UL 60745-2-1

STANDARD FOR SAFETY

Hand-Held Motor-Operated Electric Tools – Safety – Part 2-1: Particular Requirements for Drills and Impact Drills

UL Standard for Safety for Hand-Held Motor-Operated Electric Tools – Safety – Part 2-1: Particular Requirements for Drills and Impact Drills, UL 60745-2-1

Second Edition, Dated March 26, 2004

Summary of Topics

This revision of ANSI/UL 60745-2-1 dated January 7, 2022 is being issued to update the title page to reflect the most recent designation as a Reaffirmed American National Standard (ANS). No technical changes have been made.

As noted in the Commitment for Amendments statement located on the back side of the title page, UL and CSA are committed to updating this harmonized standard jointly. However, the revision pages dated January 7, 2022 will not be jointly issued by UL and CSA as these revision pages only address UL ANSI approval dates

Text that has been changed in any manner or impacted by UL's electronic publishing system is marked with a vertical line in the margin.

The requirements are substantially in accordance with Proposal(s) on this subject dated November 12, 2021.

No Text on This Page

CSA Group
CAN/CSA-C22.2 No. 60745-2-1-04
Second Edition
(IEC 60745-2-1:2003, MOD)

Underwriters Laboratories Inc.
UL 60745-2-1
Second Edition

Hand-Held Motor-Operated Electric Tools – Safety – Part 2-1: Particular Requirements for Drills and Impact Drills

March 26, 2004

(Title Page Reprinted: January 7, 2022)

This national standard is based on publication IEC 60745-2-1, Edition 2.1 (2008).

ANSI/UL 60745-2-1-2011 (R2022)

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 any time. 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.

ISBN 1-55397-465-4 © 2004 Canadian Standards Association

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. 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.

To purchase CSA Group Standards and related publications, visit CSA Group's Online Store at www.csagroup.org/store/ or call toll-free 1-800-463-6727 or 416-747-4044.

This ANSI/UL Standard for Safety consists of the Second Edition including revisions through January 7, 2022.

The most recent designation of ANSI/UL 60745-2-1 as a Reaffirmed American National Standard (ANS) occurred on January 7, 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.

Comments or proposals for revisions on any part of the Standard may be submitted to UL at any time. Proposals should be submitted via a Proposal Request in UL's On-Line Collaborative Standards Development System (CSDS) at https://csds.ul.com.

To purchase UL Standards, visit Comm 2000 at http://www.comm-2000.com/help/how_to_order.aspx or call toll-free 1-888-853-3503.

CONTENTS

Bibliography

Preface

This is the harmonized CSA and UL standard for hand-held motor-operated electric tools; drills and impact drills. It is the second edition of CAN/CSA-C22.2 No. 60745-2-1 and the second edition of UL 60745-2-1. This standard is based on IEC 60745-2-1, second edition. This harmonized standard has been jointly revised on October 6, 2010. For this purpose, CSA and UL are issuing revision pages dated October 6, 2010.

This harmonized standard was prepared by the Canadian Standards Association (CSA) and Underwriters Laboratories Inc. (UL).

This standard was reviewed by the CSA Subcommittee on Portable 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 approved as a National Standard of Canada by the Standards Council of Canada.

This standard has been approved by the American National Standards Institute (ANSI) as an American National Standard.

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

Level of harmonization

This standard adopts the IEC text with national differences.

This standard is published as an equivalent standard for CSA 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 and UL versions of the standard. While the technical content is the same in each organization's version, the format and presentation may differ.

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 literal interpretation 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.

No Text on This Page

NATIONAL DIFFERENCES

In the CSA and UL publications of this standard, National Differences from the text of International Electrotechnical Commission (IEC) Publication 60745-2-1, Safety Requirements for Hand-Held Motor-Operated Electric Tools – Safety – Part 2-1: Particular Requirements for Drills and Impact Drills, copyright 2008, 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

HAND-HELD MOTOR-OPERATED ELECTRIC TOOLS – SAFETY – Part 2-1: Particular requirements for drills and impact drills

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 non-governmental 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 provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with an IEC Publication.

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 60745-2-1 has been prepared by subcommittee 61F: Safety of hand-held motor-operated electric tools, of IEC technical committee 61: Safety of household and similar electrical appliances.

This consolidated version of IEC 60745-2-1 consists of the second edition (2003) [documents 61F/451/FDIS and 61F/471/RVD] and its amendment 1 (2008) [documents 61F/731/FDIS and 61F/751/RVD].

The technical content is therefore identical to the base edition and its amendment and has been prepared for user convenience.

It bears the edition number 2.1.

A vertical line in the margin shows where the base publication has been modified by amendment 1.

The French version of this standard has not been voted upon.

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

This Part 2-1 is to be used in conjunction with the third edition of IEC 60745-1. When this standard states "addition", "modification" or "replacement", the relevant text in Part 1 is to be adapted accordingly.

With amendment 1, this Part 2 is established on the basis of the fourth edition (2006) of IEC 60745-1: *Safety of hand-held motor-operated electric tools – Part 1: General requirements*.

Main changes include editorial modifications to match with the fourth edition of IEC 60745-1, and the addition of a new safety warning to Clause 8: Marking and instructions.

NOTE In this standard, the following print types are used:

– requirements: in roman type;

– *test specifications: in italic type;*

– notes: in small roman type.

IEC 60745 consists of the following parts, under the general title *Hand-held motor-operated electric tools – Safety*:

Part 1: General requirements

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

Part 2-2: Particular requirements for screwdrivers and impact wrenches

Part 2-3: Particular requirements for grinders, polishers and disk-type sanders

Part 2-4: Particular requirements for sanders and polishers other than disk type

Part 2-5: Particular requirements for circular saws and circular knives

Part 2-6: Particular requirements for hammers

Part 2-7: Particular requirements for spray guns for non-flammable liquids

Part 2-8: Particular requirements for shears and nibblers

Part 2-9: Particular requirements for tappers

Part 2-11: Particular requirements for reciprocating saws (jig and sabre saws)

Part 2-12: Particular requirements for concrete vibrators

Part 2-13: Particular requirements for chain saws

Part 2-14: Particular requirements for planers

Part 2-15: Particular requirements for hedge trimmers and grass shears

Part 2-16: Particular requirements for tackers

Part 2-17: Particular requirements for routers and trimmers

Part 2-18: Particular requirements for strapping tools

Part 2-19: Particular requirements for jointers

Part 2-20: Particular requirements for band saws

Part 2-21: Particular requirements for drain cleaners

The committee has decided that the contents of the base publication and its amendments will remain unchanged until the maintenance result 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.

No Text on This Page

HAND-HELD MOTOR-OPERATED ELECTRIC TOOLS – SAFETY – PART 2-1: PARTICULAR REQUIREMENTS FOR DRILLS AND IMPACT DRILLS

1 Scope

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

Addition:

This standard applies to drills and impact drills.

2 Normative references

This clause of part 1 is applicable.

3 Terms and Definitions

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

Additional definitions:

3.101 drill: tool specifically designed to bore holes in various materials such as metal, plastics, wood, etc.

3.102 impact drill: drill specifically designed to bore holes in concrete, stone and other materials. It is similar, in appearance and construction, to a drill, but has a built-in percussion system which gives an axial percussion movement to rotating output spindle

It may have a device for rendering the percussion system inoperative, so that it may be used as a conventional drill.

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:

5.5 *Addition:*

For drills which have both a mechanical means of setting different ranges of speed and an electronic means of setting the speed within a given range, the mechanical device is adjusted to the lowest range possible and the electronic device is adjusted to the highest setting within the given range.

6 Void

7 Classification

This clause of part 1 is applicable.

8 Marking and instructions

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 in revolutions per minute.

– maximum capacity, in millimetres, of the chuck.

8.12.1.1 *Addition:*

Drill safety warnings

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

NOTE The above warning applies only to impact drills and may be omitted for drills other than impact drills.

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

– **Hold 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.*

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 *Addition:*

Tools are operated continuously 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.

12.3 *Addition:*

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

13 Leakage current

This clause of part 1 is applicable.

14 Moisture resistance

This clause of part 1 is applicable.

15 Electric strength

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:*

Impact drills are operated 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 supply voltage equal to 1,1 times rated voltage and then for 12 h at a supply voltage equal to 0,9 times rated voltage. 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.

During this test, replacement of the carbon brushes is allowed, and the tool is oiled and greased as in normal use.

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

The impact drills are then mounted vertically in a test apparatus as shown in Figure 101 and are operated at rated voltage or at the mean value of the rated voltage range, 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 impact drills are 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.

During the tests, an axial force, just enough to ensure steady operation of the impact mechanism, is applied to the impact drill through a resilient medium.

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.

During these tests, overload protection devices shall not operate.

NOTE 1 Monitoring of external temperatures will help avoid mechanical failures.

NOTE 2 The change of position is made to prevent abnormal accumulation of carbon dust in any particular place. Examples of the three positions are horizontal, vertically up and vertically down.

18 Abnormal operation

This clause of part 1 is applicable.

19 Mechanical hazards

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

19.1 *Addition:*

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.

19.101 The force on the hand due to static stalling torque shall not be excessive.

Compliance is checked by the following test:

Static stalling torque or slip torque of a clutch is measured on the locked output spindle of the tool in the cold condition (M_R).

The tool is connected to rated voltage. The mechanical gears are adjusted to the lowest speed. Electronic regulators are adjusted to their maximum speed setting. The tool switch is to be in the full "on" position. The mean value of the torque measured shall not exceed the relevant maximum value in Figure 102 and Figure 103.

20 Mechanical strength

This clause of part 1 is applicable.

21 Construction

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

21.18 *Addition:*

A 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 switch actuator of the tool.

Compliance is checked by inspection or by the following test.

For a switch with a lock-on device within the grasping area, the lock-on device shall not be actuated by a straight-edged utensil when the utensil is made to pass back and forth across the device in any direction. The straight-edged utensil may be of any convenient length sufficient to bridge the surface of the lock-on device and any surface adjacent to the lock-on device.

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:*

Overload protection devices shall be of the non-self-resetting type unless the tool is equipped with a momentary switch with no provision for being locked in the "on" position.

Compliance is checked by inspection.

24 Supply connection and external flexible cords

This clause of part 1 is applicable.

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.

29 Resistance to heat, fire and tracking

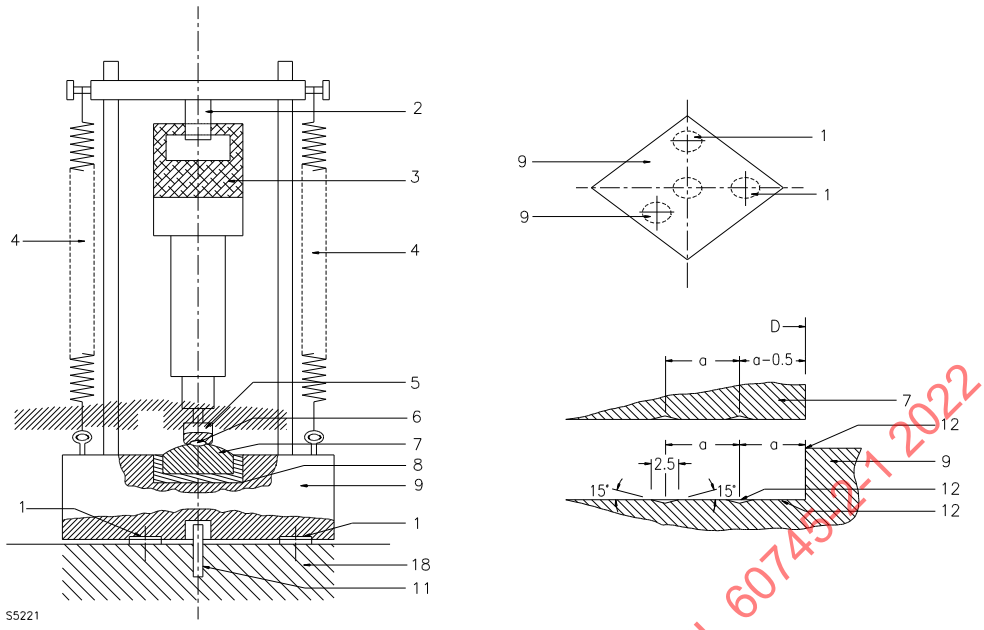
This clause of part 1 is applicable.

30 Resistance to rusting

This clause of part 1 is applicable.

31 Radiation, toxicity and similar hazards

This clause of part 1 is applicable.



Dimensions in millimetres

Key

1. Synthetic rubber disk or material having similar properties, shore hardness 70° to 80°, thickness 10 mm, diameter 75 mm.

2. Polymide-lined 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, grooved on underside as shown in detail.

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. Bottom of cavity grooved, as shown in detail.

10. Concrete block supported by compacted ballast of earth.

11. Steel peg to prevent any horizontal movement.

12. Burnished surface and edge.

NOTE When submitting a tool, the applicant may supply, if necessary, a suitable punch and shank, the total mass of which is less than that specified in the following table, for the steady operation of the impact mechanism.

Rated input of tool (W)	*D* Diameter of transfer plate (mm)	*a* Distance between centres of grooves (mm)	M_1 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	6,5	90	1,0	0,7
Over 700 up to and including 1200	140	5,75	180	2,25	1,4
Over 1200 up to and including 1800	180	5,0	270	3,8	2,3
Over 1800 up to and including 2500	220	4,5	360	6,0	3,4

Figure 101

Testing apparatus for hammers

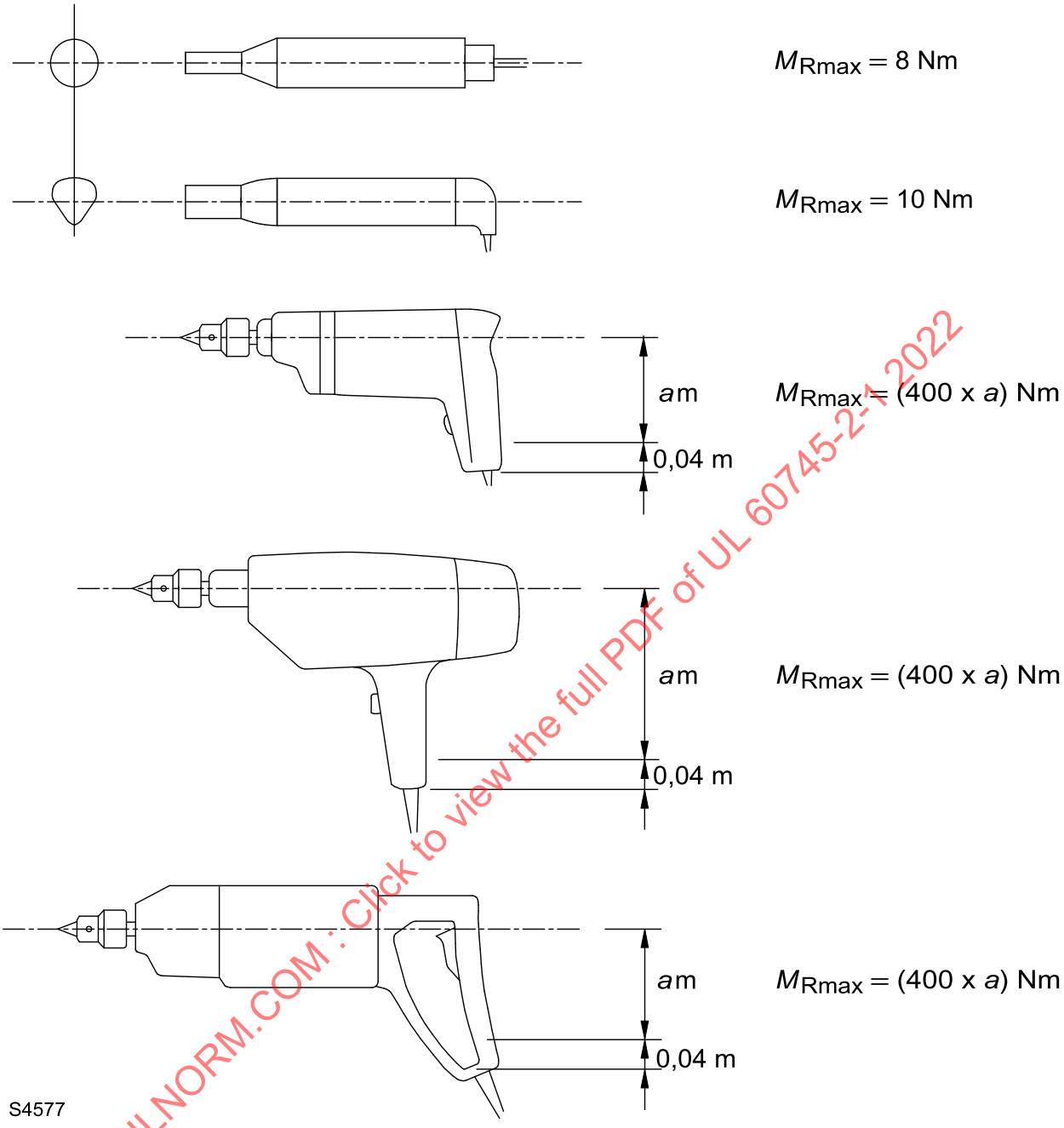


Figure 102

Reaction torque of single-hand support