National Standard of Canada

CSA C22.2 No. 62841-2-3:21

Electric motor-operated hand-held tools, transportable tools and lawn and garden machinery — Safety — Part 2-3: Particular requirements for hand-held grinders, disc-type polishers and disc-type sanders

(IEC 62841-2-3:2020, MOD)

Note: *For brevity, this Standard will be referred to as "CSA C22.2 No. 62841-2-3" throughout.*

JULY 12, 2021

This national standard is based on publication IEC 62841-2-3, First Edition (2020).

Prepared by
International Electrotechnical Commission

Reviewed by

CSA Group
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First Edition
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Underwriters Laboratories Inc.
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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 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.

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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 the 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 62841-2-3 as an American National Standard (ANSI) occurred on July 12, 2021. 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 2-3: Particular Requirements for Hand-Held Grinders, Disc-Type Polishers and Disc-Type Sanders. It is the First edition of CSA C22.2 No. 62841-2-3:21 and the First edition of UL 62841-2-3.

This harmonized standard is based on IEC Publication 62841-2-3: First edition, Electric Motor-Operated Hand-Held Tools, Transportable Tools and Lawn and Garden Machinery – Safety – Part 2-3: Particular Requirements for Hand-Held Grinders, Disc-Type Polishers and Disc-Type Sanders, issued April 2020. IEC publication 62841-2-3 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 UL 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. 62841-2-3 is to be used in conjunction with the First edition of CAN/CSA-C22.2 No. 62841-1. The requirements for hand-held grinders, disc-type polishers and disc-type sanders are contained in this Part 2 Standard and CAN/CSA-C22.2 No. 62841-1. Requirements of this Part 2 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. 62841-2-3, the CAN/CSA-C22.2 No. 62841-1 subclause applies.

UL Standard 62841-2-3 is to be used in conjunction with the First edition of UL 62841-1. The requirements for hand-held grinders, disc-type polishers and disc-type sanders are contained in this Part 2 Standard and UL 62841-1. Requirements of this Part 2 Standard, where stated, amend the requirements of UL 62841-1. Where a particular subclause of UL 62841-1 is not mentioned in UL 62841-2-3, the UL 62841-1 subclause applies.

Level of harmonization

This standard adopts the IEC text with 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 62841-2-3, Electric Motor-Operated Hand-Held Tools, Transportable Tools and Lawn and Garden Machinery – Safety – Part 2-3: Particular Requirements for Hand-Held Grinders, Disc-Type Polishers and Disc-Type Sanders, 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 IEC 62841-2-3 Electric Motor-Operated Hand-Held Tools, Transportable Tools and Lawn and Garden Machinery – Safety – Part 2-3: Particular Requirements for Hand-Held Grinders, Disc-Type Polishers and Disc-Type Sanders, 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.

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FOREWORD

INTERNATIONAL ELECTROTECHNICAL COMMISSION

ELECTRIC MOTOR-OPERATED HAND-HELD TOOLS, TRANSPORTABLE TOOLS AND LAWN AND GARDEN MACHINERY – SAFETY – Part 2-3: Particular requirements for hand-held grinders, disc-type polishers and disc-type sanders

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.

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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 62841-2-3 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
116/444/FDIS	116/454/RVD

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

This document has been drafted in accordance with the ISO/IEC Directives, Part 2. This Part 2-3 is to be used in conjunction with the first edition of IEC 62841-1:2014.

This Part 2-3 supplements or modifies the corresponding clauses in IEC 62841-1, so as to convert it into the IEC Standard: Particular requirements for hand-held grinders, disc-type polishers and disc-type sanders.

Where a particular subclause of Part 1 is not mentioned in this Part 2-3, 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 in **bold typeface** in the text are defined in Clause 3

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 7th paragraph of 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: Replace the 8th paragraph of the IEC Foreword with the following:*

Words in SMALL ROMAN CAPS in the text are defined in Clause 3.

103DV 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 2-3: Particular requirements for hand-held grinders, disc-type polishers and disc-type sanders

1 Scope

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

Addition:

This part of IEC 62841 applies to hand-held GRINDERS, DISC-TYPE POLISHERS and DISC-TYPE SANDERS, including angle, straight and vertical tools, intended for use on various materials except magnesium, with a RATED CAPACITY not exceeding 230 mm. For GRINDERS, the RATED NO-LOAD SPEED does not exceed a peripheral speed of the ACCESSORY of 80 m/s at RATED CAPACITY.

This standard does not apply to dedicated cut-off machines.

NOTE 101 It is planned that a document on cut-off machines will be published.

This standard does not apply to orbital polishers and orbital sanders.

NOTE 102 It is planned that a document on orbital polishers and orbital sanders will be published.

This standard does not apply to die grinders.

NOTE 103 Die grinders are covered by IEC 62841-2-23.

2 Normative references

This clause of Part 1 is applicable except as follows:

Addition:

ISO 525:2013, *Bonded abrasive products – General requirements*

3 Terms and definitions

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

Additional definitions:

3.101
BLOTTER
thin piece of an easily compressible material, between the abrasive product and FLANGE

3.102
DIAMOND WHEEL
metal wheel with continuous or segmented diamond abrasives

3.102.1
DIAMOND CUTTING WHEEL
metal wheel with the abrasives located on the periphery of the wheel

3.102.2
DIAMOND GRINDING WHEEL
metal wheel with abrasives located on the face of the wheel

3.103
DISC-TYPE POLISHER
tool equipped with a rotating flexible disc or pad intended for polishing

Note 101 to entry: Polishing is an operation to produce a smooth or shiny surface.

3.104
DISC-TYPE SANDER
tool, constructed like a GRINDER, intended for sanding

Note 101 to entry: Sanding is an operation to remove material using flexible abrasive material, such as sandpaper.

3.105
FLANGE
collar, disc or plate between or against which wheels are mounted

3.105.1
UNRECESSED (FLANGE)
FLANGE fixed to the machine spindle having an UNRECESSED flat surface against which a threaded hole abrasive product is screwed, e.g. a cup wheel, a cone or a plug

3.105.2
INNER FLANGE
flange which contacts and provides support to the back side of the wheel and is located on the spindle between wheel and tool

3.105.3
OUTER FLANGE
FLANGE which supports the front side of the wheel and secures and clamps the wheel to the spindle and the INNER FLANGE

Note 101 to entry: In Canada and the United States of America, the following additional definition applies:

3.105.UC1
ADAPTOR BACKING FLANGE
INNER FLANGE which contacts and supports in the hub area and extends past the raised portion to reduce the flexing of the wheel periphery

3.106
GRINDER
tool driving a rotating spindle on which a bonded abrasive product or a DIAMOND WHEEL is mounted

3.106.1
ANGLE GRINDER
GRINDER with the rotating spindle at an angle to the axis of the tool body which acts as a grasping surface, intended for peripheral and lateral grinding

Note 101 to entry: See Figure 101.

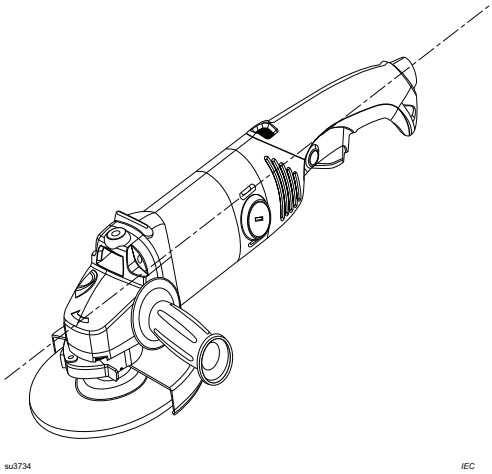


Figure 101

Example of an angle grinder

3.106.2
STRAIGHT GRINDER
GRINDER with the rotating spindle in-line with the axis of the tool body which acts as a grasping surface, intended for peripheral grinding only and not equipped with a collet or chuck

Note 101 to entry: See Figure 102.

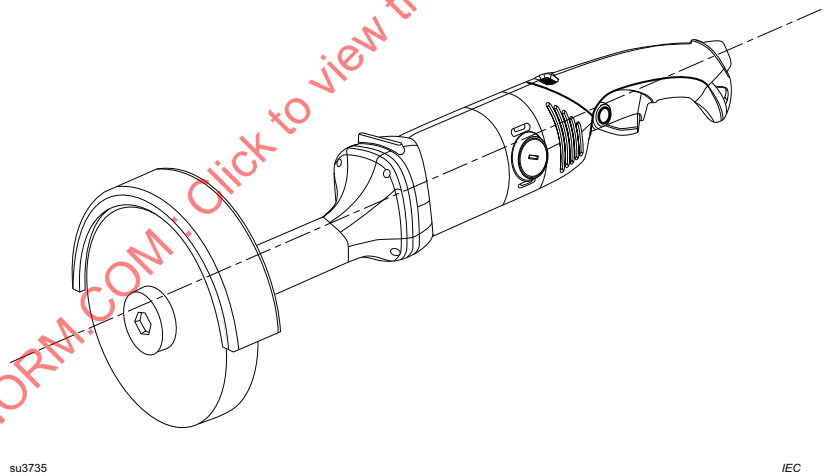


Figure 102

Example of a straight grinder

3.106.3
VERTICAL GRINDER
GRINDER with the rotating spindle in-line with the axis of the tool body and with handles that are substantially perpendicular to the axis of the rotating spindle, intended for peripheral and lateral grinding

Note 101 to entry: See Figure 103.

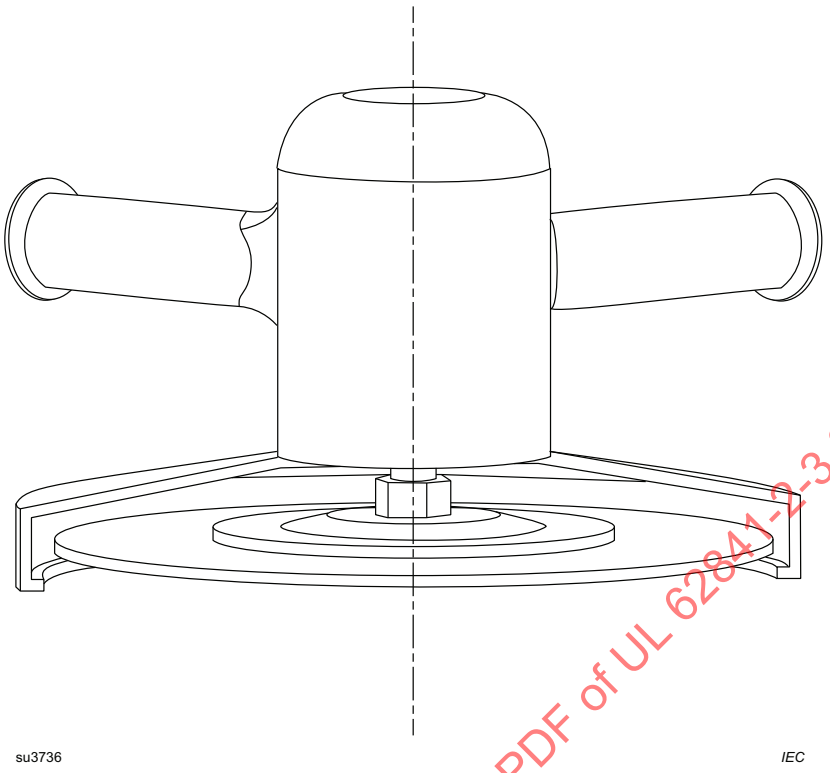


Figure 103

Example of a vertical grinder

3.107
GUIDE PLATE
flat plate on the machine which rests on the material to be cut

3.108
GUIDE ROLLER
roller on the machine which rests on the material to be cut

3.109
MINOR FRAGMENT
particles less than 1/16 of the mass of the abrasive wheel

3.110
RATED CAPACITY
maximum diameter of the rotating ACCESSORY to be fitted on the tool as specified by the manufacturer's instruction

3.111
WHEEL GUARD
device which partly encloses the abrasive wheel and gives protection to the operator

3.112
WHEEL TYPES
alphanumeric designation of wheels based upon application and shape

Note 101 to entry: Shapes for WHEEL TYPES are given in Annex CC.

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 a GRINDER includes the WHEEL GUARD, the FLANGES and the handles.

The mass of a DISC-TYPE POLISHER or DISC-TYPE SANDER includes the FLANGES and the handles.

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 also be marked with:

– RATED NO-LOAD SPEED;

– RATED CAPACITY.

NOTE 101 The requirement for marking RATED CAPACITY does not prohibit the additional marking of smaller permitted diameters of the rotating ACCESSORY other than RATED CAPACITY (e.g. 115 mm / 125 mm, where 125 mm is the RATED CAPACITY).

8.2 *Addition:*

Tools shall also be marked with:

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

The eye protection symbol may be modified by adding other personal protective equipment such as ear protection, dust mask, etc.

Tools that require at least two handles in accordance with 19.4 shall be marked with

– "⚠ **WARNING** Always operate with two hands"; or

– the following safety sign:

NOTE In Canada and the United States of America, the following additional requirements apply:

Tools shall be marked with the following additional safety warnings:

– "WARNING – To reduce the risk of injury, use only accessories rated at least equal to the maximum speed marked on the tool."

In Canada, the equivalent French wording of the above warning is as follows: "AVERTISSEMENT – Pour réduire le risque de blessure, utiliser uniquement les accessoires convenant au moins à la vitesse maximale inscrite sur l'outil."

All GRINDERS required to have a WHEEL GUARD by 19.101.2 shall be marked with the following warning:

– "WARNING – To reduce the risk of injury, always use proper guards when grinding."

In Canada, the equivalent French wording of the above warning is as follows: "AVERTISSEMENT – Pour réduire le risque de blessure, utiliser toujours les protecteurs appropriés pendant le meulage."

If the above cautionary markings are included as part of a list of cautionary markings, the words "WARNING – To reduce the risk of injury" need not be repeated.

8.2.101 A Type B WHEEL GUARD in accordance with Annex AA shall be marked with

– "⚠ **WARNING** Not for cut-off operations"; or

– the following safety sign:

8.3 *Addition:*

Tools provided with a threaded spindle intended to accept threaded ACCESSORIES in accordance with 8.14.2 shall be marked with the spindle thread size.

The direction of rotation of the spindle shall be indicated on the tool by an arrow, raised or recessed or by any other means no less visible and indelible.

8.6 *Addition:*

always operate with two hands

do not use the guard for cut-off operations

8.12 *Addition:*

The safety sign required by 8.2.101 need not be in accordance with the red colour requirements of ISO 3864-2.

8.14.1.101 Additional safety instructions for grinders, disc-type polishers and disctype sanders

8.14.1.101.1 General

The additional safety instructions as specified in 8.14.1.101.2 to 8.14.1.101.8 shall be given. This part may be printed separately from the "General Power Tool Safety Warnings".

In these safety instructions, terms such as grinding/GRINDER, sanding/sander, wire brushing/wire brush, polishing/polisher or cutting-off/cut-off tool are selected as specified by the manufacturer. These terms in the warnings and headings shall be consistently used or deleted based on the selected operations. The “and”/“or” conjunctions may be used as appropriate.

If the power tool is intended only for one of the listed operations, the heading of that section is to be used for all warnings.

8.14.1.101.2 Safety instructions for all operations

Safety warnings common for grinding, sanding, wire brushing, polishing or cutting-off operations:

NOTE 101 In the above heading, those operations not applicable are omitted.

a) **This power tool is intended to function as a grinder, sander, wire brush, polisher, hole cutter or cut-off tool. Read all safety warnings, instructions, illustrations and specifications provided with this power tool.** *Failure to follow all instructions listed below may result in electric shock, fire and/or serious injury.*

NOTE 102 Only the applicable operations are listed.

b) **Operations such as grinding, sanding, wire brushing, polishing, hole cutting or cutting-off are not to be performed with this power tool.** *Operations for which the power tool was not designed may create a hazard and cause personal injury.*

NOTE 103 Only those operations are listed that were not included in the first warning. If all listed operations are intended, then this warning is omitted, but all subsequent warnings are given without exclusion.

c) **Do not convert this power tool to operate in a way which is not specifically designed and specified by the tool manufacturer.** *Such a conversion may result in a loss of control and cause serious personal injury.*

d) **Do not use accessories which are not specifically designed and specified by the tool manufacturer.** *Just because the accessory can be attached to your power tool, it does not assure safe operation.*

e) **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.*

f) **The outside diameter and the thickness of your accessory must be within the capacity rating of your power tool.** *Incorrectly sized accessories cannot be adequately guarded or controlled.*

g) **The dimensions of the accessory mounting must fit the dimensions of the mounting hardware of the power tool.** *Accessories that do not match the mounting hardware of the power tool will run out of balance, vibrate excessively and may cause loss of control.*

h) **Do not use a damaged accessory. Before each use inspect the accessory such as abrasive wheels for chips and cracks, backing pad for cracks, tear or excess wear, wire brush for loose or cracked wires. If power tool or accessory is dropped, inspect for damage or install an undamaged accessory. 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.*

i) **Wear personal protective equipment. Depending on application, use face shield, safety goggles or safety glasses. As appropriate, wear dust mask, hearing protectors, gloves and workshop apron capable of stopping small abrasive or workpiece fragments.** *The eye protection must be capable of stopping flying debris generated by various applications. The dust mask or respirator must be capable of filtrating particles generated by the particular application. Prolonged exposure to high intensity noise may cause hearing loss.*

j) **Keep bystanders a safe distance away from work area. Anyone entering the work area must wear personal protective equipment.** *Fragments of workpiece or of a broken accessory may fly away and cause injury beyond immediate area of operation.*

k) **Hold the power tool by insulated gripping surfaces only, 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 104 The above warning is omitted if polishing or sanding are the only Intended operations.

l) **Position the cord clear of the spinning accessory.** *If you lose control, the cord may be cut or snagged and your hand or arm may be pulled into the spinning accessory.*

m) **Never lay the power tool down until the accessory has come to a complete stop.** *The spinning accessory may grab the surface and pull the power tool out of your control.*

n) **Do not run the power tool while carrying it at your side.** *Accidental contact with the spinning accessory could snag your clothing, pulling the accessory into your body.*

o) **Regularly clean the power tool's air vents.** *The motor's fan will draw the dust inside the housing and excessive accumulation of powdered metal may cause electrical hazards.*

p) **Do not operate the power tool near flammable materials.** *Sparks could ignite these materials.*

q) **Do not use accessories that require liquid coolants.** *Using water or other liquid coolants may result in electrocution or shock.*

NOTE 105 The above warning does not apply for power tools specifically designed for use with a liquid system.

8.14.1.101.3 Further safety instructions for all operations

Kickback and related warnings:

Kickback is a sudden reaction to a pinched or snagged rotating wheel, backing pad, brush or any other accessory. Pinching or snagging causes rapid stalling of the rotating accessory which in turn causes the uncontrolled power tool to be forced in the direction opposite of the accessory's rotation at the point of the binding.

For example, if an abrasive wheel is snagged or pinched by the workpiece, the edge of the wheel that is entering into the pinch point can dig into the surface of the material causing the wheel to climb out or kick out. The wheel may either jump toward or away from the operator, depending on direction of the wheel's movement at the point of pinching. Abrasive wheels may also break under these conditions.

Kickback is the result of power tool misuse and/or incorrect operating procedures or conditions and can be avoided by taking proper precautions as given below.

a) **Maintain a firm grip with both hands on the power tool and position your body and arms to allow you to resist kickback forces. Always use auxiliary handle, if provided, for maximum control over kickback or torque reaction during start-up.** *The operator can control torque reactions or kickback forces, if proper precautions are taken.*

b) **Never place your hand near the rotating accessory**. *Accessory may kickback over your hand.*

c) **Do not position your body in the area where power tool will move if kickback occurs.** *Kickback will propel the tool in direction opposite to the wheel's movement at the point of snagging.*

d) **Use special care when working corners, sharp edges, etc. Avoid bouncing and snagging the accessory.** *Corners, sharp edges or bouncing have a tendency to snag the rotating accessory and cause loss of control or kickback.*

e) **Do not attach a saw chain woodcarving blade, segmented diamond wheel with a peripheral gap greater than 10 mm or toothed saw blade.** *Such blades create frequent kickback and loss of control.*

8.14.1.101.4 Additional safety instructions for grinding and cutting-off operations

NOTE 101 If grinding and cutting-off operations are not Intended by the manufacturer, this subclause is omitted.

Safety warnings specific for grinding and cutting-off operations:

a) **Use only wheel types that are specified for your power tool and the specific guard designed for the selected wheel.** *Wheels for which the power tool was not designed cannot be adequately guarded and are unsafe.*

b) **The grinding surface of centre depressed wheels must be mounted below the plane of the guard lip.** *An improperly mounted wheel that projects through the plane of the guard lip cannot be adequately protected.*

c) **The guard must be securely attached to the power tool and positioned for maximum safety, so the least amount of wheel is exposed towards the operator.** *The guard helps to protect the operator from broken wheel fragments, accidental contact with wheel and sparks that could ignite clothing.*

NOTE 102 The above warning is omitted for grinders with a rated capacity of less than 55 mm.

d) **Wheels must be used only for specified applications. For example: do not grind with the side of cut-off wheel.** *Abrasive cut-off wheels are intended for peripheral grinding, side forces applied to these wheels may cause them to shatter.*

e) **Always use undamaged wheel flanges that are of correct size and shape for your selected wheel.** *Proper wheel flanges support the wheel thus reducing the possibility of wheel breakage. Flanges for cut-off wheels may be different from grinding wheel flanges.*

f) **Do not use worn down wheels from larger power tools.** *A wheel intended for larger power tool is not suitable for the higher speed of a smaller tool and may burst.*

NOTE 103 The above warning does not apply for tools only designated to be used with diamond wheels.

g) **When using dual purpose wheels always use the correct guard for the application being performed.** *Failure to use the correct guard may not provide the desired level of guarding, which could lead to serious injury.*

8.14.1.101.5 Additional safety instructions for cutting-off operations

NOTE 101 If cutting-off operation is not intended by the manufacturer, this subclause is omitted.

Additional safety warnings specific for cutting-off operations:

a) **Do not "jam" the cut-off wheel or apply excessive pressure. Do not attempt to make an excessive depth of cut.** *Overstressing the wheel increases the loading and susceptibility to twisting or binding of the wheel in the cut and the possibility of kickback or wheel breakage.*

b) **Do not position your body in line with and behind the rotating wheel.** *When the wheel, at the point of operation, is moving away from your body, the possible kickback may propel the spinning wheel and the power tool directly at you.*

c) **When the wheel is binding or when interrupting a cut for any reason, switch off the power tool and hold it motionless until the wheel comes to a complete stop. Never attempt to remove the cut-off wheel from the cut while the wheel is in motion otherwise kickback may occur.** *Investigate and take corrective action to eliminate the cause of wheel binding.*

d) **Do not restart the cutting operation in the workpiece. Let the wheel reach full speed and carefully re-enter the cut.** *The wheel may bind, walk up or kickback if the power tool is restarted in the workpiece.*

e) **Support panels or any oversized workpiece to minimize the risk of wheel pinching and kickback.** *Large workpieces tend to sag under their own weight. Supports must be placed under the workpiece near the line of cut and near the edge of the workpiece on both sides of the wheel.*

f) **Use extra caution when making a "pocket cut" into existing walls or other blind areas.** *The protruding wheel may cut gas or water pipes, electrical wiring or objects that can cause kickback.*

g) **Do not attempt to do curved cutting.** *Overstressing the wheel increases the loading and susceptibility to twisting or binding of the wheel in the cut and the possibility of kickback or wheel breakage, which can lead to serious injury.*

8.14.1.101.6 Additional safety instructions for sanding operations

NOTE 101 If sanding operation is not intended by the manufacturer, this subclause is omitted.

Safety warnings specific for sanding operations:

a) **Use proper sized sanding disc paper. Follow manufacturers recommendations, when selecting sanding paper.** *Larger sanding paper extending too far beyond the sanding pad presents a laceration hazard and may cause snagging, tearing of the disc or kickback.*

8.14.1.101.7 Additional safety instructions for polishing operations

NOTE 101 If polishing operation is not intended by the manufacturer, this subclause is omitted.

Safety warnings specific for polishing operations:

a) **Do not allow any loose portion of the polishing bonnet or its attachment strings to spin freely. Tuck away or trim any loose attachment strings.** *Loose and spinning attachment strings can entangle your fingers or snag on the workpiece.*

8.14.1.101.8 Additional safety instructions for wire brushing operations

NOTE 101 If wire brushing operation is not intended by the manufacturer, this subclause is omitted.

Safety warnings specific for wire brushing operations:

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

b) **If the use of a guard is specified for wire brushing, do not allow any interference of the wire wheel or brush with the guard.** *Wire wheel or brush may expand in diameter due to work load and centrifugal forces.*

8.14.2 a) *Addition:*

101) Instruction on which types of ACCESSORIES and GUARDS to be used for the intended applications of the tool in accordance with 8.14.1.101.2 a) that comply with the substance of Table 101, as applicable;

102) When using dual purpose (combined grinding and cutting-off abrasive) flange mounted wheels, instruction to only use either a Type A (cut-off) or Type C (combination) WHEEL GUARD;

103) Information on the risks associated with using incorrect GUARDS, including

– when using a Type A (cut-off) WHEEL GUARD for facial grinding, the WHEEL GUARD may interfere with the workpiece causing poor control;

– when using a Type B (grinding) WHEEL GUARD for cutting-off operations with bonded abrasive wheels, there is an increased risk of exposure to emitted sparks and particles, as well as exposure to wheel fragments in the event of wheel burst;

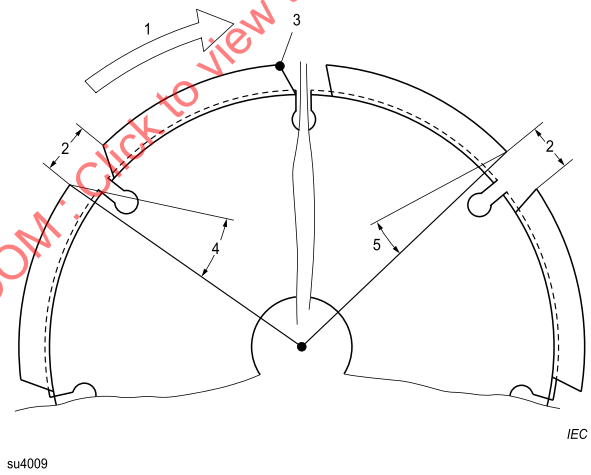
– when using a Type A (cut-off), Type B (grinding) or Type C (combination) WHEEL GUARD for cutting-off and facial operations in concrete or masonry, there is an increased risk of exposure to dust and loss of control resulting in kickback;

– when using a Type A (cut-off), Type B (grinding) or Type C (combination) WHEEL GUARD with a wheel-type wire brush with a thickness greater than the maximum thickness as specified in 8.14.2 a) 105), the wires may catch on the guard leading to breaking of wires;

104) Information about the permitted thickness and diameter of grinding wheels;

105) Information about the maximum thickness and diameter of wheel-type wire brushes;

106) Information about the permitted construction of cutting-off wheels (diamond or bonded reinforced, if diamond segmented, maximum peripheral gap between segments is 10 mm, only with a negative rake angle, see Figure 104), and about the permitted wheel diameter and wheel thickness.



Key

1 direction of rotation
2 gap
3 leading tip of segment
4 negative rake angle
5 positive rake angle

Figure 104

Examples of gaps and rake angles

8.14.2 b) *Addition:*

101) Instruction on the proper use of BLOTTERS, when they are provided with the bonded abrasive product;

102) Information about the specific FLANGES to be used with all WHEEL TYPES in accordance with 8.14.2 a) 101). Instruction on the mounting of ACCESSORIES and the use of the correct FLANGES. For reversible FLANGES, instruction on the correct method of fitting the FLANGES;

103) For all ACCESSORIES specified in accordance with 8.14.2 a) 101), instruction on their proper use. For grinding and cut-off wheels, instruction on their use for side grinding and peripheral grinding applications, and for Type 27 and 28 wheels, the recommended angle to the work surface;

104) Instruction for mounting and securing of the WHEEL GUARD identifying allowable adjustments to ensure maximum protection of the operator;

105) Instruction on proper support for the workpiece;

106) In case of cup-wheels, cones or plugs with a threaded hole intended to be mounted on the machine spindle, information about critical dimensions and other data in order to prevent the spindle end from touching the bottom of the mounting hole of the abrasive product;

107) For DISC-TYPE SANDERS exclusively intended for sanding wooden floors, instruction how to connect the external dust collection equipment, where applicable;

108) For GRINDERS intended to be used with a WHEEL GUARD of Type E or Type F, instruction how to connect the external dust collection equipment, where applicable.

8.14.2 c) *Addition:*

101) Instruction on storage and handling of specified ACCESSORIES.

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:

18.8 *Replacement of Table 4:*

Table 4
Required performance levels

Type and purpose of SCF	Minimum performance level (PL)
POWER SWITCH – prevent unwanted switch-on for GRINDERS with a RATED CAPACITY exceeding 55 mm	Shall be evaluated using the fault conditions of 18.6.1 without the loss of this SCF
POWER SWITCH – prevent unwanted switch-on for GRINDERS with a RATED CAPACITY up to and including 55 mm	c
POWER SWITCH – prevent unwanted switch-on for disc-type sanders and DISC-TYPE POLISHERS	b
POWER SWITCH – provide desired switch-off for GRINDERS with a RATED CAPACITY exceeding 55 mm	c
POWER SWITCH – provide desired switch-off for GRINDERS with a RATED CAPACITY up to and including 55 mm, DISC-TYPE SANDERS and DISC-TYPE POLISHERS	b
Provide desired direction of rotation for GRINDERS	c
Provide desired direction of rotation for DISC-TYPE POLISHERS and DISC-TYPE SANDERS	Not a SCF
Any electronic control to pass the test of 18.3	c
Prevent output speed from exceeding 120 % of rated no-load speed without accessories mounted for grinders and disc-type sanders	c
Prevent output speed from exceeding 130 % of rated no-load speed without accessories mounted for disc-type polishers	b
Prevent exceeding thermal limits as in Clause 18	a
Prevent unwanted lock-on of the power switch function	b
Restart prevention as required by 21.18.1.1	b
Lock-off function as required by 21.18.1.2	c
Prevent self-resetting as required in 23.3	c

19 Mechanical hazards

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

19.1 *Replacement of the first and second paragraph:*

Moving and other dangerous parts other than the spindle, the ACCESSORY and the FLANGES shall be so positioned or enclosed to provide adequate protection against personal injury. The guarding of the spindle, the ACCESSORY and the FLANGES is covered by 19.101.

Protective enclosures, covers, GUARDS and the like shall have adequate mechanical strength for their intended purpose. Except the WHEEL GUARD as required by 19.101.2, they shall not be removable without the aid of a tool.

19.3 *Addition:*

The requirements of this subclause are not applicable for the dust collection ports on WHEEL GUARDS, if any.

19.4 *Addition:*

Tools with a RATED CAPACITY exceeding 100 mm shall have at least two handles. One of the handles may be the body of the tool if suitably shaped.

Compliance is checked by inspection.

NOTE 101 In Japan, the following requirements apply:

Tools with a RATED CAPACITY exceeding 105 mm shall have at least two handles. One of the handles may be the body of the tool if suitably shaped.

Compliance is checked by inspection.

19.6 *Replacement:*

For GRINDERS and DISC-TYPE SANDERS, the no-load speed of the spindle at RATED VOLTAGE shall not exceed the RATED NO-LOAD SPEED.

Compliance is checked by measuring the speed of the spindle after the tool has been operating for 5 min at no-load. During the test, the ACCESSORY in accordance with 8.14.2 a) 101) that produces the maximum speed shall be installed.

For DISC-TYPE POLISHERS, the no-load speed of the spindle at RATED VOLTAGE shall not exceed 110 % of the RATED NO-LOAD SPEED.

Compliance is checked by measuring the speed of the spindle after the tool has been operating for 5 min at no-load. During the test, separable ACCESSORIES are not mounted.

19.101 Wheel guard

19.101.1 General requirements

The WHEEL GUARD shall protect the user during operation of the tool against:

– accidental contact with the abrasive product;

– ejection of fragments of the abrasive product;

– sparks and other debris.

WHEEL GUARD types are specified in Annex AA.

The WHEEL GUARD may be removable either with the aid of a tool or by requiring two separate and dissimilar actions to remove the entire WHEEL GUARD from the tool, e.g. pushing a lever and moving the WHEEL GUARD.

The WHEEL GUARD shall also:

– facilitate the change of the abrasive wheel without the need to remove the WHEEL GUARD, except for WHEEL GUARDS of Type F;

– be designed so that the risk of an accidental contact between the operator and the wheel is minimized e. g. by a possibility of adjustment.

For WHEEL GUARDS of Type A, Type B, Type C, Type D or Type G, in order to prevent the installation of an oversized wheel, the clearance between the inside of the WHEEL GUARD and the periphery of a new abrasive product of RATED CAPACITY in accordance with 8.14.2 a) 101) shall, in at least one location, be

– for WHEEL GUARDS of Type A, Type B, Type C or Type G, 8 mm maximum for tools with a RATED CAPACITY not exceeding 130 mm and 10 mm maximum for tools with a RATED CAPACITY exceeding 130 mm; and

– for WHEEL GUARDS of Type D, 11 mm maximum.

Compliance is checked by inspection and by measurement.

19.101.2 Supply of wheel guards

GRINDERS with a RATED CAPACITY up to and including 55 mm, DISC-TYPE SANDERS and DISC-TYPE POLISHERS need not be supplied with a WHEEL GUARD.

ANGLE GRINDERS with a RATED CAPACITY exceeding 55 mm shall be supplied with at least either

– both a WHEEL GUARD of Type A (cut-off) and of Type B (grinding); or

NOTE 101 In Japan, the above dash is replaced by the following:

- a wheel guard of Type B (grinding); or

– a WHEEL GUARD of Type B (grinding) and additional elements that are to be fixed to the WHEEL GUARD Type B (grinding) in order to convert it into a WHEEL GUARD of Type A (cutoff); or

– a WHEEL GUARD of Type C (combination).

STRAIGHT GRINDERS with a RATED CAPACITY exceeding 55 mm shall be supplied with a Type G WHEEL GUARD.

For tools with a RATED CAPACITY exceeding 55 mm, WHEEL GUARDS as specified in Table 101 for the intended applications and accessory types of the tool in accordance with 8.14.2 a) 101) shall

– be supplied with the tool for any ACCESSORY type supplied with the tool;

– be available from the manufacturer and be listed in the instructions in accordance with 8.14.2 c) 3); and

– comply with all applicable requirements of 19.101, Clause 20 and Annex AA.

Compliance is checked by inspection, by measurement and by relevant tests.

Table 101
Accessories and guards for various applications

Application	Accessory types	Guard types
Facial grinding	WHEEL TYPES 27, 28, 29	Type B or Type C (grinding or combination WHEEL GUARD)
	WHEEL TYPES 6, 11	Type D (cup WHEEL GUARD)
	DIAMOND GRINDING WHEELS for masonry/concrete	Type E (diamond surface grinding WHEEL GUARD)
Peripheral grinding	WHEEL TYPE 1, 4	(straight grinder WHEEL GUARD)
	Cones, plugs	None
Cutting-off	WHEEL TYPES 41 (1A), 42 (27A) for metal	Type A or Type C (cut-off or combination WHEEL GUARD)
	WHEEL TYPES 41 (1A), 42 (27A) for masonry/concrete	Type A or Type F (cut-off or masonry/concrete cut-off WHEEL GUARD)
	DIAMOND CUTTING WHEEL for metal	Type A or Type C (cut-off or combination WHEEL GUARD)
	DIAMOND CUTTING WHEEL for masonry/concrete	Type A or Type F (cut-off or masonry/concrete cut-off WHEEL GUARD)
	Abrasive wheels for materials other than metal or masonry/concrete	Type A or Type C (cut-off or combination WHEEL GUARD)
Dual purpose (combined cut-off and grinding)	Dual purpose abrasive wheel	Type A or Type C (cut-off or combination WHEEL GUARD)
Hole cutting	Diamond hole cutters	None
Wire brushing	Wheel-type wire brush	Type A or Type B or Type C (cut-off or grinding or combination WHEEL GUARD)
	Cup-type wire brush	None
Sanding	Flap disc	Type B or Type C (grinding or combination WHEEL GUARD)
	Flexible abrasive (e.g. sanding paper) supported by a flexible backing pad	None
	Hard metal wheel (sanding of materials other than metal or masonry/concrete)	None
Polishing	Polishing ACCESSORY	None
Any operation	ACCESSORY with a diameter up to and including 55 mm	None

19.102 Spindles

Spindles shall be designed so that they provide for or aid in securing and driving the abrasive products designed for the tool.

Either the direction of spindle threads or the design of an equivalent securing means shall be such that any clamping device or wheel with threaded hole tends to tighten during working, or the OUTER FLANGE shall have positive locking to the spindle.

Compliance is checked by inspection.

In order to limit the unbalance of any rotating ACCESSORY, the eccentricity of the 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 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:

– 0,30 mm for RATED NO-LOAD SPEEDS less than 15 000 min^{-1}.

– 0,15 mm for RATED NO-LOAD SPEEDS from 15 000 min^{-1} to less than 25 000 min^{-1}.

– 0,10 mm for RATED NO-LOAD SPEEDS equal 25 000 min^{-1} and higher.

Compliance is checked by measurement. The eccentricity is measured as the difference between the minimum and the maximum reading of the indicator.

For tools with FLANGES, the eccentricity of the FLANGE in the worst off-centre position allowed by the mounting procedure is measured.

19.103 Flanges

The tool shall be designed so as to prevent the abrasive product coming loose under NORMAL USE.

GRINDERS shall be provided with at least INNER FLANGE(s) and OUTER FLANGE(s) for mounting the type of grinding wheels that are intended to be used with the WHEEL GUARD(S) supplied with the GRINDER. The FLANGES shall meet the requirements of 19.104 and 19.105.

FLANGES are not required to be provided if the tool is designed to only accept wheels with a non-reusable plate mount or other non-threaded mounting affixed to the wheel.

Compliance is checked by inspection.

19.104 Flange dimensions

19.104.1 FLANGES required by 19.103 shall be designed so that they secure and locate the abrasive products to the GRINDER. At least one of the FLANGES shall be keyed, screwed, shrunk-on or otherwise secured to prevent rotation relative to the tool spindle.

The FLANGES shall be flat and have no sharp edges.

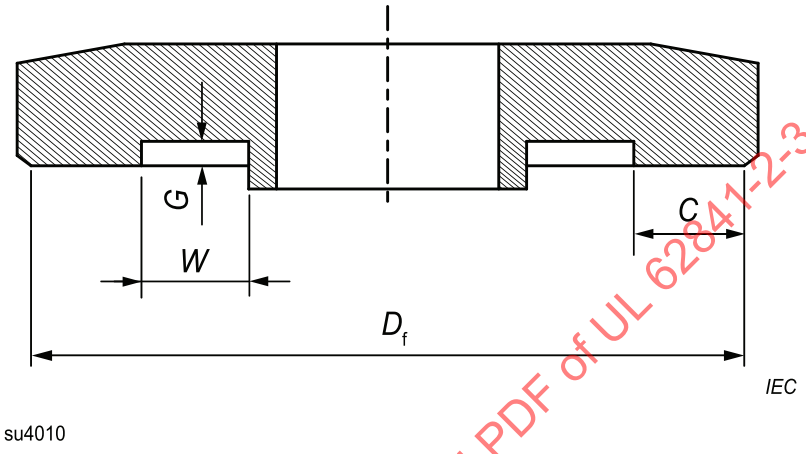
The FLANGES shall have the dimensions specified in 19.104.1 and 19.104.2 as illustrated in Figure 105 or the dimensions specified in 19.104.3 as illustrated in Figure 106, where D is the outside diameter of the abrasive wheel, G and W are the dimensions of the recess and D_f is the outside diameter of the FLANGE clamping surface.

FLANGES for wheels under 55 mm diameter may be UNRECESSED.

For wheels of any diameter with threaded inserts or projecting studs, the FLANGES shall be UNRECESSED, i. e. $G = 0$.

The INNER FLANGE and the OUTER FLANGE shall have the same diameter D_f or the overlap of the INNER FLANGE and OUTER FLANGE bearing surfaces shall be at least equal to dimension C.

In order to prevent interference, the OUTER FLANGE and/or nut shall not extend beyond the plane defined by the lip of the WHEEL GUARD when mounted with the thickest Type 27, 28 or 29 wheel as specified in accordance with 8.14.2 a) 104).



Key

C radial width of the clamping surface

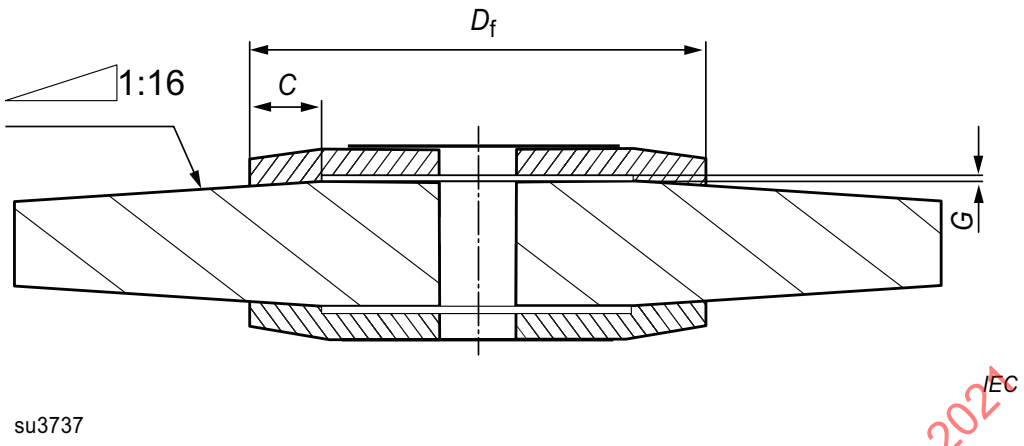
D_f outside diameter of the FLANGE clamping surface

G depth of recess

W width of recess

Figure 105

Principal dimensions of flanges for wheels other than Type 4



Key

C radial width of the clamping surface

D_f outside diameter of the FLANGE clamping surface

G depth of recess

Figure 106

Principal dimensions of flanges for wheels type 4

19.104.2 The FLANGE diameter for WHEEL TYPE 1 that are thicker than 5 mm shall be:

$D_f \geq 0{,}33D$

The FLANGE diameter for WHEEL TYPE 1 that are 5 mm and thinner and WHEEL TYPES 6, 11, 27, 28, 29, 41 and 42 shall be:

D_f = (20 ± 1) mm	for 55 mm ≤ *D* < 80 mm
D_f = (20 ± 1) mm	for 80 mm ≤ *D* ≤ 105 mm for wheels with a bore diameter of 10 mm (3/8 inch UNC)
D_f = (29 ± 1) mm	for 80 mm ≤ *D* ≤ 105 mm for wheels with a bore diameter of 16 mm (5/8 inch UNC)
D_f = (41 ± 1) mm	for 105 mm < *D* ≤ 230 mm

For WHEEL TYPE 41 and DIAMOND WHEELS, the D_f dimension may exceed the above values for INNER FLANGES and OUTER FLANGES. For all other WHEEL TYPES, the diameter D_f may exceed the above values for INNER FLANGES only.

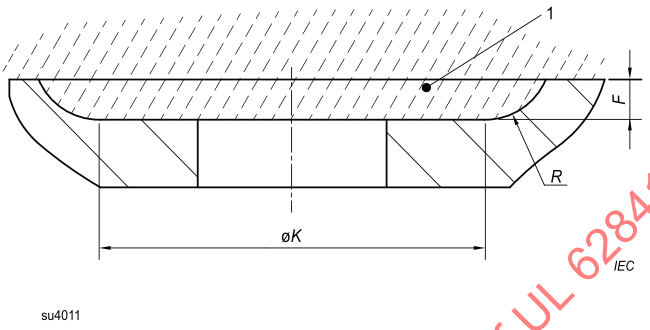
If the clamping surface of the OUTER FLANGE is chamfered, the bevel angle, measured from the clamping surface, shall be at least 45° and the non-clamping surface outside diameter of the flange may be increased by not more than 4 mm.

NOTE 101 In Europe (EN 62841-2-3), the above paragraph is replaced by the following:

For WHEEL TYPES 27, 28 and 42: The outer dimensions of the OUTER FLANGE shall be limited so that there is no interference with the depressed centre of wheels in accordance with ISO 603-14:1999 and ISO 603-16:1999 as illustrated in Figure Z101 with the dimensions ØK, R and F as specified in Table Z101.

Table Z101
Dimensions of depressed centre wheels

Outside diameter of the abrasive wheel *D* mm	*ØK* mm	Radius *R* mm	*F* mm
≤ 80	23	6	4
> 80 and ≤ 100	35,5	6	4
> 100 and ≤ 230	45	8	4,6



Key

1 area without interference

ØK diameter of the depressed centre bottom

R radius

F height of the depressed centre

Figure Z101
Depressed centre of abrasive wheels

19.104.3 The dimensions *C*, *G* and *W* in Figure 105 shall be:

$C \geq 3$ mm

$W \geq 1$ mm, $G \geq 0{,}5$ mm for $D_f < 50$ mm

$W \geq 1{,}5$ mm, $G \geq 1{,}0$ mm for $D_f \geq 50$ mm

The cross-section of the recess need not be rectangular.

19.104.4 FLANGES for WHEEL TYPE 4 as illustrated in Figure 106 shall have minimum dimensions in accordance with Table 102.

NOTE 101 In Canada and the United States of America, this subclause is not applicable.

Table 102
Minimum flange dimensions for wheel type 4

Outside diameter of the abrasive wheel *D* mm	Outside diameter of the flange clamping surface D_f mm	Radial width of the clamping surface *C* mm	Depth of recess *G* mm
≤ 100	50	8	1,0
> 100 and ≤ 125	63	10	1,0
> 125 and ≤ 150	75	13	1,0
> 150 and ≤ 175	88	14	1,0
> 175 and ≤ 200	100	16	2,0

Compliance of the requirements in 19.104.1, 19.104.2, 19.104.3 and 19.104.4 is checked by measurement.

NOTE 102 In Canada and the United States of America, this following additional subclause applies.

19.104.UC.1 An ADAPTOR BACKING FLANGE may be used in place of the INNER FLANGE to mount WHEEL TYPES 27, 28 and 29 with a diameter greater than 155 mm. The ADAPTOR BACKING FLANGE shall extend beyond the central hub, or raised portion, of the wheel. The adaptors are exempt from the FLANGE strength test specified in 19.105.

19.105 Strength of flanges

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

Compliance is checked by the following test.

The GRINDER is fitted with a steel disc having an equal thickness and shape as the abrasive product.

The clamping nut is tightened with a first test torque according to Table 103. A feeler gauge of a thickness of 0,05 mm is used to test whether the FLANGES are in contact with the disc all around the circumference. The test is satisfactory if at no place the feeler gauge can be pushed underneath the FLANGES.

The clamping nut is further tightened to the second test torque according to Table 103. A feeler gauge of a thickness of 0,05 mm is used to test the deflection of the FLANGES. The result is satisfactory if at no place the feeler gauge can be pushed underneath the FLANGES by more than 1 mm.

Table 103
Torques for testing flanges

Thread		First test torque	Second test torque
Metric	UNC	Nm	Nm
5		0,5	2
6		1	4
8	2	2	8
10	3/8	4	15
12	1/2	7,5	30
14		11	45
16	5/8	17,5	70
> 16	> 3/4	35	140

20 Mechanical strength

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

20.1 *Replacement of the fifth paragraph:*

Deformation of a WHEEL GUARD is acceptable. If there is any mechanical damage to other parts of the tool that is likely to compromise compliance with a relevant requirement of Clause 19, the requirement in Clause 19 shall be re-evaluated.

NOTE 1 The strength of the wheel guard is evaluated in 20.101, 20.102 or 20.103.

NOTE 2 See Annex BB for the recommended minimum thickness of wheel guards.

20.5 *Modification:*

This subclause is not applicable for DISC-TYPE POLISHERS and DISC-TYPE SANDERS, provided these tools are not intended to be used as a GRINDER as specified in the instructions in accordance with 8.14.1.101.2 a).

20.101 Strength of wheel guards of Types A, B, C and D

20.101.1 WHEEL GUARDS of Types A, B, C and D specified in accordance with 8.14.2 a) 101) shall have sufficient mechanical strength to prevent the wheel fragments from being ejected towards the operator in the event of the wheel breakage.

Compliance is checked by submitting three samples of the WHEEL GUARD to the test specified in 20.101.2 to 20.101.5. At the manufacturer's discretion, the test may be conducted with three WHEEL GUARDS for each WHEEL GUARD type but less than three separate GRINDERS.

The test is conducted with the thickest bonded reinforced wheel that may be used with the WHEEL GUARD in accordance with 8.14.2 a) 101).

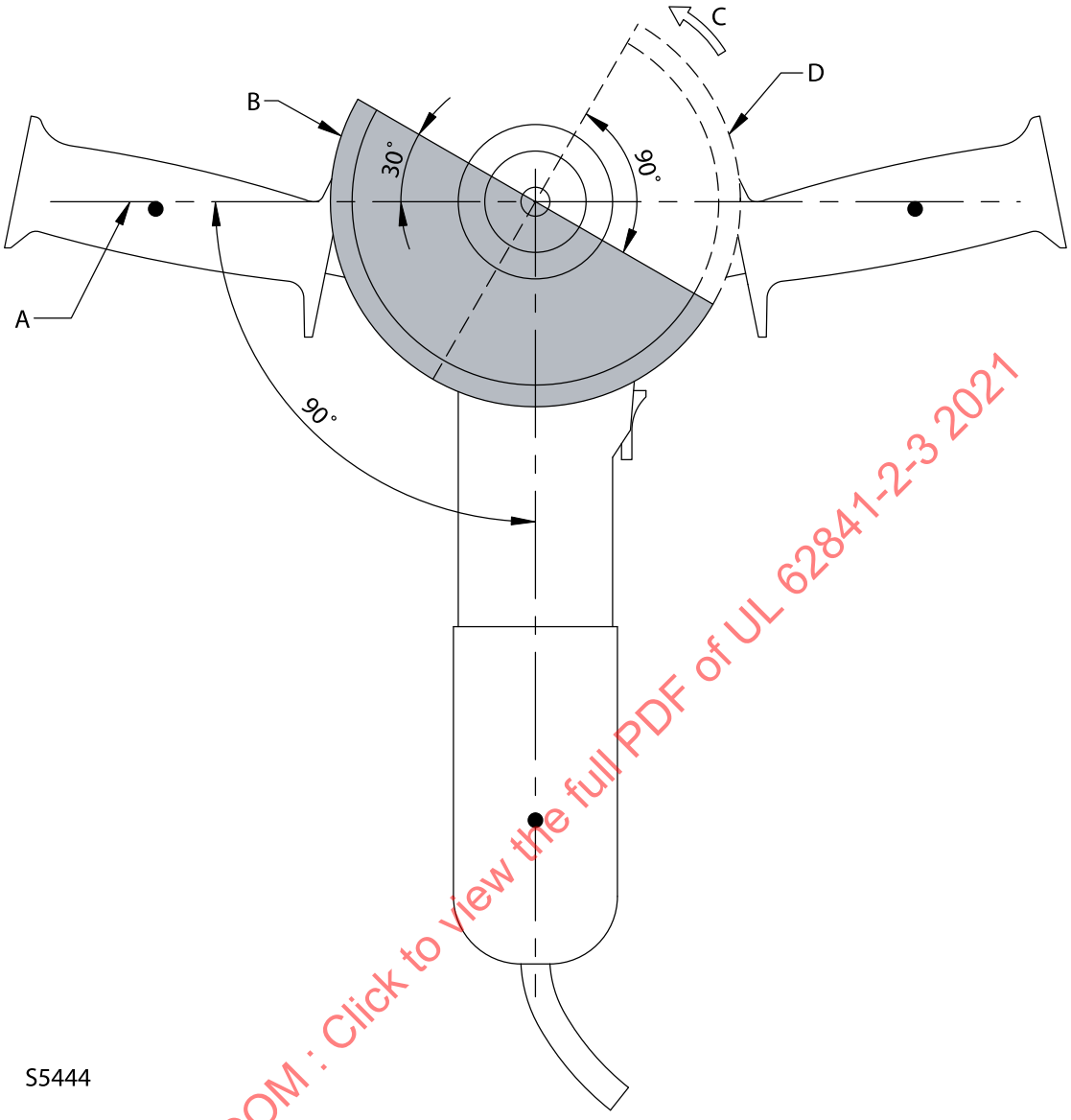
After the test, the tool shall meet the acceptance criteria of 20.101.6.

For WHEEL GUARDS intended only for DIAMOND WHEELS or flap discs, compliance is checked either by:

– submitting three samples of the WHEEL GUARD to the test specified in 20.102.2 to 20.102.5, also using bonded reinforced wheels with a minimum thickness of 2,5 mm and a diameter approximately equal to the diameter of the DIAMOND WHEELS or flap discs in accordance with 8.14.2 a) 101). After the test, the tool shall meet the acceptance criteria of 20.102.6; or

– meeting the design requirements in Table 105.

20.101.2 *The WHEEL GUARD is mounted and securely fixed to the GRINDER in accordance with the instructions of 8.14.2 b) 104). If the WHEEL GUARD is adjustable, it is positioned as close as possible to 30° from the neutral or the symmetrical wheel covering position against the direction of the wheel's rotation. See Figure 107 a) and Figure 107 b). For WHEEL GUARDS of Type D, the axial adjustment is such that the lower edge of the WHEEL GUARD extends beyond the grinding surface of the wheel by not more than 1,0 mm.*



Key

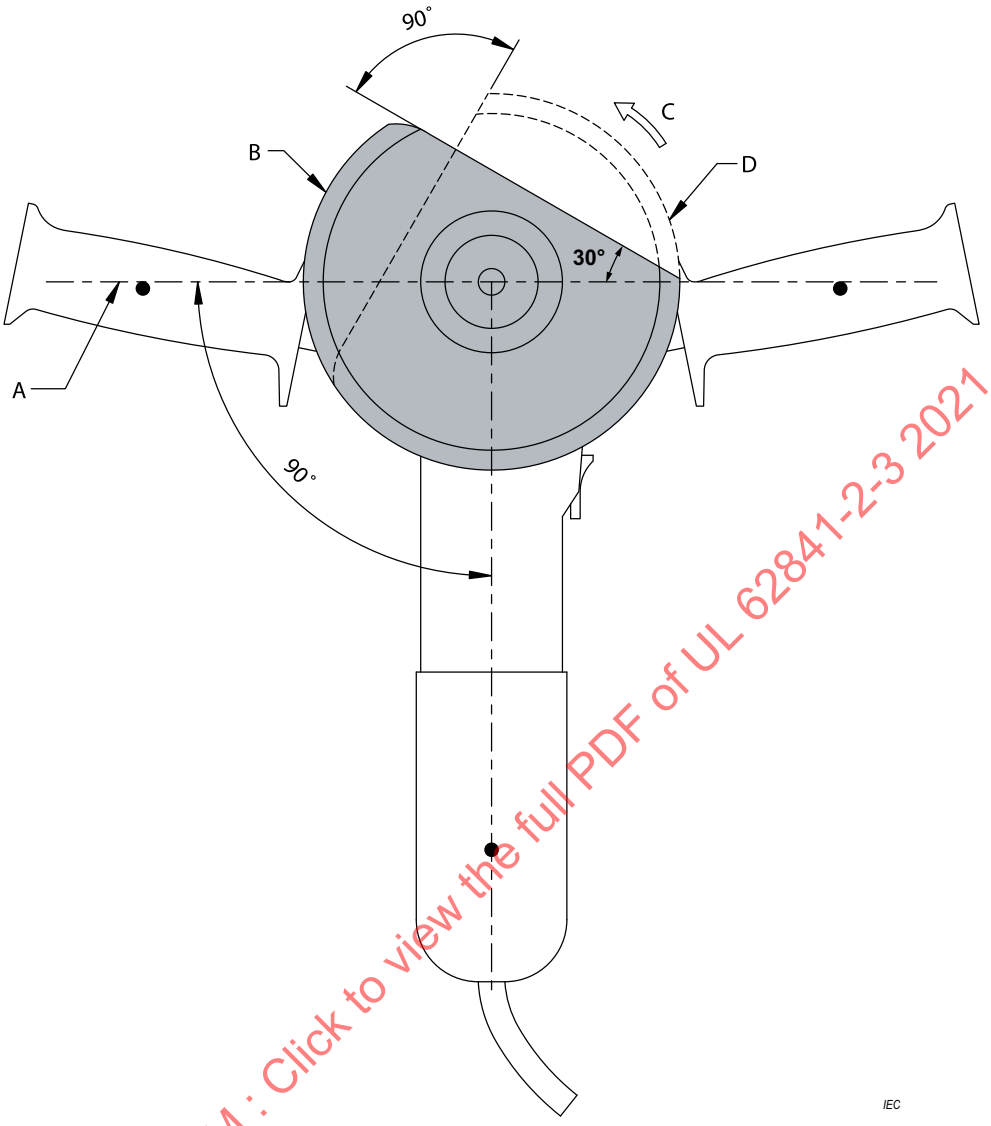
A neutral WHEEL GUARD position

B initial WHEEL GUARD position (WHEEL GUARD turned 30° from neutral position against the direction of wheel rotation)

C direction of the wheel rotation

D maximum permissible WHEEL GUARD position after the test (90° from initial position in the direction of the wheel rotation)

a) Wheel guard strength test: wheel guard positions for wheel types 1, 27, 28, 29, 41 and 42



Key

A neutral WHEEL GUARD position

B initial WHEEL GUARD position (wheel guard turned 30° from neutral position against the direction of wheel rotation)

C direction of the wheel rotation

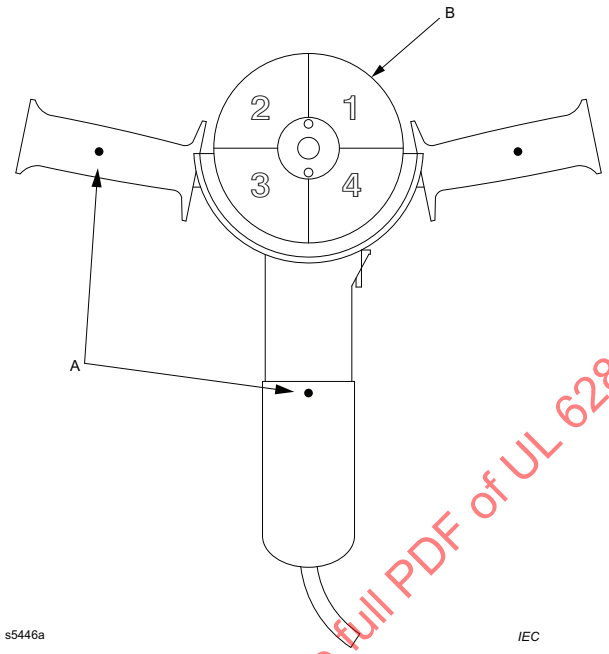
D maximum permissible WHEEL GUARD position after the test (90° from initial position in the direction of the wheel rotation)

b) Wheel guard strength test: wheel guard positions for cup wheel types 6 and 11

Figure 107

Wheel guard strength test: explanation of wheel guard positions

The maximum thickness grinding wheel in accordance with 8.14.2 a) 104) with a diameter equal to the RATED CAPACITY of the GRINDER shall be notched into four equal segments (quadrants). The width of each notch shall not exceed 2,5 mm. For WHEEL TYPES 1, 27, 28, 29, 41, 42 and dual purpose wheels, the cut is directed from the outer edge radially towards the centre (see Figure 108). For WHEEL TYPES 6 and 11, the cut starts across the working surface towards the mounting end (see Figure 109).



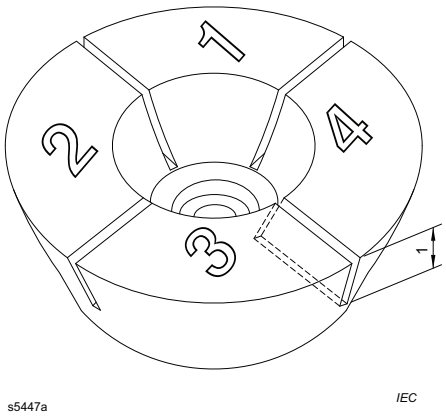
Key

A midpoints of the gripping zone

B grinding wheel quadrant

Figure 108

Wheel guard strength test: preparation of the grinder



Key

1 cut

Figure 109

Wheel guard strength test: preparation of cup wheel types 6 and 11

The notched grinding wheel is mounted to the spindle with any mounting means that will allow for the centrifugal forces to cause the wheel to disintegrate at a speed equal to or greater than 90 % of the RATED NO-LOAD SPEED of the GRINDER. The mounting means shall position the wheel at the same location relative to the WHEEL GUARD as would occur with the FLANGES recommended in accordance with the instructions in 8.14.2 b) 102).

20.101.3 Table 104 provides typical pre-cut length ranges for standard wheel dimensions.

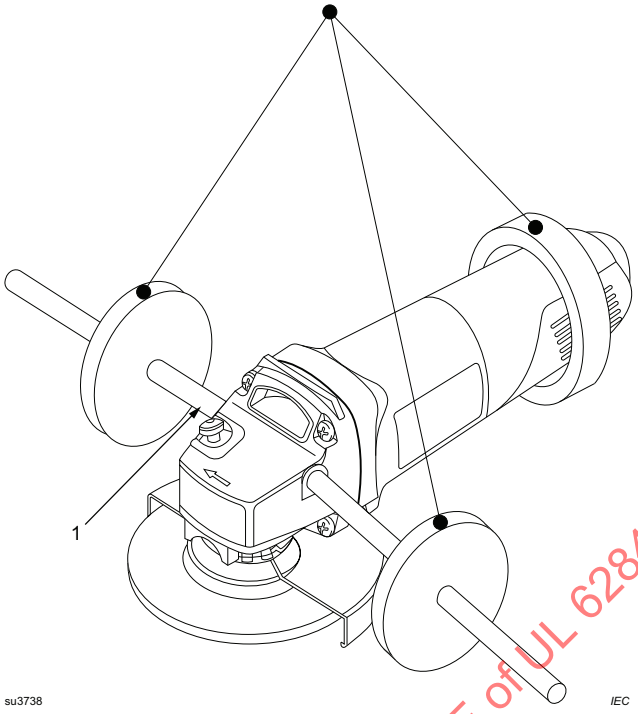
Table 104
Typical pre-cut length ranges for standard wheel dimensions

Wheel type	Wheel dimensions (diameter × thickness × bore diameter) mm	Average burst speed min^{-1}	Pre-cut length range mm
Type 27	115 × 6 × 22,23	10 200	37,6 to 39,6
	125 × 6 × 22,23	9 800	42,7 to 45,7
	180 × 6 × 22,23	5 900	67,3 to 72,1
	230 × 6 × 22,23	5 700	83,3 to 93,5
Type 11	125 × 50 × 22,23	6 150	28
	150 × 50 × 22,23	5 400	30
Type 1	125 × 25 × 16	6 950	46
	155 × 25 × 16	5 800	57 to 60

20.101.4 *For ANGLE GRINDERS and VERTICAL GRINDERS with side handles, a mass of 1 kg is mounted at the midpoint of the POWER SWITCH handle and a mass of 0,5 kg is mounted at the midpoint of a side handle installed on each side of the GRINDER (see Figure 108). Using a flexible nylon braided rope, the GRINDER is suspended at the midpoint of the gripping zone on each side handle and at the midpoint of the POWER SWITCH handle.*

NOTE 101 The above test requires a second side handle or adaptor.

For ANGLE GRINDERS and VERTICAL GRINDERS without side handles, a mass of 1 kg is attached at the midpoint of the POWER SWITCH handle. An adaptor with simulated side handles as means of suspension and weight attachment of 0,5 kg at each side is to be provided for the test (see Figure 110). The adaptor shall have a mass as small as possible and be located at less than half the RATED CAPACITY distance behind the output spindle for ANGLE GRINDERS and VERTICAL GRINDERS. The suspension point and weight attachment on the left and right side of the tool are located at a distance from the centre of the spindle which is equivalent to RATED CAPACITY and at 90° to the centre line through the length of the tool.



Key

1 adaptor

Figure 110

Wheel guard strength test: angle grinders and vertical grinders without side handles

The three suspension ropes are anchored to a single point and the tool is positioned inside a test box (see Figure 111). For WHEEL GUARDS of Type D that cover 360° of the wheel's periphery, it is not required to position the tool inside the test box of Figure 111. In this case, the tool should be positioned inside a suitable enclosure for test operator safety.

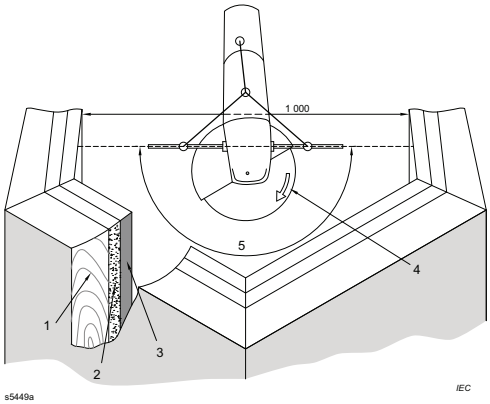
The test box, preferably with a hexagonal, octagonal or round shape, approximately 1 m in interior diameter and approximately 1 m deep, shall have an outer shell capable of restraining the disintegrating wheel segments and the interior surfaces, lined with material able to absorb and retain the wheel segments or the impression of the impacting segments (see Figure 111).

NOTE 102 An example of a material for the lining is a 25 mm to 35 mm thick layer of modelling clay, backed by an additional 25 mm to 35 mm thick layer of cork.

An ANGLE GRINDER or a VERTICAL GRINDER with the mounted WHEEL GUARD and the notched wheel facing down in the horizontal plane is positioned with the wheel approximately in the centre and 300 mm from the bottom of the box (see Figure 111). To align the GRINDER inside the box and to prevent the GRINDER from twisting during the wheel's acceleration, the two side handles are secured to the box with a force less than 5 N.

NOTE 103 One possible method to achieve the force necessary is the use of permanent magnets.

Dimensions in millimetres



Key

1 outer shell

2 cork

3 liner material

4 direction of the wheel rotation

5 fragment zone defined by midpoints of handles

Figure 111

Wheel guard strength test box

As an alternative method, the use of a high-speed camera is allowed to fix the position of the tool just prior to the wheel burst.

20.101.5 *While monitoring the wheel speed with a tachometer, the voltage to the tool is gradually increased until 90 % of the RATED NO-LOAD SPEED of the GRINDER is achieved.*

If the wheel does not disintegrate at this specified speed,

– stop the GRINDER, increase the length of the pre-cuts and repeat the test above; or

– at the manufacturer's option, continue increasing the wheel speed beyond the specified speed

until the wheel bursts.

Dust, MINOR FRAGMENTS and segments remaining in the WHEEL GUARD are ignored. Most of the four major segments will be captured by the liner material wall. If any of the major segments rebound from the liner material, the segment's impression is to be identified. Afterward, the segments of the wheel in the liner material wall are removed.

NOTE 101 Typically, the wheel will burst within 5 min.

20.101.6 *The WHEEL GUARD complies with the requirements of 20.101 if the following results a) to d) have been achieved:*

a) The speed of the wheel just prior to the wheel bursting is at least the speed specified in 20.101.5.

b) The WHEEL GUARD and the fasteners or the WHEEL GUARD'S mounting hardware shall remain mounted. Deformation, hairline cracks or scratches and gouges to the WHEEL GUARD and mounting hardware are acceptable.

c) The impression of the impact in the wall from the major wheel segments shall be within the fragment zone. The fragment zone is defined by extending a straight line through the midpoints of the two side handles onto the wall facing the unguarded wheel in the position of the GRINDER just prior to the wheel bursting (see Figure 111). For WHEEL GUARDS of Type D that cover 360° of the wheel's periphery, this requirement is not applicable.

d) The WHEEL GUARD shall not have rotated in the direction of the wheel rotation by more than 90° (see Figure 107 a) and Figure 107 b). If the WHEEL GUARD covers 360° of the wheel's periphery, the 90° limitation on the WHEEL GUARD'S rotation is not applicable.

NOTE 101 An example of a method to measure the rotation of the WHEEL GUARD is the use of a high-speed camera.

If the WHEEL GUARD has failed any of the requirements in b) to d) above at a wheel burst speed that is above the speed specified in 20.101.6, the test shall be repeated using the method of increasing the length of the pre-cut segments.

20.102 Strength of wheel guards of Type F

20.102.1 A WHEEL GUARD of Type F shall have sufficient mechanical strength to withstand a wheel breakage.

For WHEEL GUARDS intended for bonded reinforced wheels or intended for both DIAMOND CUTTING WHEELS and bonded reinforced wheels, compliance is checked by submitting three samples of any recommended Type F WHEEL GUARD to the test specified in 20.102.2 to 20.102.5. At the manufacturer's discretion, the test may be conducted with three WHEEL GUARDS but less than three separate GRINDERS. After the test, the tool shall meet the acceptance criteria of 20.102.6.

For WHEEL GUARDS intended only for DIAMOND CUTTING WHEELS, compliance is checked either by:

– submitting three samples of the WHEEL GUARD to the test specified in 20.102.2 to 20.102.5, also using bonded reinforced wheels with a minimum thickness of 2,5 mm and a diameter approximately equal to the diameter of the DIAMOND CUTTING WHEELS in accordance with 8.14.2 a) 101). After the test, the tool shall meet the acceptance criteria of 20.102.6; or

– meeting the design requirements in Table 105.

Table 105
Guard thickness for diamond cutting wheels

Material of wheel guard	Ultimate tensile strength N/mm²	Minimum fracture elongation	Minimum thickness mm	
			Peripheral part	Side part
Metal	≥ 380	–	1,25	0,75
Metal	≥ 350 and < 380	–	1,50	1,00
Metal	≥ 200 and < 350	–	2,00	1,50
Metal	≥ 160 and < 200	–	2,50	1,75
Polycarbonate	60	80 %	3,00	2,00

20.102.2 *The WHEEL GUARD is mounted and securely fixed to the GRINDER in accordance with the instructions of 8.14.2 b) 104).*

Regardless the intended wheel construction, a bonded reinforced wheel with the maximum thickness recommended in 8.14.2 a) 104) and with a diameter equal to the RATED CAPACITY of the GRINDER is mounted to the spindle in accordance with the instructions.

The GRINDER is operated at RATED VOLTAGE for a minimum of 5 min. The speed of the wheel is measured and recorded.

20.102.3 *The wheel as specified in 20.102.2 is notched into four equal segments (quadrants). The cut is directed from the outer edge radially towards the centre (see Figure 108). The width of each notch shall not exceed 2,5 mm. The extent of the notches shall allow for the centrifugal forces to cause the wheel to disintegrate at a speed equal to or greater than either the speed established in 20.102.2 or 90 % of the RATED NO-LOAD SPEED of the GRINDER, whichever is higher.*

The notched grinding wheel is mounted to the spindle with any mounting means that will allow for the centrifugal forces to cause the wheel to disintegrate. The mounting means shall position the wheel at the same location relative to the WHEEL GUARD as would occur with the FLANGES recommended in accordance with 8.14.2 b) 102).

20.102.4 *For GRINDERS with side handles, a mass of 1 kg is mounted at the midpoint of the POWER SWITCH handle and a mass of 0,5 kg is mounted at the midpoint of a side handle installed on each side of the GRINDER. Using a flexible nylon braided rope, the GRINDER is suspended at the midpoint of the gripping zone on each side handle and at the midpoint of the power switch handle.*

NOTE 101 The above test requires a second side handle or adaptor.

The tool is suspended such that the foot of the WHEEL GUARD is facing downwards. The test is set up such that the operator is protected and so that any rebounding fragments do not affect the test result.

20.102.5 *While monitoring the wheel speed with a tachometer, the speed of the tool is gradually increased until the speed specified in 20.102.3 is achieved.*

If the wheel does not disintegrate,

– stop the GRINDER, increase the length of the pre-cuts and repeat the test above; or

– at the manufacturer's option, continue increasing the wheel speed

until the wheel bursts.

NOTE 101 Typically, the wheel will burst within 5 min.

20.102.6 *The WHEEL GUARD and the fasteners or the WHEEL GUARD'S mounting hardware shall remain in place. Deformation, hairline cracks or scratches and gouges to the WHEEL GUARD and mounting hardware are acceptable.*

20.103 Strength of wheel guards of Type G

20.103.1 All WHEEL GUARDS for STRAIGHT GRINDERS specified in accordance with 8.14.2 a) 101) shall have sufficient mechanical strength to prevent the wheel fragments from being ejected towards the operator in the event of the wheel breakage.

Compliance is checked by submitting three samples of any recommended WHEEL GUARD to the test specified in 20.103.2 to 20.103.4. At the manufacturer's discretion, the test may be conducted with three WHEEL GUARDS but less than three separate GRINDERS. After the test, the tool shall meet the acceptance criteria of 20.103.5.

20.103.2 *The WHEEL GUARD is mounted and securely fixed to the GRINDER in accordance with 8.14.2 b) 104). If the WHEEL GUARD is adjustable, it is positioned horizontal to the floor.*

The maximum thickness grinding wheel in accordance with 8.14.2 a) 104) with a diameter equal to the RATED CAPACITY of the GRINDER is notched into four equal segments (quadrants). The width of each notch shall not exceed 2,5 mm. For WHEEL TYPE 1, the cut is directed from the outer edge radially towards the centre (see Figure 108). For STRAIGHT GRINDERS intended to be used only with WHEEL TYPE 4, the test is conducted with a wheel type 1 that has at least the same thickness as the thickest WHEEL TYPE 4 in accordance with 8.14.2 a) 104) for that tool, measured in the centre of the wheel.

The notched grinding wheel is mounted to the spindle with any mounting means that will allow for the centrifugal forces to cause the wheel to disintegrate at a speed equal to or greater than 90 % of the RATED NO-LOAD SPEED of the GRINDER. The mounting means shall position the wheel at the same location relative to the WHEEL GUARD as would occur with the FLANGES recommended in accordance with in 8.14.2 b) 102).

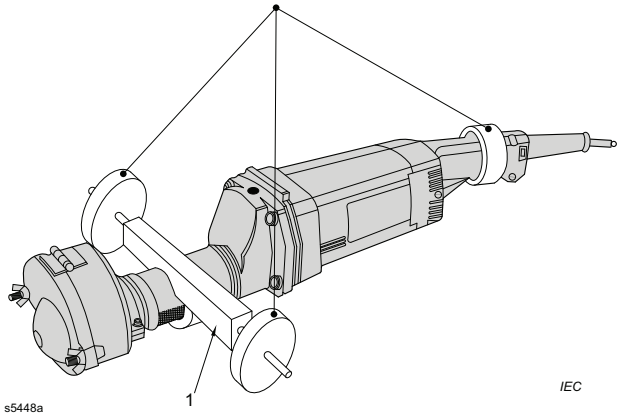
Table 106 provides typical pre-cut length ranges for standard wheel dimensions.

Table 106
Typical pre-cut length ranges for standard wheel dimensions

Wheel type	Wheel dimensions (diameter × thickness × bore diameter) mm	Average burst speed min^{-1}	Pre-cut length range mm
Type 1	125 × 25 × 16	6 950	46
	155 × 25 × 16	5 800	57 to 60

20.103.3 *A mass of 1 kg is attached. An adaptor with means of suspension and weight attachment of 0,5 kg at each side is provided for the test (see Figure 112). The adaptor shall have a mass as small as possible and is located at the midpoint of the front gripping zone and less than half the RATED CAPACITY distance behind the output spindle. The suspension point and weight attachment on the left and right side of the tool is located at a distance from the centre of the spindle which is equivalent to RATED CAPACITY and at 90° to the centre line through the length of the tool.*

The three suspension ropes are anchored to a single point.



Key

1 adaptor

Figure 112

Wheel guard strength test: straight grinder with additional masses

20.103.4 *While monitoring the wheel speed with a tachometer, the voltage to the tool is gradually increased until 90 % of the RATED NO-LOAD SPEED of the GRINDER is achieved. If the wheel does not disintegrate at this specified speed, stop the GRINDER, increase the length of the pre-cuts and repeat the test above until the wheel disintegrates. At the manufacturer's option, in place of stopping the GRINDER and increasing the length of the pre-cut segments, the wheel speed can be increased beyond the specified speed in order to cause the wheel to disintegrate.*

NOTE 101 Typically, the wheel will burst within 5 min.

20.103.5 *The WHEEL GUARD complies with the requirements of 20.103 if the following results a) to b) have been achieved:*

a) the speed of the wheel just prior to the wheel bursting is at least the speed specified in 20.103.2;

b) the WHEEL GUARD and the fasteners or the guard's mounting hardware shall remain mounted. Deformation, hairline cracks or scratches and gouges to the guard and mounting hardware are acceptable.

If the WHEEL GUARD has failed requirement b) at a wheel burst speed that was above the speed specified by in 20.103.2, the test shall be repeated using the method of increasing the length of the pre-cut segments.

21 Construction

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

21.18.1 *Addition:*

For ANGLE GRINDERS and VERTICAL GRINDERS with a RATED CAPACITY not exceeding 100 mm and STRAIGHT GRINDERS with a RATED CAPACITY not exceeding 55 mm, POWER SWITCHES other than MOMENTARY POWER SWITCHES are permitted.

NOTE 101 In Japan, the following requirements apply:

21.18.1 *Addition:*

For ANGLE GRINDERS and VERTICAL GRINDERS with a RATED CAPACITY not exceeding 105 mm and STRAIGHT GRINDERS with a RATED CAPACITY not exceeding 55 mm, POWER SWITCHES other than MOMENTARY POWER SWITCHES are permitted.

21.18.1.1 *Replacement:*

For tools with a MOMENTARY POWER SWITCH, a lock-on device is allowed provided that two dissimilar actions are necessary to lock the POWER SWITCH in the "on" position. In addition, only a single motion to the switch shall be required to automatically return to the "off" position.

For tools with both a lock-off and lock-on function, it shall not be possible to actuate both the

– lock-off function; and the

– lock-on function

with a single direction of motion, unless a distinct change in the direction of the motion is required to continue to the lock-on position

– after actuating the lock-off function; and

– before actuating the lock-on function.

NOTE An example of a design that fulfils this requirement is a slide-style power switch with integrated lock-off and lock-on features such that release of lock-off is achieved through an initial pressing or rocking motion, followed by a forward sliding motion that turns on the tool and permitting a lock-on function through a pressing or rocking motion near the end of the sliding action.

For mains-operated single phase GRINDERS, either

– the POWER SWITCH shall automatically switch off the motor as soon as the actuating member of the switch is released and shall have no locking arrangement in the "on" position,

or

– the tool incorporates a lock-on device and shall not restart after an interruption of the mains supply without releasing the lock-on device and re-actuating the POWER SWITCH.

Compliance is checked by inspection, by manual test and for mains-operated single-phase GRINDERS incorporating a lock-on device, by the following test.

The GRINDER is operated with the lock-on device engaged. The GRINDER is then disconnected from the mains for at least 2 s. The GRINDER is then reconnected to the mains. The tool shall not operate without releasing the lock-on device and re-actuating the POWER SWITCH.

21.18.1.2 *Replacement:*

For GRINDERS and DISC-TYPE SANDERS with a RATED CAPACITY greater than 55 mm diameter, POWER SWITCHES shall be so located or designed that inadvertent operation is unlikely to occur during lifting, carrying or when the tool is resting on a flat surface.

For tools not provided with a lock-off device,

– it shall not be possible to start the tool when a sphere with a diameter of (100 ± 1) mm is applied to the POWER SWITCH perpendicularly to the tool's surface where the switch is mounted; and

– the gripping length *L* of the grasping surface identified in accordance with 8.14.2 b) 6) immediately in front of or behind the POWER SWITCH actuating member shall be a minimum of 70 mm. This length *L* includes

• the straight line distance of any portion of the grasping surface that is straight or curved at a radius of greater than 100 mm; plus

• the straight line distance of the length(s) *A* where the radius of the grasping surface is 10 mm to 100 mm, but each length *A* shall not exceed 10 mm. See Figure 113 and Figure 114.

If there are finger grips or similar superimposed profiles, the radius of the grasping surface shall not be measured along the surface, but only the arc(s) or straight line distance of the grasping surface, as applicable, shall be taken into account. See Figure 115;

or

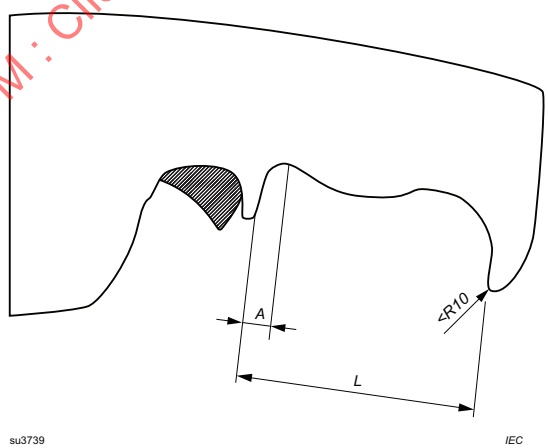
for tools provided with a lock-off device,

– two separate and dissimilar actions shall be necessary before the motor is switched on (e.g. a POWER SWITCH which has to be pushed in before it can be moved laterally to close the contacts to start the motor); and

– it shall not be possible to achieve these two actions with a single grasping motion or a straight line motion; and

– the lock-off device shall not be activated when the tool is resting on a flat surface such that the POWER SWITCH actuator is facing upwards.

Compliance is checked by inspection and by manual test.



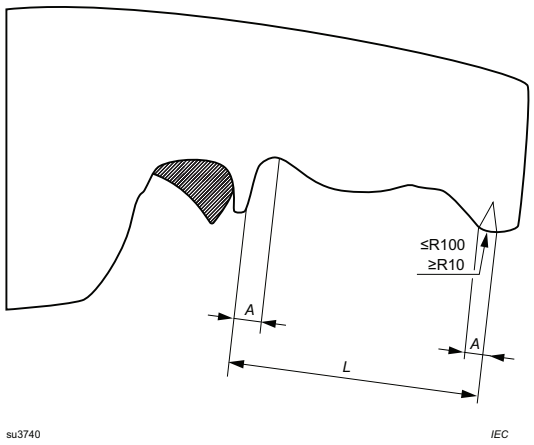
Key

L gripping length

A straight line distance of the length(s) where the radius of the grasping surface is 10 mm to 100 mm

Figure 113

Measurement of handle gripping length



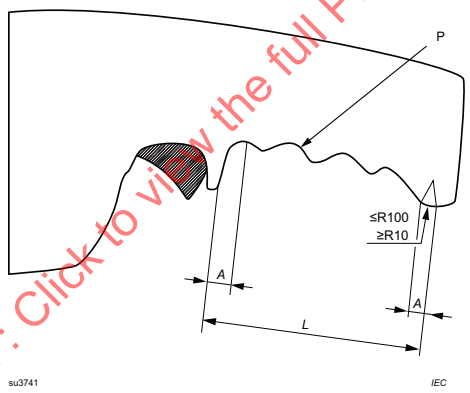
Key

L gripping length

A straight line distance of the length(s) where the radius of the grasping surface is 10 mm to 100 mm

Figure 114

Measurement of handle gripping length



Key

L gripping length

A straight line distance of the length(s) where the radius of the grasping surface is 10 mm to 100 mm

P finger grips or similar superimposed profiles

Figure 115

Measurement of handle gripping length for a handle with finger grips or similar superimposed profiles

21.30 *Modification:*

This subclause is not applicable for DISC-TYPE POLISHERS and DISC-TYPE SANDERS, provided these tools are not intended to be used as a GRINDER as specified in the instructions in accordance with 8.14.1.101.2 a).

21.35 *Modification:*

This subclause is applicable only for

– DISC-TYPE SANDERS used exclusively for sanding wooden floors in accordance with 8.14.2 b) 107); and

– GRINDERS intended to be used with a WHEEL GUARD of Type E or Type F in accordance with 8.14.2 a) 101).

22 Internal wiring

This clause of Part 1 is applicable.

23 Components

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

23.3 *Replacement of the first paragraph:*

Protection devices or circuits 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 paragraph:*

For ANGLE GRINDERS and VERTICAL GRINDERS with a RATED CAPACITY greater than 155 mm and for STRAIGHT GRINDERS with a RATED CAPACITY greater than 130 mm, the SUPPLY CORDS shall be not lighter than heavy polychloroprene-sheathed flexible cable (code designation 60245 IEC 66) or equivalent.

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 62841-2-3), Annex I is normative.

I.2 Noise test code (grade 2)

This clause of Part 1 is applicable except as follows:

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

Addition:

GRINDERS, DISC-TYPE POLISHERS and DISC-TYPE SANDERS are suspended and fitted with a wheel or pad as specified in I.3.5.3.101 and I.3.5.3.102. For angle and vertical tools, the wheel or pad shall be horizontal. For straight tools, the wheel or pad shall be vertical.

I.2.5 Operating conditions

Addition:

GRINDERS, DISC-TYPE POLISHERS and DISC-TYPE SANDERS are tested at no-load.

I.3 Vibration

This clause of Part 1 is applicable except as follows:

I.3.3.2 Location of measurement

Addition:

Figure I.101 to Figure I.103 show the positions for different types of tools.

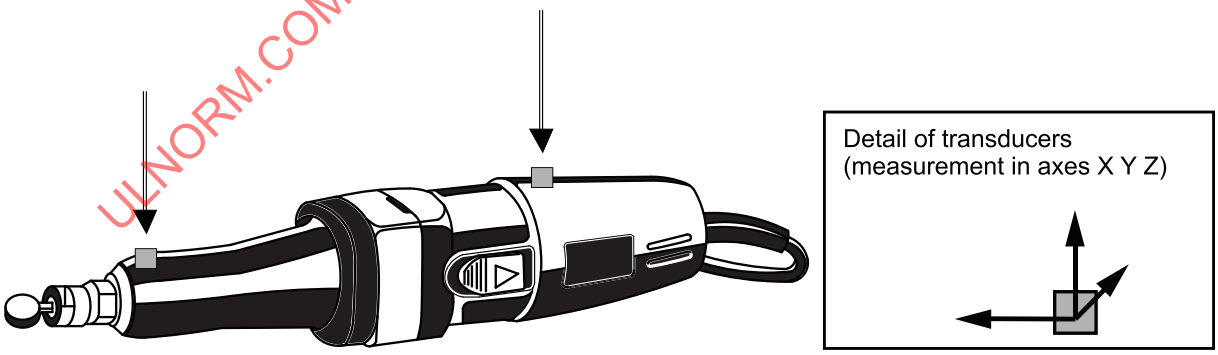


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Figure I.101

Positions of transducers for straight grinders

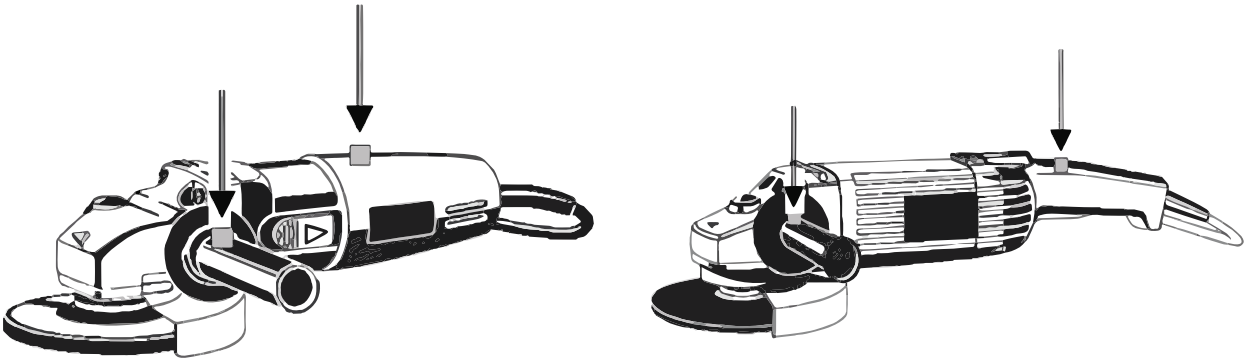

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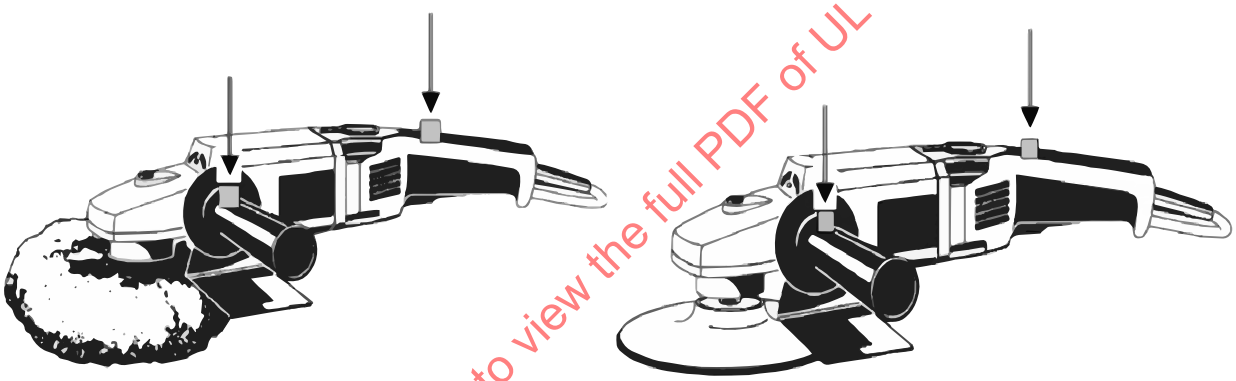
Figure I.102

Positions of transducers for angle grinders



su3753 IEC

Figure I.103

Positions of transducers for disc-type polishers and disc-type sanders

For vibration isolated stick type side handles, the transducer may alternatively be placed half way along the length of the handle. In this case, in order not to disturb the operator's normal grip, the transducer shall be placed inside the handle, without modifying the construction of the handle.

I.3.5.3 Operating conditions

Addition:

The weight of the tool as used in this subclause is considered the force caused by the mass of the tool in accordance with 5.17, but with the artificial wheel mounted.

I.3.5.3.101 Grinding and cutting off applications

For tools intended for angle grinding that can also be used for other applications such as concrete grinding or cutting-off applications, the angle grinding application is considered to produce the highest vibration

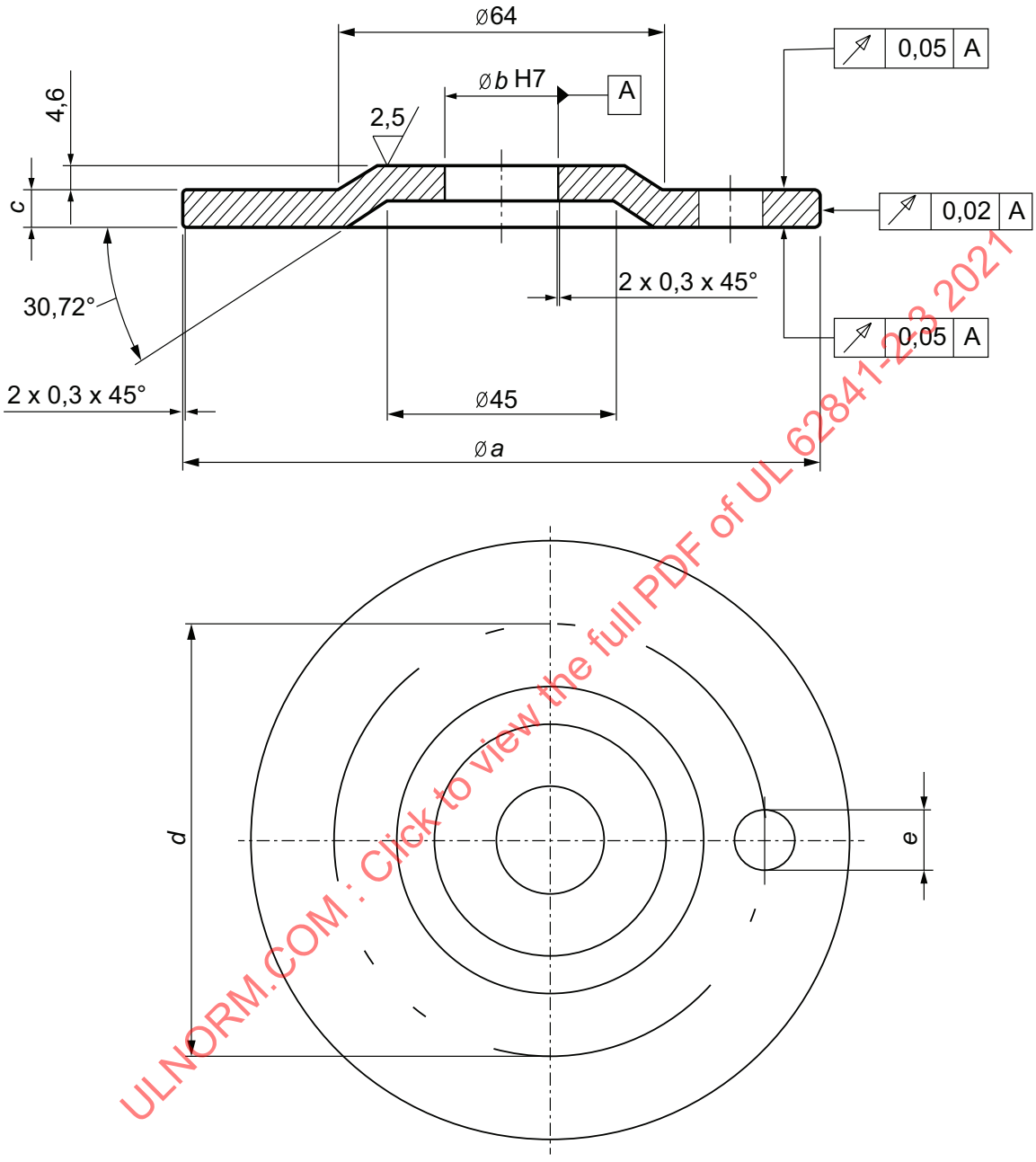
emission. Therefore, the tools shall be at least tested under load by using the artificial wheel for angle grinding under the conditions described below in Table I.101.

Tools intended for straight grinding applications shall be tested under load by using the artificial wheel for straight grinding under the conditions described below in Table I.104.

Table I.101
Test conditions for angle grinding and concrete grinding

Orientation	Tool to be held as in normal use for grinding a horizontal plate.
Tool bit	Artificial wheel as specified in Figure I.104 of a diameter equivalent to the rated capacity and dimensions in accordance with Table I.102. When using the artificial wheel, start with a diameter (e – 1 mm) and increase the size at the hole in stages of 1/10 mm until the required unbalance is obtained.
Feed force	Applied at a position as close as that in NORMAL USE. The feed force is specified in Table I.103 and obtained by applying an upward force equal to the sum of the intended feed force and the weight of the tool. The upward force is normally applied using the threaded holes for the support handle. For tools where the support handle can be mounted on either side, insert an extra bolt in the empty hole. Fix a short sling of cord from the extra bolt to the inner part of the support handle. Fix the cord used for applying the upward force in that sling. On tools with anti-vibration handles, the sling shall be attached between the tool body and the handle without blocking the anti-vibration function. The tool being suspended on a cord, the force can be applied using a weight (see Figure I.105) or, alternatively, a dynamometer can be attached to the cord. The application of force shall be achieved with minimum adaptation to the machine. NOTE Any weight added to the tool, e.g. fixing devices for the upward force, will alter the inertia of the tool and thereby reduce the vibration magnitude.
Test cycle	A test cycle is given by conducting a measurement for at least 10 s. After each test the wheel shall be loosened and repositioned 360° / 5 = 72° from its previous position on the shaft. Three series of five consecutive tests shall be carried out using a different operator for each series.

Dimensions in millimetres

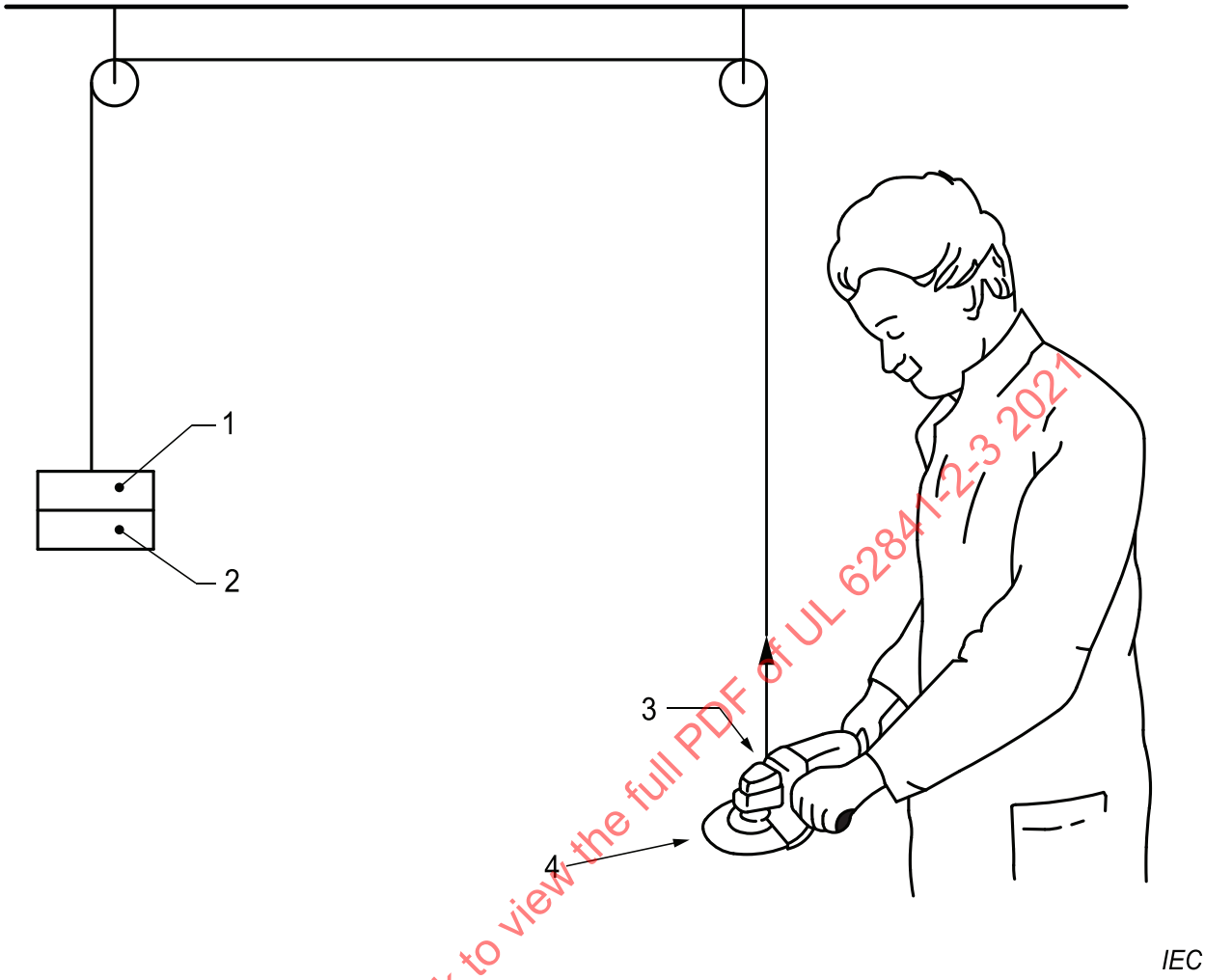


su3754

Material: aluminium

Figure I.104

Artificial grinding wheel for angle grinding and concrete grinding



Key

1 weight of the GRINDER

2 feed force weight

3 application of the feed force using a sling of cord

4 GRINDER is suspended at an angle of 20° ± 5° to the horizontal

Figure I.105

Working positions of operator and application of force

Table I.102
Dimensions of the artificial wheel of Figure I.104 or Figure I.106 for angle grinding, cutting off and concrete grinding

ø a mm	*ø b* mm	*c* mm	*ø d* mm	*ø e* for grinding mm	*ø e* for cutting off and concrete grinding mm	Unbalance for grinding g mm	Unbalance for cutting off and concrete grinding g mm
100 ± 0,2	16,0	6 ± 0,05	70 ± 0,02	11,4	10,4	58	49
115 ± 0,2	22,23	6 ± 0,05	80 ± 0,02	12,2	11,2	76	64
125 ± 0,2	22,23	6 ± 0,05	90 ± 0,02	12,5	11,4	90	75
150 ± 0,2	22,23	6 ± 0,05	120 ± 0,02	13,0	11,9	130	109
180 ± 0,2	22,23	6 ± 0,05	150 ± 0,02	14,1	12,9	190	159
230 ± 0,2	22,23	6 ± 0,05	200 ± 0,02	15,5	14,2	305	255

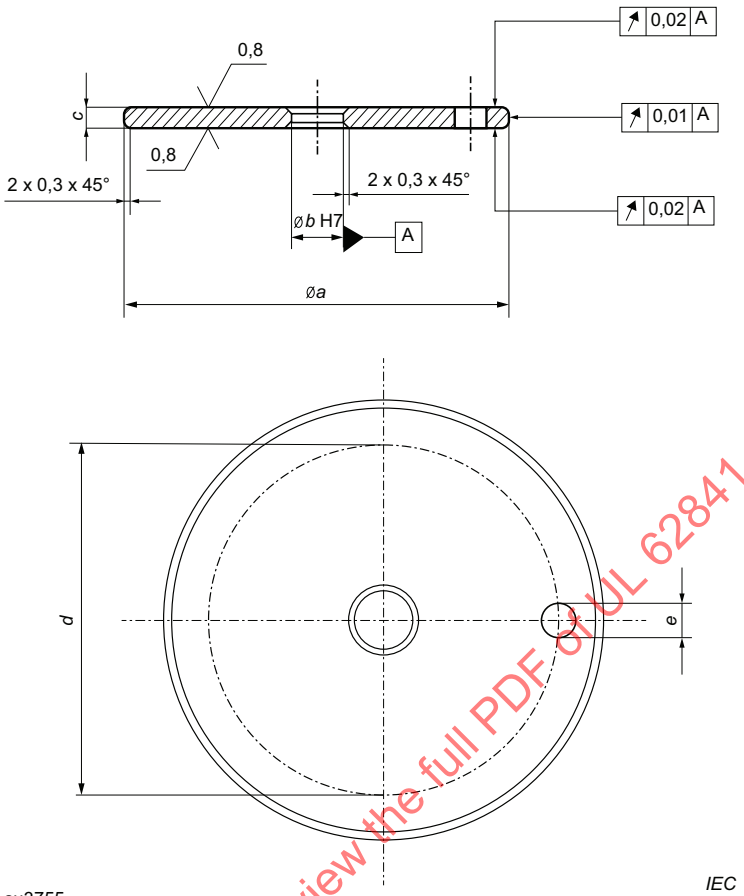
Table I.103
Feed force

ø a mm	100	115	125	150	180	230
Feed force N	40 ± 5	40 ± 5	40 ± 5	40 ± 5	60 ± 5	60 ± 5

Table I.104
Test conditions for straight grinding

Orientation	Tool to be held as in normal use for grinding a horizontal plate
Tool bit	Artificial wheel as specified in Figure I.106 of a diameter equivalent to the RATED CAPACITY and dimensions in accordance with Table I.105. When using the artificial wheel, start with a diameter (*e* – 1 mm) and increase the size at the hole in stages of 1/10 mm until the required unbalance is obtained.
Feed force	Applied at a position as close as that in NORMAL USE. For a RATED CAPACITY less than or equal to 55 mm, the feed force is 20 N, and for a RATED CAPACITY exceeding 55 mm, the feed force is 50 N. The feed force is obtained by applying an upward force equal to the sum of the intended feed force and the weight of the tool. The upward force is applied to the front part of the handle or gripping area closest to the wheel. On tools with anti-vibration handles, the upward force shall be applied without blocking the anti-vibration function. The force can be applied using a weight (see Figure I.105) or, alternatively, a dynamometer can be attached. The application of force shall be achieved with minimum adaptation to the machine. NOTE Any weight added to the tool, e.g. fixing devices for the upward force, will alter the inertia of the tool and thereby reduce the vibration magnitude.
Test cycle	A test cycle is given by conducting a measurement for at least 10 s.

Dimensions in millimetres



Material: aluminium

Figure I.106

Artificial grinding wheel for straight grinding

Table I.105
Dimensions of the artificial wheel of Figure I.106 for straight grinding

ø *a* mm	ø *b* mm	*c* mm	ø *d* mm	ø *e* mm	Unbalance g mm
25 ± 0,2	4,0	10 ± 0,05	18 ± 0,02	4,3	3,6
50 ± 0,2	4,0	10 ± 0,05	35 ± 0,02	6,2	14,5
80 ± 0,2	4,0	10 ± 0,05	65 ± 0,02	7,1	37
100 ± 0,2	19,0	25 ± 0,05	70 ± 0,02	5,6	58
125 ± 0,2	19,0	25 ± 0,05	90 ± 0,02	6,1	90
150 ± 0,2	19,0	25 ± 0,05	120 ± 0,02	6,4	130
200 ± 0,2	19,0	25 ± 0,05	170 ± 0,02	7,1	230

I.3.5.3.102 Polishing

Tools for polishing applications are tested under load and under the conditions described below in Table I.106.

Table I.106
Test conditions for polishing

Orientation	Polishing a horizontal steel plate of minimum 400 mm × 400 mm × 20 mm mounted on a bench
Tool bit	Polishing pad
Feed force	Vertical force applied on tool: – (30 ± 5) N, if the mass of the tool is less than 1,5 kg; – (50 ± 5) N, if the mass of the tool is equal or greater than 1,5 kg; or the force necessary to obtain RATED INPUT, whichever is the lower
Test cycle	A test cycle is given by conducting a measurement for at least 10 s

I.3.5.3.103 Disc-type sanding

Tools for disc-type sanding applications are tested under load and under the conditions described below in Table I.107.

Table I.107
Test conditions for disc-type sanding

Orientation	Sanding a horizontal steel plate of minimum 400 mm × 400 mm × 20 mm mounted on a bench
Tool bit	Recommended sanding disc for steel with a grain size of 120
Feed force	Vertical force applied on the tool: – (30 ± 5) N, if the mass of the tool is less than 1,5 kg; – (50 ± 5) N, if the mass of the tool is equal or greater than 1,5 kg; or the force necessary to obtain RATED INPUT, whichever is the lower
Pre-test requirements	With a new sanding disc carry out 1 min sanding before starting measurements
Test cycle	A test cycle is given by conducting a measurement for at least 10 s

I.3.5.4 Operator

Replacement:

The vibration of the machine is influenced by the operators. The operators shall therefore be skilled enough to be able to hold the tool in a manner similar to that used in real grinding. Also the angle of attack should equal to that used in real grinding on a horizontal surface (e.g. for ANGLE GRINDERS 20° ± 5°).

The forces and torques applied to the handles influence the vibration. It is therefore important that the force and torque distribution between the handles equals that in real use.

I.3.6.1 Reported vibration value

Replacement of the third paragraph:

If the coefficient of variation C_V of the five vibration total values a_{hv}, recorded for each series, is less than 0,15 or the standard deviation s_{N-1} is less than 0,3 m/s^2, the results are accepted (the note in I.3.1 provides information on possible sources of errors of measurement). This requirement is not applicable for the measurement of $a_{h,SG}$, $a_{h,AG}$, $a_{h,CO}$ and $a_{h,CG}$.

Addition:

The result a_h for each operating mode measured shall be reported:

$a_{h,SG}$ or $a_{h,AG}$	= mean vibration for straight grinding or angle grinding in accordance with I.3.5.3.101;
$a_{h,CO}$	= mean vibration for cutting off in accordance with I.3.5.3.101;
$a_{h,CG}$	= mean vibration for concrete grinding in accordance with I.3.5.3.101;
$a_{h,P}$	= mean vibration for polishing in accordance with I.3.5.3.102;
$a_{h,DS}$	= mean vibration for disc-type sanding in accordance with I.3.5.3.103.

Underestimation of the vibration for tools equipped with technical means to automatically reduce unbalances shall be taken into account by multiplying the vibration values of such tools with a correction factor of 1,3.

In cases where the measurement was done at practical use with specific discs, information about the operating conditions (such as specification of the disc used, work piece material, feed force) shall be reported.

I.3.6.2 Declaration of the vibration total value

Addition:

For ANGLE GRINDERS, the vibration total value of the handle with the highest emission and the uncertainty *K* shall be declared:

− the value of $a_{h,SG}$ or $a_{h,AG}$ with the work mode description “surface grinding”.

In addition, the following applications may be reported, if measured:

– for cutting-off applications,
the value of $a_{h,CO}$ with the work mode description “cutting off”;

– for concrete grinding applications,
the value of $a_{h,CG}$ with the work mode description “concrete grinding”;

– for polishing applications,
the value of $a_{h,P}$ with the work mode description “polishing”;

– for disc-type sanding applications,
the value of $a_{h,DS}$ with the work mode description “disc sanding”.

For tools intended only for one or more of the following applications in accordance with 8.14.1.101.2 a), the vibration total value of the handle with the highest emission and the uncertainty *K* shall be declared, as applicable:

– for concrete grinding applications,
the value of $a_{h,CG}$ with the work mode description “concrete grinding”;

– for polishing applications,
the value of $a_{h,P}$ with the work mode description “polishing”;

– for disc-type sanding applications,
the value of $a_{h,DS}$ with the work mode description “disc sanding”.

In addition, the information shall be given in the instruction manual that other applications such as wire brushing, may have different vibration emission values.

Annex K
(normative)

Battery tools and battery packs

All clauses of the main body of this Part 2-3 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 2-3 unless otherwise specified.

K.8.14.1.101.2 Safety instructions for all operations

Replacement of item j):

j) **Hold the power tool by insulated gripping surfaces only, when performing an operation where the cutting tool may contact hidden wiring.** *Contact with a "live" wire will also make exposed metal parts of the power tool "live" and could give the operator an electric shock.*

NOTE 101 The above warning is omitted, if polishing or sanding are the only intended operations.

Item k) is not applicable.

K.8.14.1.101.2DV D2 *Modification: Replace Clause K.8.14.1.101.2 of the Part 2 with the following:*

K.8.14.1.101.2DV Safety instructions for all operations

Replacement of item k):

k) Hold the power tool by insulated gripping surfaces only, when performing an operation where the cutting accessory may contact hidden wiring. ***Contact with a "live" wire will also make exposed metal parts of the power tool "live" and could give the operator an electric shock.***

NOTE 101 The above warning is omitted, if polishing or sanding are the only intended operations.

Item l) is not applicable.

K.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 – prevent unwanted switch-on for GRINDERS with a RATED CAPACITY exceeding 55 mm	Shall be evaluated using the fault conditions of 18.6.1 without the loss of this SCF
POWER SWITCH – prevent unwanted switch-on for GRINDERS with a RATED CAPACITY up to and including 55 mm	c
POWER SWITCH – prevent unwanted switch-on for DISC-TYPE SANDERS and DISC-TYPE POLISHERS	b
POWER SWITCH – provide desired switch-off for GRINDERS with a RATED CAPACITY exceeding 55 mm	c

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 GRINDERS with a RATED CAPACITY up to and including 55 mm, DISC-TYPE SANDERS and DISC-TYPE POLISHERS	b
Provide desired direction of rotation for GRINDERS	c
Provide desired direction of rotation for DISC-TYPE POLISHERS and DISC-TYPE SANDERS	Not an SCF
Prevent output speed from exceeding 120 % of RATED NO-LOAD SPEED without ACCESSORIES mounted for GRINDERS and DISC-TYPE SANDERS	c
Prevent output speed from exceeding 130 % of RATED NO-LOAD SPEED without ACCESSORIES mounted for DISC-TYPE POLISHERS	b
Prevent exceeding thermal limits as in Clause 18	a
Prevent unwanted lock-on of the POWER SWITCH function	b
Restart prevention as required by K.21.18.1.1	a
Lock-off function as required by 21.18.1.2	c
Prevent self-resetting as required in 23.3	c

K.21.18.1.1 For tools with a MOMENTARY POWER SWITCH, a lock-on device is allowed provided that two dissimilar actions are necessary to lock the POWER SWITCH in the "on" position. In addition, only a single motion to the switch shall be required to automatically return to the "off" position.

For tools with both a lock-off and lock-on function, it shall not be possible to actuate both the

– lock-off function, and the

– lock-on function

with a single uninterrupted motion, unless a change in direction of the motion is required

– after actuating the lock-off function, and

– before actuating the lock-on function.

NOTE 1 An example of a design that fulfils this requirement is a slide-style POWER SWITCH with integrated lock-off and lock-on features such that release of lock-off is achieved through an initial pressing or rocking motion, followed by a forward sliding motion that turns on the tool and permitting a lock-on function through a pressing or rocking motion near the end of the sliding action.

For GRINDERS with a DETACHABLE BATTERY PACK or a SEPARABLE BATTERY PACK, either

– the POWER SWITCH shall automatically switch off the motor as soon as the actuating member of the switch is released and shall have no locking arrangement in the "on" position;

or

– the tool incorporates a lock-on device and shall not restart after reconnection of the BATTERY pack without releasing the lock-on device and re-actuating the POWER SWITCH.

Compliance is checked by inspection, by manual test and for GRINDERS with a DETACHABLE BATTERY PACK or a SEPARABLE BATTERY PACK incorporating a lock-on device, by the following test.

With the BATTERY pack disconnected from the GRINDER for at least 2 s, the lock-on device of the tool is engaged. The BATTERY pack is then re-connected to the GRINDER. The tool shall not operate without releasing the lock-on device and re-actuating the POWER SWITCH.

NOTE 2 In Europe (EN 62841-2-3), the following additional subclause applies:

K.21.18.Z101 Isolation and disabling device

Tools 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 101 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 102 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.24.2 This subclause of Part 2-3 is not applicable.