time graph of the tool's output during the test of K.19.102.4.

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 ±2°.

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 ± 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.

Compliance is checked by inspection and by measurement.

K.19.102.3 Test to determine tool configuration

This test is only applicable for tools that employ (an) ***electronic circuit(s)*** *that affect(s) the output torque in the test of K.19.102.4.*

Prior to the test, any device or circuit that slows the rate of increase of motor speed at initial startup (e.g. soft start) is disabled.

Prior to each measurement, the sample is operated for at least 5 min at no-load using any suitable battery. After each 5 min operation period, the measurement shall be conducted within 20 min.

The sample is tested together with its intended battery. If more than one battery is specified for use with the tool, the battery with the highest short-circuit current shall be used.

At the beginning of the test, the ***battery*** *shall be* ***fully charged****.*

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 tool configuration for the test of 19.102.4 shall be either:

– when all functions affecting the output torque are considered ***SCF****s and are evaluated according to 18.8, all functions affecting the output torque are enabled; or*

– when all functions affecting the output torque are not evaluated as ***SCF****s according to 18.8, the configuration that results in the greatest output torque for one trial of the test of K.19.102.4 through steps 1) and 2) as specified below:*

- *all functions affecting the output torque enabled; or*
- *each function affecting the output torque disabled one at a time*

K.19.102.3DV D2 ***Modification: Replace Clause K19.102.3 of the Part 2 with the following:***

Assessment to determine tool configuration

This assessment is only applicable for tools that employ (an) electronic circuit(s) that affect(s) the output torque in the test of K.19.102.4.

Prior to each measurement, the sample is operated for at least 5 min at no-load. After each 5 min operation period, the measurement shall be conducted within 20 min.

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.

For tools with a soft start function, the test of K.19.102.4 through steps 1) and 2) is conducted on the sample with the soft start function enabled and then repeated with the soft start function disabled. If analysis shows that the tool will not operate with the soft start function disabled, then the test with the soft start function disabled is not conducted. For tools employing electronically commutated motors, the configuration that results in the greatest output torque shall be used for the test of K.19.102.4.

For tools other than those employing electronically commutated motors, when all functions affecting the test value of the output torque, except for any soft start function, are not evaluated as SCFs according to K.18.8 (e.g. current limit and stall detection), the tool configuration for the test of K.19.102.4 shall be the configuration that results in the greatest output torque for one trial of the test of K.19.102.4 through steps 1) and 2) as specified below:

– all functions affecting the output torque enabled; or

– each function not evaluated as an SCF affecting the output torque disabled one at a time.

K.19.102.4 Test procedure

If applicable, the sample is configured as specified in K.19.102.3.

Prior to the test, any device or circuit that slows the rate of increase of motor speed at initial startup (e.g. soft start) is disabled.

*Prior to the test, the sample is operated for at least 5 min at no-load, using any suitable **battery**. After the 5 min operation period, the test shall be conducted within 20 min.*

*The sample is tested together with its intended **battery**. If more than one **battery** is specified for use with the tool, the **battery** with the highest short-circuit current shall be used.*

*At the beginning of the test, the **battery** shall be **fully charged**.*

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 the greater of 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 109.

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 110.

NOTE 101 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 111.

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.

NOTE 102 It is recognized that disabling functions that affect the torque can result in a test where the tool is permanently impaired after the test.

K.19.102.4DV D1 *Modification: Delete the second paragraph of Clause K19.102.4 of the Part 2.*

K.21 Construction

Addition:

NOTE 101 In Europe (EN 62841-2-6), the following additional subclause applies:

K.21.18.Z101 Isolation and disabling device

Rotary hammers with an **integral battery** shall either be equipped

– with an isolation device to prevent the risk of injury from mechanical hazards during servicing or **user maintenance**; or

– with a disabling device that prevents unintentional starting of the tool.

An isolation device shall

– provide disconnection of all poles of the **battery** from the serviceable region of the tool;

– be equipped with an unambiguous indication of the state of the disconnection device which corresponds to each position of its manual control (actuator);

– be provided with protection against accidental reconnection.

NOTE 1 Examples of methods to achieve this disconnection include removable jumpers, **integral batteries** that can be disconnected for servicing or **user maintenance**, or an electromechanical **power switch** with a direct mechanical link between the actuator and the contact.

NOTE 2 The risk of accidental reconnection for a **power switch** is addressed by the requirement of 21.18.1.2. The other examples in NOTE 1 achieve this by the necessary actions for reconnection.

A disabling device may be achieved by any of the following:

– a self-restoring or non-self-restoring lock-off device where two separate and dissimilar actions are 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;

– a removable disabling device provided with the tool where it shall not be possible for the tool to be operated when either applied or removed.

Compliance is checked by inspection and by manual test.

K.24.4 This subclause of Part 2-6 is not applicable.

K.24.11 This subclause of Part 2-6 is not applicable.