UL 62841-3-4

STANDARD FOR SAFETY

Electric Motor-Operated Hand-Held Tools, Transportable Tools And Lawn And Garden Machinery – Safety – Part 3-4: Particular Requirements For Transportable Bench Grinders

UL Standard for Electric Motor-Operated Hand-Held Tools, Transportable Tools And Lawn And Garden Machinery –Safety – Part 3-4: Particular Requirements For Transportable Bench Grinders, UL 62841-3-4

First Edition, Dated December 23, 2016

Summary of Topics

The revisions to ANSI/UL 62841-3-4, dated October 18, 2019, includes revisions to Clauses 1 and 2 and addition of new Figure 106 to align with changes in IEC Amendment 1 for IEC 62841-3-4.

UL 62841-3-4 is an adoption of IEC 62841-3-4, Edition 1 published February 2016, and includes IEC Amendment 1 to IEC 62841-3-4, published by the IEC in July 2019. Please note that the National Difference document incorporates all of the U.S. national differences for UL 62841-3-4.

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 new and revised requirements are substantially in accordance with Proposal(s) on this subject dated July 26, 2019.

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Underwriters Laboratories Inc.
UL 62841-3-4
First Edition

Electric Motor-Operated Hand-Held Tools, Transportable Tools And Lawn And Garden Machinery – Safety – Part 3-4: Particular Requirements For Transportable Bench Grinders

December 23, 2016

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This national standard is based on publication IEC 62841-3-4, First Edition (2016), and IEC Amendment 1 (2019).

ANSI/UL 62841-3-4-2019

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 ANSI/UL Standard for Safety consists of the First Edition including revisions through October 18, 2019. The most recent designation of ANSI/UL 62841-3-4 as an American National Standard (ANSI) occurred on October 18, 2019. 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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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 3-4: Particular Requirements for Transportable Bench Grinders. It is the First edition of CAN/CSA-C22.2 No. 62841-3-4 and the First edition of UL 62841-3-4. This harmonized Standard has been jointly revised on October 18, 2019. For this purpose, CSA Group and UL are issuing revision pages October 18, 2019.

This harmonized standard is based on IEC Publication 62841-3-4: First edition Electric Motor-Operated Hand-Held Tools, Transportable Tools And Lawn And Garden Machinery – Safety – Part 3-4: Particular Requirements for Transportable Bench Grinders issued February 2016, as revised by Amendment 1 issued July 2019. IEC 62841-3-4 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.

This CAN/CSA-C22.2 No. 62841-3-4, Standard For Electric Motor-Operated Hand-Held Tools, Transportable Tools And Lawn And Garden Machinery – Safety – Part 3-4: Particular Requirements for Transportable Bench Grinders is to be used in conjunction with the First edition of CAN/CSA-C22.2 No. 62841-1. The requirements for transportable bench grinders are contained in this Part 3 Standard and CAN/CSA-C22.2 No. 62841-1. Requirements of this Part 3 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 CAN/CSA-C22.2 No. 62841-3-4, the CAN/CSA-C22.2 No. 62841-1 subclause applies.

This UL 62841-3-4 Standard For Electric Motor-Operated Hand-Held Tools, Transportable Tools And Lawn And Garden Machinery – Safety – Part 3-4: Particular Requirements for Transportable Bench Grinders, is to be used in conjunction with the First edition of UL 62841-1. The requirements for

transportable bench grinders are contained in this Part 3 Standard and UL 62841-1. Requirements of this Part 3 Standard, where stated, amend the requirements of UL 62841-1. Where a particular subclause of UL 62841-1 is not mentioned in UL 62841-3-4, 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

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

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 IEC 62841-3-4 Electric Motor-Operated Hand-Held Tools, Transportable Tools And Lawn And Garden Machinery – Safety – Part 3-4: Particular Requirements for Transportable Bench Grinders, copyright 2016, 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 the International Electrotechnical Commission (IEC) publication 62841-3-4, Electric Motor-Operated Hand-Held Tools, Transportable Tools And Lawn And Garden Machinery – Safety – Part 3-4: Particular Requirements for Transportable Bench Grinders, copyright 2016 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.

INTERNATIONAL ELECTROTECHNICAL COMMISSION

ELECTRIC MOTOR-OPERATED HAND-HELD TOOLS, TRANSPORTABLE TOOLS AND LAWN AND GARDEN MACHINERY – SAFETY – PART 3-4: PARTICULAR REQUIREMENTS FOR TRANSPORTABLE BENCH GRINDERS

FOREWORD

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.

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International Standard IEC 62841-3-4 has been prepared by IEC technical committee 116: Safety of motor-operated electric tools.

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

FDIS	Report on voting
116/258/FDIS	116/275/RVD

Full information on the voting for the approval of this 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 3-4 is to be used in conjunction with the first edition of IEC 62841-1:2014.

This Part 3-4 supplements or modifies the corresponding clauses in IEC 62841-1, so as to convert it into the IEC Standard: Particular requirements for transportable bench grinders.

Where a particular subclause of Part 1 is not mentioned in this Part 3-4, that subclause applies as far as relevant. Where this standard states ″addition″, ″modification″ or ″replacement″, the relevant text in Part 1 is to be adapted accordingly.

The following print types are used:

– requirements: in roman type

– *test specifications: in italic type;*

– notes: in small roman type

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

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

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

The committee has decided that the contents of this 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.

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.

ELECTRIC MOTOR-OPERATED HAND-HELD TOOLS, TRANSPORTABLE TOOLS AND LAWN AND GARDEN MACHINERY – SAFETY – PART 3-4: PARTICULAR REQUIREMENTS FOR TRANSPORTABLE BENCH GRINDERS

1 Scope

This clause of Part 1 is applicable except as follows:

Addition:

This part of IEC 62841 applies to transportable bench grinders that can be equipped with one or two accessories as follows:

– type 1 grinding wheels (see Figure 106) with a diameter not exceeding 310 mm and a thickness not exceeding 55 mm;

– wire brushes with a diameter not exceeding 310 mm and a thickness not exceeding 55 mm;

– polishing wheels with a diameter not exceeding 310 mm;

and with a peripheral speed of any **accessory** between 10 m/s and 50 m/s.

NOTE Polishing wheels are also known as buffing wheels.

2 Normative references

This clause of Part 1 is applicable.

3 Terms and definitions

This clause of Part 1 is applicable except as follows:

3.101 **bench grinder:** tool designed to grind, clean, polish or debur metal or similar materials by means of one or two rotating **accessories** fixed to one or two **tool spindles**, see Figure 101, where the workpiece is held by hand and possibly assisted by a **work rest**

3.102 **tool spindle:** drive spindle of a **bench grinder** which supports the **accessories** and provides the rotation

3.103 **work rest:** surface or device intended to support or to guide the workpiece

4 General requirements

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

4.101 *D* is understood to be the maximum diameter of the **accessory** to be used on each tool spindle. Unless otherwise specified, **tool spindle** specific requirements dependent on *D* shall be based on the value of *D* for the relevant **tool spindle**.

Throughout the remaining part of this document, unless otherwise explicitly stated, whenever a requirement or a reference is made to "force" as multiple of *D*, the force shall be expressed in newtons (N) and *D* shall be expressed in millimetres (mm).

5 General conditions for the tests

This clause of Part 1 is applicable except as follows

5.17 Addition:

*The mass of the tool shall include the **guards**, **work rests** and transparent screens. Any additional parts such as leg sets or carrying means that are required in accordance with the instructions for the safe use of the tool shall be included in the mass.*

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:

8.1 Addition:

Tools shall be marked with:

– **rated no-load speed** of the **tool spindle**(s).

8.2 *Addition:*

Addition:

Tools shall also be marked with the following safety warning:

– ⚠ "**WARNING** Always wear eye protection" or the sign M004 of ISO 7010 or the following safety sign:

su0995

– a warning near any polishing spindle (i.e. a spindle without a **guard**) never to use a grinding wheel or wire brush on the polishing side of the tool, if applicable.

8.3 Addition:

Bench grinders shall be marked with the minimum and maximum diameter of the **accessory** to be used on each **tool spindle**.

Bench grinders shall be marked with the direction of rotation of the **tool spindle**, indicated in a visible location on the tool in the vicinity of the **tool spindle**, by an arrow raised or recessed or by any other means no less visible and indelible.

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 **Safety instructions for bench grinders**

Bench grinder safety warnings

a) **Do not use a damaged accessory. Before each use, inspect the accessory such as abrasive wheels for chips and cracks and wire brushes for loose or cracked wires. After inspecting and installing an accessory, position yourself and bystanders away from the plane of the rotating accessory and run the power tool at maximum no-load speed for one minute.** *Damaged accessories will normally break apart during this test time.*

NOTE 1 For tools that are not intended for wire brushes, the phrase "and wire brushes for loose or cracked wires" is omitted.

b) **The rated speed of the accessory must be at least equal to the maximum speed marked on the power tool.** *Accessories running faster than their rated speed can break and fly apart.*

c) **Be aware that wire bristles are thrown by the wire brush even during ordinary operation. Do not overstress the wires by applying excessive load to the wire brush.** *The wire bristles can easily penetrate light clothing and/or skin.*

NOTE 2 The above safety warning applies only to tools intended to be used with wire brushes.

d) **Never grind on the sides of a grinding wheel.** *Grinding on the side can cause the wheel to break and fly apart.*

8.14.2 a) *Addition:*

101) Information about details and type of the **accessory**(ies) recommended for each tool **spindle**, e.g. the maximum thickness of the **accessory** and the diameter of the hole in the **accessory**;

102) Instruction to use only **accessories** with a diameter according to the relevant marking as required by 8.3;

103) Instruction to ensure that the **bench grinder** is always stable and secure (e.g. fixed to a bench) and instruction how to fix the tool to a workbench or the like;

104) Instructions on the correct mounting of wheels and ensuring that wheels are free of defects before use, including instructions for performing a ring test for cracks.

8.14.2 b) *Addition:*

101) Instruction to adjust the spark arrestor and the **work rest** frequently so as to compensate for wear of the wheel;

102) Instruction to keep the distance between the spark arrestor/**work rest** and the wheel as small as possible and in any case not greater than 2 mm;

103) Instruction to replace the worn wheel when these gaps are no longer able to be maintained;

104) For tools with two spindles: instruction to always use the tool with **accessories** on both spindles in order to limit the risk of contact with the rotating spindle;

105) Instruction to always use the **guard**, **work rest**, transparent screen and spark arrestor as required for the **accessory**(ies);

106) For tools with a vertically adjustable or inclinable **work rest**: instruction on how to properly adjust and secure the **work rest** angle in relation to the wheel;

107) Instructions on how to perform grinding functions safely;

108) Instruction to replace damaged or deeply grooved wheels;

109) Instruction where to lift and support the **bench grinder** during transportation;

110) Instruction to always adjust the work rest so that the angle between the **work rest** and the tangent of the **accessory** is always greater than 85°.

8.14.2 c) *Addition:*

101) Instructions for handling and storage of grinding wheels and wire brushes, if applicable.

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.

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.

18 Abnormal operation

This clause of Part 1 is applicable except as follows:

18.5 Addition:

For **bench grinders** operated by three phase motors, the tests of 18.5.1 and 18.5.2 may be replaced by the test of 18.5.3.

18.5.3 *Addition:*

If the test of 18.5.3 is applied, the tool shall be tested for a period of 5 min.

18.8 **Electronic circuits providing safety critical functions**

Replacement of Table 4 by the following:

Table 4 – Required performance levels

Type and purpose of SCF	Minimum Performance Level (PL)
For tools intended to be used with grinding wheels or wire brushes, **power switch** – prevent unwanted switch-on	a
For tools intended to be used with grinding wheels or wire brushes, **power switch** – provide desired switch-off	a
For tools not intended to be used with grinding wheels or wire brushes, **power switch** – prevent unwanted switch-on	Not a SCF
For tools not intended to be used with grinding wheels or wire brushes, **power switch** – provide desired switch-off	Not a SCF
Any electronic control to pass the test of 18.3	a
For tools intended to be used with grinding wheels, overspeed prevention to prevent output speed above 120 % of **rated no-load speed**	c
For tools not intended to be used with grinding wheels, overspeed prevention to prevent output speed above 130 % of **rated no-load speed**	a
Provide desired direction of rotation	b
Prevent exceeding thermal limits as in Clause 18	a
Prevent self-resetting as required in 23.3	a

19 Mechanical hazards

This clause of Part 1 is applicable except as follows:

19.1 *Replacement of the first paragraph:*

Moving and dangerous parts other than the **accessories** shall be so positioned or enclosed to provide adequate protection against personal injury. The guarding of **accessories** is covered in 19.1.101 through 19.1.103.

For grinding wheels and wire brushes, a **guard** in accordance with 19.1.101 and 19.1.102, a **work rest** in accordance with 19.1.102 and a transparent screen in accordance with 19.1.103 shall be provided.

For polishing wheels, a **guard**, a **work rest** and a transparent screen are not required.

Guards for **accessories** shall not be removable without the aid of a tool.

19.1.101 **Guards**

The **guard** shall cover the periphery and the sides of the **accessory**, flanges and the end of the **tool spindle**, except a portion of the **accessory** as allowed in 19.1.102 and indicated in Figure 102.

The **guard** shall be designed so that the **tool spindle** cannot be fitted with an **accessory** greater than 1,07 times the maximum diameter marked on the tool.

The **guard** shall be constructed so that removal of the peripheral protecting member is not necessary for replacement of the **accessory**.

Compliance is checked by inspection and by measurement.

19.1.102 **Openings in the guard**

For grinding wheels and for wire brushes, the opening angle in the **guard** shall not exceed 65° above the horizontal plane passing through the centre of the wheel. The total opening angle shall not exceed 90°. See Figure 102.

Compliance is checked by inspection and by measurement.

19.1.103 **Transparent screens**

Transparent screens shall be adjustable and have the minimum dimensions as specified in Figure 103.

The operation of adjusting the screen shall not modify the adjustment of other parts of the **bench grinder**.

The screen shall be made of transparent material having an appropriate resistance against shattering, such as polycarbonate or laminated glass which is held in place by an interlayer, between its two or more layers of glass.

For all **bench grinders**, the screens shall be mounted in such a way that the symmetrical axis of the screen coincides with the vertical median plane of the working part of the grinding wheel or the wire brush.

Compliance is checked by inspection.

19.6 Replacement:

The tool shall be designed so as to prevent excessive speed under **normal use**. The no-load speed of the **tool spindle** at **rated voltage** shall not exceed the **rated no-load speed**.

Compliance is checked by measuring the speed of the tool spindle after the tool has been operating for 5 min at no-load.

19.7 Addition:

If a working stand is provided with a **bench grinder**, or is specifically identified in accordance with 8.14.2, the requirements of 19.7 are also applicable to the combination of the **bench grinder** and the working stand.

19.7.101 **Bench grinders** shall be provided with means to facilitate the fixing of the tool to a bench, e.g. by providing holes in the base of the tool.

Compliance is checked by inspection.

19.8 This subclause is applicable for **bench grinders**, if provided with:

– wheels; or

– a pedestal with wheels.

19.101 **Spark arrestor**

For grinding wheels, a spark arrestor to limit the ejection of sparks and pieces of wheel from the wheel **guard** shall be provided.

The spark arrestor shall be situated at the upper part of the wheel **guard** in line with the periphery of the wheel and cover all the width of the wheel **guard**.

The spark arrestor shall be adjustable to within 2 mm of the surface of the wheel for all wheel diameters between the maximum wheel diameter and 90 % of the smallest wheel diameter in accordance with 8.3, see dimension *E* in Figure 102.

Compliance is checked by inspection and by measurement.

19.102 **Work rest**

The **work rest** shall not extend around the side of the wheel and cover at least the width of the wheel **guard**. The **work rest** shall only be radially adjustable to within 2 mm of the peripheral surface of the wheel for all wheel diameters between the maximum wheel diameter and 90 % of the smallest wheel diameter in accordance with 8.3, see dimension *F* in Figure 102.

The plane of the **work rest** surface shall either be fixed or be capable of adjustment only so as to form an angle of not less than 85° to the tangent of the wheel with the smallest diameter wheel in accordance with 8.3. See Figure 104.

If the **work rest** is adjustable in height, it shall be possible to achieve this angle at any height setting.

Any required adjustment of the **work rest** shall be capable of being performed without the aid of a tool.

Compliance is checked by inspection, by measurement and by manual test in accordance with 8.14.2 b).

19.103 **Flanges**

Bench grinders shall be provided with flanges for mounting grinding wheels to the **tool spindle**. Flanges shall comply with the minimum dimensions in relation to the maximum diameter *D* of the wheel, as specified in Table 101.

Table 101 – Minimum flange dimensions (see Figure 105)

Maximum wheel diameter	d_f mm	*r* mm	*T* mm
$D \leq 100$ mm	34	6	1,5
100 mm < $D \leq 125$ mm	42	8	1,5
125 mm < $D \leq 150$ mm	52	9	1,5
150 mm < $D \leq 200$ mm	68	12	1,5
200 mm < $D \leq 250$ mm	85	15	1,5
250 mm < $D \leq 310$ mm	100	17	1,5

Compliance is checked by measurement.

19.104 **Torque test for flanges**

The flanges required by 19.103 shall be designed so that they are of adequate strength.

Compliance is checked by the following test.

The abrasive wheel is replaced by a flat steel plate of sufficient thickness to be clamped between the flanges, having the same bore diameter of the wheel and which extends beyond the flanges.

The clamping nut shall be tightened with a first test torque according to Table 102. A feeler gauge of thickness 0,05 mm shall be used to check whether the flanges are in contact with the plate all around the circumference. It shall not be possible to push the feeler gauge between the flange and the surface of the plate by more than 1 mm at any point around the circumference of the flange, excluding any chamfer.

The test is then repeated using the second test torque according to Table 102.

Table 102 – Test torque for flanges

Thread		First test torque	Second test torque
Metric	UNC	Nm	Nm
8		2	8
10	3/8	4	15
12	1/2	7,5	30
14		11	45
16	5/8	17,5	70
20	3/4	35	140
> 20	> 3/4	75	300

19.105 **Direction of accessory rotation**

The periphery of all **accessories** shall move in a downward direction with respect to the operator's position.

Compliance is checked by inspection.

19.106 **Eccentricity of the tool spindle and flange**

The eccentricity of the **tool spindle** shall be less than 0,1 mm.

For tools that provide for mounting of the accessory through the flange or similar clamping and locating device, the total eccentricity of the combination of the **tool spindle**, the diameter of the flange bore and the diameter of the part of the flange which locates and guides the **accessory** shall be less than 0,3 mm.

Compliance is checked by measurement.

The eccentricity of the flange in the worst off-centre position allowed by the mounting procedure is measured.

19.107 **Out of balance**

A **bench grinder** intended for use with grinding wheels of 100 mm or more in diameter shall have adequate strength when out of balance.

Compliance is checked by the following test.

*A simulated grinding wheel having a diameter equal to the maximum diameter marked on the **tool spindle** in accordance with 8.3 is mounted on the **tool spindle**. The **bench grinder** is then to be operated at no-load for 250 000 revolutions. The simulated wheel may consist of a circular steel plate. The simulated wheel is to be out of balance, by the addition or removal of material:*

– for wheels less than 150 mm in diameter, by $d^2/1\ 607$ Nmm, where d is the diameter of the wheel in mm;

– for wheels of 150 mm or more in diameter, by 14 Nmm.

*After the test, the tool shall withstand the electric strength test of Annex D between **live parts** and **accessible parts** and **live parts** shall not have become accessible as specified in Clause 9. In addition, all **guards** shall remain intact.*

20 Mechanical strength

This clause of Part 1 is applicable except as follows:

20.5 This subclause of Part 1 is not applicable.

20.101 Strength of guards

Guards for grinding wheels and wire brushes shall be made of a material with a minimum peripheral thickness *P* and a minimum side thickness *J* as specified in Table 103 or Table 104 and illustrated in Figure 102.

Table 103 – Guard thickness for steel

Minimum ultimate tensile strength	Peripheral speed	Maximum wheel thickness	Maximum wheel diameter							
			D ≤125 mm		125 mm < D ≤ 200 mm		200 mm < D ≤ 250 mm		250 mm < D ≤ 310 mm	
			P	*J*	*P*	*J*	*P*	*J*	*P*	*J*
N/mm²	m/s	mm	mm	mm	mm	mm	mm	mm	mm	mm
300	≥ 10 and ≤ 32	25	1,5	1,5	2	1,5	2,0	2	2,5	2,5
		55	1,5	1,5	2	1,5	3	2	3,5	2,5
	> 32 and ≤ 40	25	1,5	1,5	2	1,5	2,5	2	3,0	2,5
		55	1,5	1,5	2	1,5	3,5	2	4,0	2,5
	> 40 and ≤ 50	25	1,5	1,5	2	1,5	3	2	3,5	2,5
		55	2	1,5	3	2	4,5	3	5,0	3,5

Table 104 – Guard thickness for aluminium

Minimum ultimate tensile strength	Peripheral speed	Maximum wheel thickness	Maximum wheel diameter					
			D ≤125 mm		125 mm < D ≤ 200 mm		200 mm < D ≤ 250 mm	
			P	*J*	*P*	*J*	*P*	*J*
N/mm²	m/s	mm	mm	mm	mm	mm	mm	mm
200	≥ 10 and ≤ 32	10	5,5	5	6,5	5	8	6
		20	6	5	8	6	10	8
		32	6,5	5	9	7	12	10
	> 32 and ≤ 50	10	6	5	8,5	7	10,5	9
		20	7	6	10	8	13	11
310	≥ 10 and ≤ 40	10	2,5	2,5	3,5	3,5	4	4
		20	3	3	4	4	5	5
		32	3,5	3,5	4,5	4,5	6	5
	> 40 and ≤ 50	10	3	3	4	4	5	5
		20	3,5	3,5	4,5	4,5	6	5
		32	4	4	5	5	7	6

Compliance is checked by inspection, by measurement and by either receipt of confirmation of the ultimate tensile strength of the material from the material manufacturer or through measurement of samples of the material.

20.102 **Tool spindle**

Tool spindles shall be made of steel and have sufficient size to support **accessories** with a maximum diameter in accordance with 8.3. The diameter of the **tool spindle** shall comply with the minimum values specified in Table 105.

Table 105 – Minimum tool spindle diameter

Maximum accessory diameter	Minimum tool spindle diameter mm
$D \leq 80$ mm	8
80 mm < D ≤ 155 mm	12
155 mm < $D \leq 206$ mm	15
206 mm < $D \leq 256$ mm	18
256 mm < $D \leq 310$ mm	24

Compliance is checked by measurement.

20.103 **Means for transportation**

Means for transportation of **bench grinders** as required by 19.4 and as described in the instructions in accordance with 8.14.2 b) 109) shall be of adequate strength to safely transport the tool.

Compliance is checked by inspection and the following test.

Carrying means other than grasping surfaces on motor housings are subjected to a force corresponding to three times the weight of the equipment but not more than 600 N per carrying means. The force is applied in the direction of lifting uniformly over a 70 mm width at the centre of the carrying means. The force is steadily increased so that the test value is attained within 10 s and maintained for a period of 1 min.

If more than one carrying means is provided, the force is distributed between the carrying means in the same proportion as in the normal transportation position. If the equipment is provided with more than one carrying means, but so designed that it may readily be carried by only one carrying means, each carrying means shall be capable of sustaining the total force.

The carrying means shall not break loose from the equipment and there shall not be any permanent distortion, cracking or other evidence of failure.

20.104 **Working stand**

A working stand for a ***bench grinder***, if provided with the tool or if specifically identified in accordance with 8.14.2, shall have adequate strength.

Compliance is checked by the following test.

The **bench grinder** *is mounted to the working stand and an additional vertical force of 3 times the largest D is gradually applied for 1 min, distributed equally on the housing of the* ***bench grinder****. During the test the working stand shall not collapse, and after removing the force it shall not show any permanent deformation.*

NOTE One example of achieving equal distribution of the additional force is using bags of sand or other similar means.

21 Construction

This clause of Part 1 is applicable except as follows:

21.15 This subclause of Part 1 is not applicable.

21.18.2.1 Addition:

Bench grinders are not considered to give rise to danger on restoration of the voltage supply.

21.30 This subclause of Part 1 is not applicable.

21.35 This subclause of Part 1 is not applicable.

21.101 **Dust outlet**

Connection ports for external dust collection equipment, if any, shall be directed away from the operator.

Compliance is checked by inspection.

22 Internal wiring

This clause of Part 1 is applicable.

23 Components

This clause of Part 1 is applicable except as follows:

23.3 Addition:

For **bench grinders**, protection devices (e.g. overload or over-temperature protection devices) or circuits that switch off the tool shall be of the non-self-resetting type.

24 Supply connection and external flexible cables and 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.

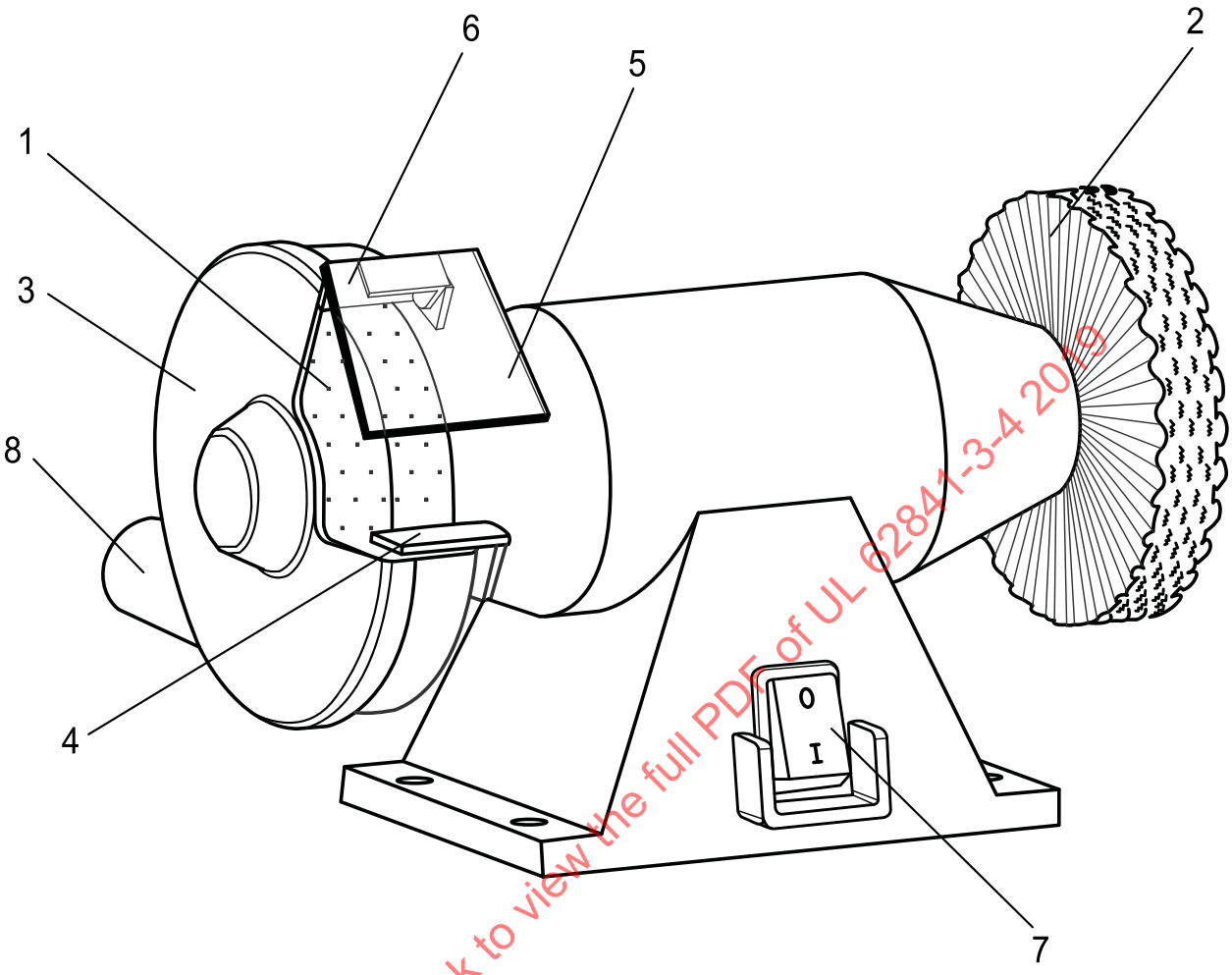
27 Screws and connections

This clause of Part 1 is applicable.

28 Creepage distances, clearances and distances through insulation

This clause of Part 1 is applicable.

Figure 101 – Bench grinder



IEC

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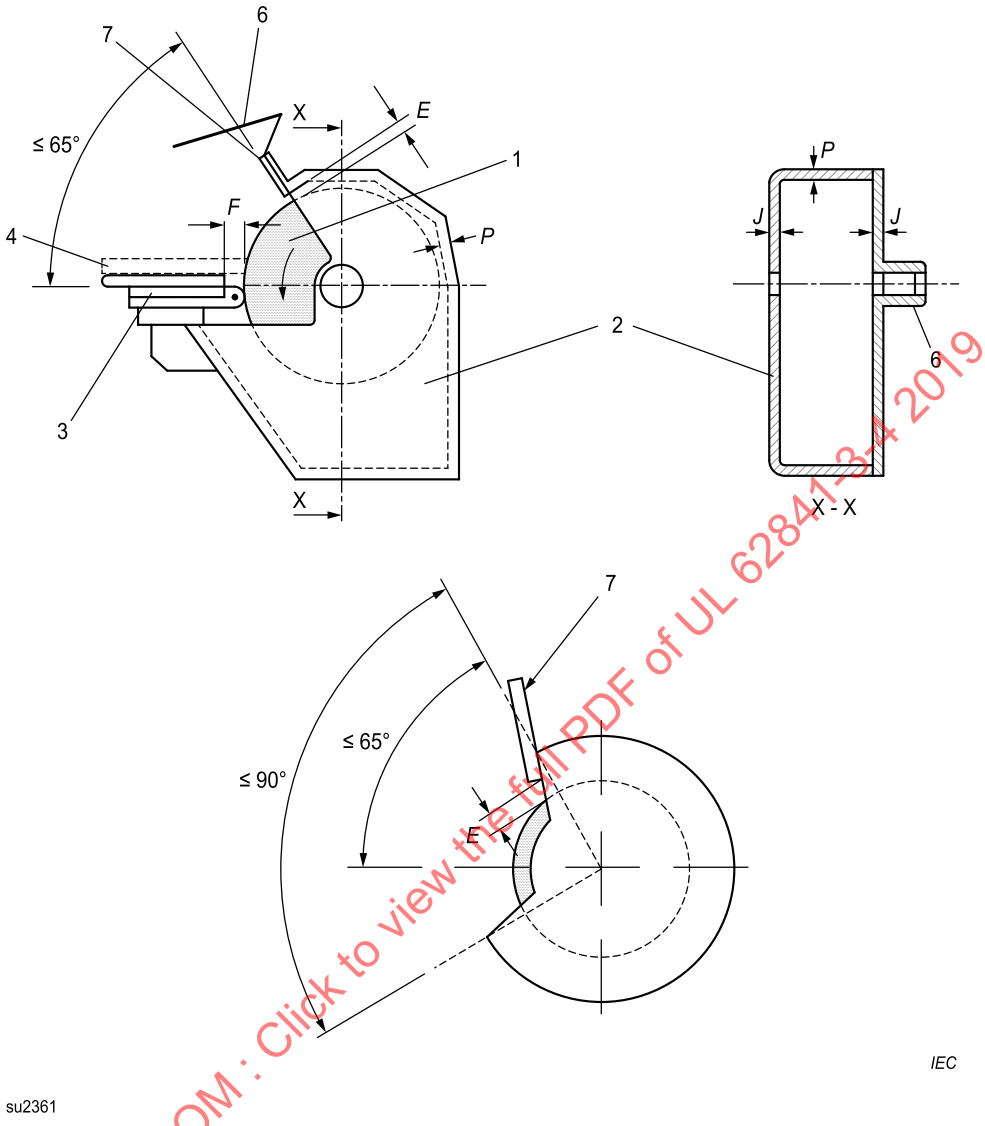
Key

1 grinding wheel
2 polishing wheel
3 **guard** for grinding wheel or wire brush
4 **work rest**
5 transparent screen
6 spark arrestor
7 **power switch**
8 dust outlet, if any

Figure 102 – Opening angles and dimensions for a guard



NOTE The lower part of Figure 102 is based on Figure 38.1 in the Standard for Stationary and Fixed Electric Tools, UL 987, Edition 8.

Key

1 grinding wheel
2 **guard** for grinding wheel or wire brush
3 **work rest**
4 workpiece
5 transparent screen
6 **guard** for the tool spindle
7 spark arrestor

P thickness of the periphery of the **guard**
J thickness of the sides of the **guard**
E clearance between spark arrestor and wheel
F clearance between **work rest** and wheel 5 transparent

NOTE For articulation of the work rest, see Figure 104.