UL 60745-2-3

STANDARD FOR SAFETY

Hand-Held Motor-Operated Electric Tools – Safety – Part 2-3: Particular Requirements for Grinders, Polishers and Disk-Type Sanders

UL Standard for Safety for Hand-Held Motor-Operated Electric Tools – Safety – Part 2-3: Particular Requirements for Grinders, Polishers, and Disk-Type Sanders, UL 60745-2-3

Second Edition, Dated May 31, 2007

Summary of Topics

The revisions of ANSI/UL 60745-2-3 dated December 11, 2018 is being issued to update the title page to reflect the most recent designation as a Reaffirmed American National Standard (ANS). No technical changes have been made.

As noted in the Commitment for Amendments statement located on the back side of the title page, UL and CSA are committed to updating this harmonized standard jointly. However, the revision pages dated December 11, 2018 will not be jointly issued by UL and CSA as these revision pages address UL ANSI approval dates only.

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

The requirements are substantially in accordance with Proposal(s) on this subject dated October 5, 2018.

No Text on This Page

CSA Group

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CAN/CSA-C22.2 No. 60745-2-3-07
Second Edition
(IEC 60745-2-3:2006, MOD)

Underwriters Laboratories Inc.
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Hand-Held Motor-Operated Electric Tools – Safety – Part 2-3: Particular Requirements for Grinders, Polishers and Disk-Type Sanders

May 31, 2007

(Title Page Reprinted: December 11, 2018)

This national standard is based on publication IEC 60745-2-3, Second Edition (2006).

Approved American National Standard

ANSI

ANSI/UL 60745-2-3-2013 (R2018)

NATIONAL STANDARD OF CANADA
STANDARDS COUNCIL OF CANADA
CONSEIL CANADIEN DES NORMES
NORME NATIONALE DU CANADA

Commitment for Amendments

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

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This Standard is subject to review within five years from the date of publication, and suggestions for its improvement will be referred to the appropriate committee. The technical content of 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 inquires@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 Second Edition including revisions through December 11, 2018. The most recent designation of ANSI/UL 60745-2-3 as a Reaffirmed American National Standard (ANS) occurred on December 11, 2018. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, Title Page (front and back), or the Preface. The National Difference Page and IEC Foreword are also excluded from the ANSI approval of IEC-based standards.

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

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Preface

This is the harmonized CSA Group and UL standard for Hand-Held Motor-Operated Electric Tools – Safety – Part 2-3: Particular Requirements for Grinders, Polishers, and Disk-Type Sanders. It is the second edition of CAN/CSA-C22.2 No. 60745-2-3 and the second edition of UL 60745-2-3. This standard is based on IEC 60745-2-3, second edition. This harmonized standard has been jointly revised on September 20, 2013. For this purpose, CSA Group and UL are issuing revision pages dated September 20, 2013.

This standard is based on edition 2.2 of the Standard for Hand-Held Motor-Operated Electric Tools – Safety – Part 2-3: Particular Requirements for Grinders, Polishers, and Disk-Type Sanders, IEC 60745-2-3, published July 2012.

The first edition of this standard was designated CAN/CSA-C22.2 No. 745-2-3/UL 745-2-3. This standard CAN/CSA-C22.2 No. 60745-2-3/UL 60745-2-3, second edition, supersedes:

a) the first edition CAN/CSA-C22.2 No. 745-2-3/UL 745-2-3 published in 1995; and

b) CAN/CSA-C22.2 No. 745-4-3/UL 745-4-3, (requirements for battery tools and battery packs are now incorporated into the requirements of CAN/CSA-C22.2 No. 60745-2-3, second edition, and UL 745-4-3, second edition).

This common standard was prepared by the CSA Group and Underwriters Laboratories Inc. (UL). The efforts and support of the Harmonization Working Group for the Adoption of the IEC 60745 Series of Tool Standards 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 approved as a National Standard of Canada by the Standards Council of Canada.

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

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

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

Level of Harmonization

This standard adopts the IEC text with national differences.

This standard is published as an equivalent standard for CSA and UL. An equivalent standard is a standard that is substantially the same in technical content, except as follows: Technical national differences are allowed for codes and governmental regulations as well as those recognized as being in

accordance with NAFTA Article 905, for example because of fundamental climatic, geographical, technological, or infrastructural factors, scientific justification, or the level of protection that the country considers appropriate. Presentation is word for word except for editorial changes.

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

Reasons for Differences From IEC

Differences from the IEC are being added in order to address basic safety requirements and existing safety practices present in the USA 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 literal interpretation has been identified, a revision is to be proposed as soon as possible to each of the standards development organizations to more accurately reflect the intent.

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For CSA Group, the text, figures, and tables of International Electrotechnical Commission Publication 60745-2-3, Hand-Held Motor-Operated Electric Tools – Safety – Part 2-3: Particular Requirements for Grinders, Polishers and Disk-Type Sanders, copyright 2012, are used in this standard with the consent of the International Electrotechnical Commission. The IEC Foreword is not part of the requirements of this standard but is included for information purposes only.

For UL, the text, figures and tables of IEC publication 60745-2-3, Hand-Held Motor-Operated Electric Tools – Safety – Part 2-3: Particular Requirements for Grinders, Polishers and Disk-Type Sanders, copyright 2012 are used in this Standard with the consent of the IEC and the American National Standards Institute (ANSI). The IEC copyrighted material has been reproduced with permission from ANSI. ANSI should be contacted regarding the reproduction of any portion of the IEC material. The IEC Foreword is not a part of the requirements of this Standard but isincluded for information purposes only. Copies of IEC Publication 60745-2-3 may be purchased from ANSI, 25 West 43rd Street, 4th Floor, New York, New York, 10036, (212) 642- 4900.

The IEC Foreword and Introduction are not a part of the requirements of this standard but are included for information purposes only.

NATIONAL DIFFERENCES

In the CSA and UL publications of this standard, National Differences from the text of International Electrotechnical Commission (IEC) Publication 60745-2-3, Safety Requirements for Hand-Held Motor-Operated Electrical Tools – Safety – Part 2-3: Particular Requirements for Grinders, Polishers and Disk-Type Sanders, copyright 2006 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**.

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.

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

INTERNATIONAL ELECTROTECHNICAL COMMISSION

HAND-HELD MOTOR-OPERATED ELECTRIC TOOLS – SAFETY – Part 2-3: Particular requirements for grinders, polishers and disk-type sanders

FOREWORD

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

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This consolidated version of IEC 60745-2-3 consists of the second edition (2006) [documents 61F/624/FDIS and 61F/634/RVD], its amendment 1 (2010) [documents 116/53/FDIS and 116/56/RVD], its corrigendum of February 2011, and its amendment 2 (2012) [documents 116/89/FDIS and 116/95/RVD]. It bears the edition number 2.2.

The technical content is therefore identical to the base edition and its amendments and has been prepared for user convenience. A vertical line in the margin shows where the base publication has been modified by amendments 1 and 2. Additions and deletions are displayed in red, with deletions being struck through.

International Standard IEC 60745-2-3 has been prepared by subcommittee 61F: Safety of hand-held motor-operated electric tools, of IEC technical committee 61: Safety of household and similar electrical appliances.

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

This part 2 is to be used in conjunction with the latest edition of IEC 60745-1, *Hand-held motor-operated electric tools – Safety – Part 1: General requirements*, and its amendments. It was established on the basis of the third edition (2001) of that standard.

NOTE 1 When ″Part 1″ is mentioned in this standard, it refers to IEC 60745-1.

This part 2 supplements or modifies the corresponding clauses of IEC 60745-1, so as to convert that publication into the IEC standard: Safety for grinders, polishers and disk-type sanders.

When a particular subclause of Part 1 is not mentioned in this part 2, that subclause applies as far as is reasonable. When this standard states ″addition″, ″modification″ or ″replacement″, the relevant text in Part 1 is to be adapted accordingly.

NOTE 2 The following numbering system is used:

– subclauses, tables and figures that are numbered starting from 101 are additional to those in Part 1;

– additional annexes are lettered AA, BB, etc.

NOTE 3 In this standard, the following print types are used:

– requirements: in roman type

– *test specification: in italic type*

– Notes: in smaller roman type

Words in bold in the text are defined in Clause 3. When a definition concerns an adjective, the adjective and the associated noun are also in bold.

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

Part 1: General requirements

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

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

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

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

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

Part 2-6: Particular requirements for hammers

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

Part 2-8: Particular requirements for shears and nibblers

Part 2-9:Particular requirements for tappers

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

Part 2-12: Particular requirements for concrete vibrators

Part 2-13: Particular requirements for chain saws

Part 2-14: Particular requirements for planers

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

Part 2-16: Particular requirements for tackers

Part 2-17: Particular requirements for routers and trimmers

Part 2-18: Particular requirements for strapping tools

Part 2-19: Particular requirements for jointers

Part 2-20: Particular requirements for band saws

Part 2-21: Particular requirements for drain cleaners

The amendment modifies the present part 2-3 to ensure its conformity with the fourth edition (2006) of IEC 60745-1, *Hand-held motor-operated electric tools – Safety – Part 1: General requirements*.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

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

101DV DE *Modification: Add the following to Note 2 of the IEC Foreword of the Part 2:*

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 *Modification: Replace the paragraph after Note 3 of the IEC Foreword of the Part 2 with the following:*

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

In the CSA Group publication of this Standard, Clause 102DV is not applicable.

HAND-HELD MOTOR-OPERATED ELECTRIC TOOLS – SAFETY – PART 2-3: PARTICULAR REQUIREMENTS FOR GRINDERS, POLISHERS AND DISK-TYPE SANDERS

1 Scope

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

1.1 Addition:

This standard applies to grinders, POLISHERS and DISK-TYPE SANDERS, including ANGLE, STRAIGHT AND VERTICAL tools, with a RATED CAPACITY not exceeding 230 mm. For GRINDERS, the RATED 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 which are covered by IEC 60745-2-22.

This standard does not apply to random-orbit POLISHERS and random-orbit sanders which are covered by IEC 60745-2-4.

This standard does not apply to die GRINDERS utilizing collets or chucks for mounting threaded cones and mandrel mounted wheels which are covered by IEC 60745-2-23.

2 Normative references

This clause of Part 1 is applicable except as follows:

Addition:

ISO 603-12:1999
Bonded abrasive products – Dimensions – Part 12: Grinding wheels for deburring and fettling on a straight grinder

ISO 603-14:1999
Bonded abrasive products – Dimensions – Part 14: Grinding wheels for deburring and fettling/snagging on an angle grinder

ISO 603-16:1999
Bonded abrasive products – Dimensions – Part 16: Grinding wheels for cutting-off on hand held power tools

ANSI B74.2:2003,
Specifications for Shapes and Sizes of Grinding Wheels, and for Shapes, Sizes and Identification of Mounted Wheels

3 Terms and Definitions

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

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

3.102 DISK-TYPE SANDER: tool, constructed like a GRINDER, intended for sanding

3.102.1 ANGLE DISK-TYPE SANDER: tool with the rotating spindle at a right angle to the motor shaft, intended for lateral sanding

3.102.2 STRAIGHT DISK-TYPE SANDER: tool with the rotating spindle in-line with the motor shaft, intended for peripheral or lateral sanding

3.102.3 VERTICAL DISK-TYPE SANDER: tool with the rotating spindle in-line with the motor shaft, intended for lateral sanding

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

3.103.1 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

3.103.2 RECESSED FLANGE: FLANGE fixed to the machine spindle having a recessed flat surface

3.103.3 FLANGE OUTSIDE DIAMETER: outside diameter of the contact surface of a FLANGE

3.103.4 BACKING FLANGE: contacts and provides support to the back side of the wheel and is located on the spindle between wheel and tool

3.103.5 LOCKING FLANGE: supports the front side of the wheel and secures and clamps the wheel to the spindle and the BACKING FLANGE

3.103.6DV D2 ***Addition: Add the following definition to Clause 3 of the Part 2:***

ADAPTOR BACKING FLANGE: backing flange which contacts and supports in the hub area and extends past the raised portion to reduce the flexing of the wheel periphery

3.104 GRINDER: tool driving a rotating spindle on which a bonded abrasive product is mounted

3.104.1 ANGLE GRINDER: tool with the rotating spindle at a right angle to the motor shaft, intended for peripheral and lateral grinding

3.104.2 STRAIGHT GRINDER: tool with the rotating spindle in-line with the motor shaft, equipped with an abrasive wheel intended for peripheral grinding but not equipped with a collet or chuck

3.104.3 VERTICAL GRINDER: tool with the rotating spindle in-line with the motor shaft, intended for peripheral and lateral grinding

3.105 THREADED WHEELS: organic or inorganic bonded abrasives of various types provided with a threaded insert for direct mounting to the GRINDER spindle

3.106 POLISHER: tool equipped with a rotating disk or pad intended for polishing

3.106.1 ANGLE POLISHER: tool with the rotating spindle at a right angle to the motor shaft, intended for peripheral and lateral polishing

3.106.2 STRAIGHT POLISHER: tool with the rotating spindle in-line with the motor shaft, intended for peripheral polishing

3.106.3 VERTICAL POLISHER: tool with the rotating spindle in-line with the motor shaft, intended for lateral polishing

3.107 RATED CAPACITY: maximum diameter of the rotating accessory to be fitted on the tool as recommended by the manufacturer's instruction

3.108 RATED SPEED: maximum attainable speed as designated by the manufacturer, with any recommended accessory installed, at rated voltage or at the upper limit of the rated voltage range

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

3.110 WHEEL TYPES: wheels for different applications in accordance with ISO 603-12, ISO 603-14, ISO 603-16 or ANSI B74.2

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

4 General requirements

This clause of Part 1 is applicable.

5 General conditions for the tests

This clause of Part 1 is applicable.

6 Void

7 Classification

This clause of Part 1 is applicable.

8 Marking and instructions

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

8.1 Addition:

Tools shall also be marked with:

– RATED SPEED in revolutions per minute;

– RATED CAPACITY in mm;

– tools provided with a threaded spindle shall be marked with the spindle thread size;

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

su0995

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

8.1DV D1 ***Modification: Add the following to Clause 8.1 of this Part 2:***

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

All GRINDERS required to have a guard by Clause 19.101 shall be marked with the following warning:

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

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.

8.6 Addition:

n .....RATED SPEED

8.12.1 Addition:

For the following safety instructions specified in 8.12.1.101 to 8.12.1.107, terms such as grinding/grinder, sanding/sander, wire brushing/wire brush, polishing/POLISHER or cutting-off/cut-off tool, are selected as recommended 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 recommended only for one of the listed operations, the heading of that section is to be used for all warnings.

8.12.1.101 Safety instructions for all operations

Safety Warnings Common for Grinding, Sanding, Wire Brushing, Polishing or Abrasive Cutting-Off Operations:

NOTE In the above heading, those operations not applicable may be omitted.

a) **This power tool is intended to function as a GRINDER, sander, wire brush, POLISHER 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 List only those operations that are recommended.

b) **Operations such as grinding, sanding, wire brushing, polishing or cutting-off are not recommended 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 List only those operations that were not included in the first warning. If all listed operations are recommended, then this warning may be omitted, but all subsequent warnings are to be given without exclusion.

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

d) **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.*

e) **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.*

f) **Threaded mounting of accessories must match the GRINDER spindle thread. For accessories mounted by FLANGES, the arbour hole of the accessory must fit the locating diameter of the FLANGE.** *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.*

g) **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.*

h) **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 operations. The dust mask or respirator must be capable of filtrating particles generated by your operation. Prolonged exposure to high intensity noise may cause hearing loss.*

i) **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.*

j) **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 The above warning may be omitted if polishing or sanding are the only recommended operations.

k) **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.*

l) **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.*

m) **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.*

No Text on This Page

n) **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.*

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

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

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

8.12.1.102 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 on the power tool and position your body and arm 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 or toothed saw blade.** *Such blades create frequent kickback and loss of control.*

8.12.1.103 Additional safety instructions for grinding and cutting-off operations

NOTE If grinding and cut-off operations are not recommended by the manufacturer, this section may be omitted.

Safety Warnings Specific for Grinding and Abrasive Cutting-Off Operations:

a) **Use only WHEEL TYPES that are recommended 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 The above warning may be omitted for GRINDERS or cut-off GRINDERS with RATED CAPACITY of less than 55 mm.

d) **Wheels must be used only for recommended 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.** *Wheel intended for larger power tool is not suitable for the higher speed of a smaller tool and may burst.*

8.12.1.104 Additional safety instructions for cutting-off operations

NOTE If cutting-off operation is not recommended by the manufacturer, this section may be omitted.

Additional Safety Warnings Specific for Abrasive 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 wheel is binding or when interrupting a cut for any reason, switch off the power tool and hold the power tool 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 reenter 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.*

8.12.1.105 Additional safety instructions for Sanding Operations

NOTE If sanding operation is not recommended by the manufacturer, this section may be omitted.

Safety Warnings Specific for Sanding Operations:

a) **Do not use excessively oversized sanding disc paper. Follow manufacturers recommendations, when selecting sanding paper.** *Larger sanding paper extending beyond the sanding pad presents a laceration hazard and may cause snagging, tearing of the disc or kickback.*

8.12.106 Additional safety instructions for polishing operations

NOTE If polishing operation is not recommended by the manufacturer, this section may be 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.*

8.12.1.107 Additional safety instructions for wire brushing operations

NOTE If wire brushing operation is not recommended by the manufacturer, this section may be 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 recommended 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.*

8.12.2

a) *Addition:*

101) Types of accessories in accordance with 8.12.1.101 a)

102) Thickness and diameter of grinding wheels

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 8.12.2 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 wheels specified in accordance with 8.12.2 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) For all operations listed in accordance with 8.12.1.101 a), where the use of a guard is required, instruction for the proper type of guard to be used

105 Instruction for the mounting and securing of the guard identifying allowable adjustments to ensure maximum protection of the operator

106) Instruction on proper support for the workpiece

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

108) For DISK-TYPE SANDERS exclusively intended for sanding wooden floors, an instruction stating how to connect the external dust collection equipment where applicable

c) *Addition:*

101) Storage and handling of recommended accessories

8.101 Tools shall also be marked with an indication of direction of rotation of the spindle. This shall be indicated by an arrow, raised or sunk, or by any other means no less visible and indelible.

9 Protection against access to live parts

This clause of Part 1 is applicable.

10 Starting

This clause of Part 1 is applicable.

11 Input and current

This clause of Part 1 is applicable.

12 Heating

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

12.4 Replacement:

The tool is operated at rated input or rated current for 30 min. The temperature rises are measured at the end of the 30 min.

13 Leakage current

This clause of Part 1 is applicable.

14 Moisture resistance

This clause of Part 1 is applicable.

15 Electric strength

This clause of Part 1 is applicable.

16 Overload protection of transformers and associated circuits

This clause of Part 1 is applicable.

17 Endurance

This clause of Part 1 is applicable.

18 Abnormal operation

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

18.10.4 *Addition:*

During these tests, the speed of the spindle shall not exceed 120 % of the RATED SPEED*. The accessory in accordance with 8.12.2 a) 101) that results in the maximum speed shall be installed.*

19 Mechanical hazards

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

19.1 *Modification:*

The second sentence of the second paragraph does not apply to WHEEL GUARDS which are covered in 19.101.

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.

19.101 GRINDERS with a RATED CAPACITY exceeding 55 mm shall be provided with at least one wheel guard to protect the user during normal use against:

– accidental contact with the abrasive product;

– ejection of fragments of the abrasive product;

– sparks and other debris.

If the tool is supplied with one or more accessories, the wheel guard(s) supplied shall be appropriate for the supplied accessory(ies). The wheel guard (hereafter referred to as a guard) may be removable either with the aid of a tool or by fulfilling the following requirements:

– two separate and dissimilar actions shall be required to remove the guard, e.g. pushing a lever and turning the guard;

– for removal, the guard shall be turned to a position that does not occur in normal operation.

The guard shall also fulfil the following requirements:

– be designed so that, in case of a wheel burst, the guard reduces the risk of injury to the operator, remains attached to the GRINDER by effective and secure means and complies with the test of 20.101;

– facilitate the change of the abrasive wheel without the need to remove the guard;

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

To prevent the installation of an oversized wheel, the clearance between the inside of the guard and the periphery of a new abrasive product in accordance with 8.12.2 a) 101) shall, in at least one location, be 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.

For WHEEL TYPE 1 (grinding wheels) and WHEEL TYPES 41 and 42 (cutting-off wheels), the guard shall cover at least 175° of the abrasive wheel periphery and both sides of the wheel. The front curtain shall be designed to facilitate easy replacement of the wheel. Enclosure of the spindle end, nut and the LOCKING FLANGE is not required. See Figure 101.

For WHEEL TYPES 27, 28 and 29, the guard shall cover the abrasive wheel periphery and the BACKING FLANGE side for at least 175°. The guard periphery shall have a lip on the outer edge that curls inward for at least 3 mm from the intersect line of the top surface of the thickest wheel and largest wheel diameter, as specified in accordance with 8.12.2 a) 102), with the inner surface of the guard to the inner edge of the lip, measured radially. The face of the thickest recommended wheel shall be at least 2 mm axially from the inner surface of the lip. The ends of the lip protruding the thickest recommended wheel may be chamfered by not more than 45°. See Figure 102.

For diamond cutting-off wheels, either one of the two guards above is acceptable.

For WHEEL TYPES 6 and 11 (straight and flaring cup wheels), the guard shall cover at least 240° of the abrasive wheel periphery, see Figure 103. The guard shall be adjustable axially to compensate for the wear of the largest permitted wheel and restrict the axial exposure of the wheel to less than 3 mm.

Compliance is checked by inspection and by measurement. The guard coverage angle is measured with the vertex at the centre of the spindle and extended to the guard periphery.

19.101DV D2 *Modification: Replace the first item of paragraph 3 of Clause 19.101 of the Part 2 with the following:*

– be designed so that, in case of a wheel burst, the guard reduces the risk of injury to the operator and complies with the test of 20.101;

19.102 The tool shall be designed so as to prevent the abrasive product coming loose under normal use.

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

FLANGES are not required with the following designs:

- non-reusable plate mount or threaded nut affixed to the wheel by the manufacturer;
- threaded hole or modified cup wheels.

Compliance is checked by inspection.

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

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.

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 SPEEDS less than 15 000 min^{-1};
- 0,15 mm for RATED SPEEDS from 15 000 min^{-1} to less than 25 000 min^{-1};
- 0,10 mm for RATED SPEEDS 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.

19.104 FLANGES required by 19.102 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 and illustrated in Figure 104, 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. If the clamping surface of the LOCKING 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.

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 BACKING AND THE LOCKING FLANGE shall have the same diameter D_f or the overlap of the BACKING AND THE LOCKING FLANGE bearing surfaces shall be at least equal to dimension *C*.

In order to prevent interference, the LOCKING FLANGE and/or nut shall not extend beyond the plane defined by the lip of the guard when mounted with the thickest recommended Type 27, 28 or 29 wheel.

19.104.1 The flange dimensions for WHEEL TYPE 1 shall be:

$D_f \geq 0{,}33\ D$

The flange diameter for 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″ in UNC)
D_f = (29 ± 1) mm	for 80 mm ≤ D <105 mm for wheels with a bore diameter of 16 mm (5/8″ in UNC)
D_f = (41 ± 1) mm	for 105 mm ≤ D ≤ 230 mm

For WHEEL TYPE 41, the D_f dimension may exceed the above values for BACKING AND LOCKING FLANGES. For all other WHEEL TYPES, the diameter D_f may exceed the above values for BACKING FLANGES only.

NOTE In the United States of America, the following conditions apply:

The flange dimensions for WHEEL TYPE 1 that are thicker than 5 mm shall be:

$D_f \geq$ **0,33 D**

The flange diameter for wheels Type 1 that are 5 mm and thinner and Types 6, 11, 27, 28, 29, 41, and 42 (27A) 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 in UNC)
D_f = (29 ± 1) mm	for 80 mm ≤ D <105 mm for wheels with a bore diameter of 16 mm (5/8 in UNC)
D_f = (41 ± 1) mm	for 105 mm ≤ D ≤ 230 mm

For WHEEL TYPES 1 and 41, the D_f dimension may exceed the above values for BACKING AND LOCKING FLANGES. For all other WHEEL TYPES the diameter D_f may exceed the above values for BACKING FLANGES only.

19.104.2 The dimensions C, G and W in Figure 104 shall be:

$C \geq 3$ mm	
$W \geq 1$ mm, $G \geq 1$ mm	for $D_f < 50$ mm
$W \geq 1{,}5$ mm, $G \geq 1{,}5$ mm	for $D_f \geq 50$ mm

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

Compliance of the requirements 19.104, 19.104.1 and 19.104.2 is checked by measurement.

19.104.3DV D2 *Addition: Add Clause 19.104.3DV to the Part 2:*

An ADAPTOR BACKING FLANGE may be used in place of the backing flange to mount WHEEL TYPES 27, 28 and 29 with a diameter greater than 155 mm. The adaptor backing 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 FLANGES required by 19.102 shall be designed so that they are of adequate strength.

Compliance is checked by the following test.

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

The clamping nut shall be tightened with a first test torque according to Table 101. A feeler gauge of a thickness of 0,05 mm shall be 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 shall be further tightened to the second test torque according to Table 101. A feeler gauge of a thickness of 0,05 mm shall be 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 101 – Torques for testing FLANGES

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

19.6 *Replacement:*

The tool shall be designed so as to prevent excessive speed under normal use. The speed of the tool shall not exceed the RATED SPEED under any operating condition.

Compliance is checked by inspection and by measuring the speed after the tool is operated for a period of 5 min. The recommended accessory that produces the maximum speed shall be installed.

If the tool is provided with a load sensitive speed control, then an accessory need not be installed to load the tool to find maximum speed.

20 Mechanical strength

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

20.5 All wheel guards specified in accordance with 8.12.2 b) 104) shall have sufficient mechanical strength to prevent the wheel fragments from being ejected towards the operator in the event of the wheel breakage.

20.5DV D2 *Deletion: Delete Clause 20.5 of the Part 2:*

This clause is not applicable.

20.101 All WHEEL GUARDS specified in accordance with 8.12.2 b) 104) 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 guard to the test specified in 20.101.1 to 20.101.4. At the manufacturer's discretion, the test may be conducted with three guards but less than three separate GRINDERS. After the test, the tool shall meet the acceptance criteria of 20.101.5.

20.101.1 The guard shall be mounted and securely fixed to the GRINDER in accordance with the instructions of 8.12.2 b) 105). If the guard is adjustable, it shall be positioned as close as possible to 30° (in a range of ±10°) from the neutral or the symmetrical wheel covering position against the direction of the wheel's rotation or to its maximum setting if the adjustable range is less than 30°. See Figures 106A and 106B.

The maximum thickness grinding wheel recommended by the manufacturer with a diameter equal to the RATED CAPACITY of the GRINDER shall be mounted to the spindle in accordance with the instructions.

The GRINDER shall be operated at rated voltage and no-load for a minimum of 5 min. The speed of the wheel is measured and recorded.

20.101.1DV D2 *Modification: Delete the last two paragraphs of Clause 20.101.1 of the Part 2:*

The requirements in the last two paragraphs do not apply.

20.101.2 A wheel as specified in 20.101.1 shall be notched into four equal segments (quadrants). For wheel Types 1, 27, 28, 29, 41 and 42, the cut is directed from the outer edge radially towards the centre (see Figure 107). For wheel Types 6 and Type 11, the cut starts across the working surface towards the mounting end (see Figure 108).

The width of each notch shall not exceed 2,5 mm. The extend 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 20.101.1 or 90% of the RATED SPEED of the GRINDER, whichever is higher. The notched grinding wheel is mounted to the spindle in accordance with the instructions.

NOTE The following Table 102 provides typical pre-cut length ranges for standard wheel dimensions.

Table 102 –Typical pre-cut length ranges for standard wheel dimensions

Wheel type	Wheel dimensions (diameter × thickness × bore diameter)	Average burst speed	Pre-cut length range
	mm	min^{-1}	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

20.101.2DV D2 *Modification: Replace Clause 20.101.2 of the Part 2 with the following:*

The maximum thickness grinding wheel recommended by the manufacturer 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 and 42, the cut is directed from the outer edge radially towards the center (see Figure 107). For WHEEL TYPES 6 and Type 11, the cut starts across the working surface towards the mounting end (see Figure 108).

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 guard as would occur with the flange recommended in accordance with the instructions in 8.12.2b).

20.101.3 For GRINDERS with side handles, a mass of 1 kg shall be mounted at the midpoint of the switch handle and a mass of 0,5 kg shall be mounted at the midpoint of a side handle installed on each side of the GRINDER(see Figure 107). 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 switch handle.

NOTE 1 The above test requires a second side handle or adaptor.

For GRINDERS without side handles, a mass of 1 kg shall be attached at the midpoint of the switch handle. An adaptor with simulated side handles as means of suspension and weight attachment of 0,5 kg at each side shall be provided for the test. The adaptor shall have a mass as small as possible and be located at the midpoint of the front gripping zone for STRAIGHT GRINDERS(see Figure 109) and less than half the RATED CAPACITY distance behind the output spindle for ANGLE AND VERTICAL GRINDERS. The suspension point and weight attachment on the left and right side of the tool shall be 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 and the tool is positioned inside a test box (see Figures 110A and 110B).

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 walls, lined with 25 mm to 35 mm of modelling clay, backed by an additional 25 mm to 35 mm thick layer of cork (see Figures 110A and 110B). The function of the modelling clay and cork is to absorb and retain the wheel segments or the impression of the impacting segments. The modelling clay and cork may be replaced by other materials performing the same function. Prior to the test, the clay walls shall be free of any wheel segment impressions.

An ANGLE AND VERTICAL GRINDER with the mounted 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 110A). 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.

For STRAIGHT GRINDERS, the test box is turned on its side, thus the axis of the box is horizontal. The GRINDER is positioned with the wheel approximately in the centre of the box, with the plane of the wheel perpendicular to the clay walls of the box (see Figure 110B). To restrain the GRINDER from excessive movement during the wheel's acceleration, the switch handle is secured with a force less than 5 N to the box. After securing, the movement of the midpoint of the switch handle shall not exceed 30 mm from side to side.

NOTE 2 One possible method to achieve the force necessary is the use of permanent magnets.

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.

20.101.4 While monitoring the wheel speed with a tachometer, the voltage to the tool is gradually increased until the speed specified in 20.101.2 is achieved. If the wheel does not disintegrate, stop the GRINDER, increase the length of the pre-cuts and repeat the test above until the wheel bursts.

Dust, minor fragments and segments remaining in the guard are ignored. Most of the four major segments will be captured by the clay wall. If any of the major segments rebound from the clay, the segment's impression must be identified. Afterward, the segments of the wheel in the clay wall are removed.

NOTE Typically, the wheel will burst within 5 min.

20.101.4DV D2 *Modification: Replace Clause 20.101.4 of the Part 2 with the following:*

While monitoring the wheel speed with a tachometer, the voltage to the tool is gradually increased until the higher of the speeds established in 19.6 or 90 % of the RATED SPEED of the grinder is achieved. If the wheel does not disintegrate at this specified speed, at the manufacturer's option:

– either continue further increasing the speed; or

– stop the grinder, increase the length of the pre-cuts and repeat the test above until the wheel bursts at or above the speed specified in this clause.

20.101.5 The guard and the fasteners or the guard's mounting hardware shall remain in place. Deformation, hairline cracks or scratches and gouges to the guard and mounting hardware are acceptable.

As a result of the wheel's disintegration, the guard shall not have rotated in the direction of the wheel rotation by more than 90° (see Figures 106A and 106B). If the guard covers 360° of the wheel's periphery, the 90° limitation on the guard's rotation is not applicable.

The impression of the impact in the clay wall from the major 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 clay wall facing the unguarded wheel in the position of the GRINDER just prior to the wheel bursting (see Figure 110A).

20.101.5DV D2 *Modification: Replace Clause 20.101.5 of the Part 2 with the following:*

The wheel guard has met the requirements of 20.101 if the following results have been achieved:

a) the wheel burst speed was at or higher than required by first paragraph of 20.101.4;

b) the guard and the fasteners or the guard's mounting hardware shall remain in place. Deformation, hairline cracks or scratches and gouges to the guard and mounting hardware are acceptable;

c) the guard shall not have rotated in the direction of the wheel rotation by more than 90° (see Figures 106A) and 106B). If the guard covers 360° of the wheel's periphery, the 90° limitation on the guard's rotation is not applicable;

d) the impression of the impact in the clay wall from the major segments shall be within the fragment zone. There shall be no major fragments or impressions of fragments outside the fragment zone (the operator zone). The fragment zone is defined by extending a straight line through the midpoints of the two side handles onto the clay wall facing the unguarded wheel in the position of the grinder just prior to the wheel bursting (see Figure 110A). After the wheel's disintegration, most of the four major wheel segments will be captured by the clay wall. If any of the major segments rebound from the clay, the segment's impression must be identified. Dust, minor fragments and segments remaining in the guard are ignored.

If the wheel guard has failed any of the b) – d) requirements at the wheel burst speed that was above the speed specified by the first paragraph of 20.101.4, the test shall be repeated with the increased length of segment pre-cuts.

21 Construction

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

21.18.1 Replacement:

For ANGLE and VERTICAL GRINDERS with a RATED CAPACITY exceeding 100 mm and STRAIGHT GRINDERS with a RATED CAPACITY exceeding 55 mm, the switch shall be of momentary contact type. A lock-on device is allowed provided that two dissimilar actions are necessary to lock the switch in the "on" position. In addition, only a single motion to the switch shall be required to automatically return to the "off" position.

Compliance is checked by inspection and manual test.

21.18.2 Replacement:

For GRINDERS and disc type sanders with a RATED CAPACITY greater than 55 mm diameter, switches shall be so located or designed that inadvertent operation is unlikely to occur during lifting or carrying.

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

and

the grasping surface immediately in front of or behind the switch shall be a minimum of 70 mm;

or

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

Compliance is checked by inspection and manual test.

21.32 This subclause is not applicable for POLISHERS and DISK-TYPE SANDERS, provided these tools are not intended to be used as a GRINDER as specified in the instructions in accordance with 8.12.2.

22 Internal wiring

This clause of Part 1 is applicable.

23 Components

This clause of Part 1 is applicable.

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 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.

29 Resistance to heat, fire and tracking

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

29.3 Addition:

GRINDERS and DISK-TYPE SANDERS are considered to be subjected to severe duty conditions.

30 Resistance to rusting

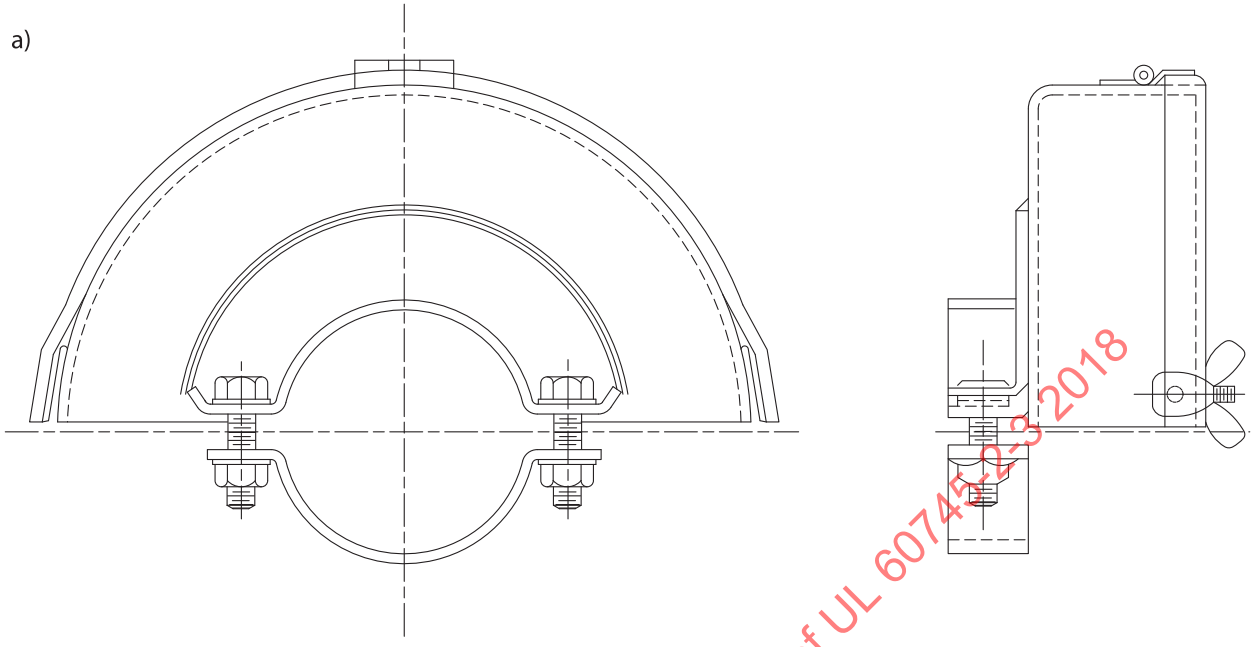
This clause of Part 1 is applicable.

31 Radiation, toxicity and similar hazards

This clause of Part 1 is applicable.

Figure 101 – Typical guard designs a) and b) for wheel Types 1, 41 and 42

a)



b)

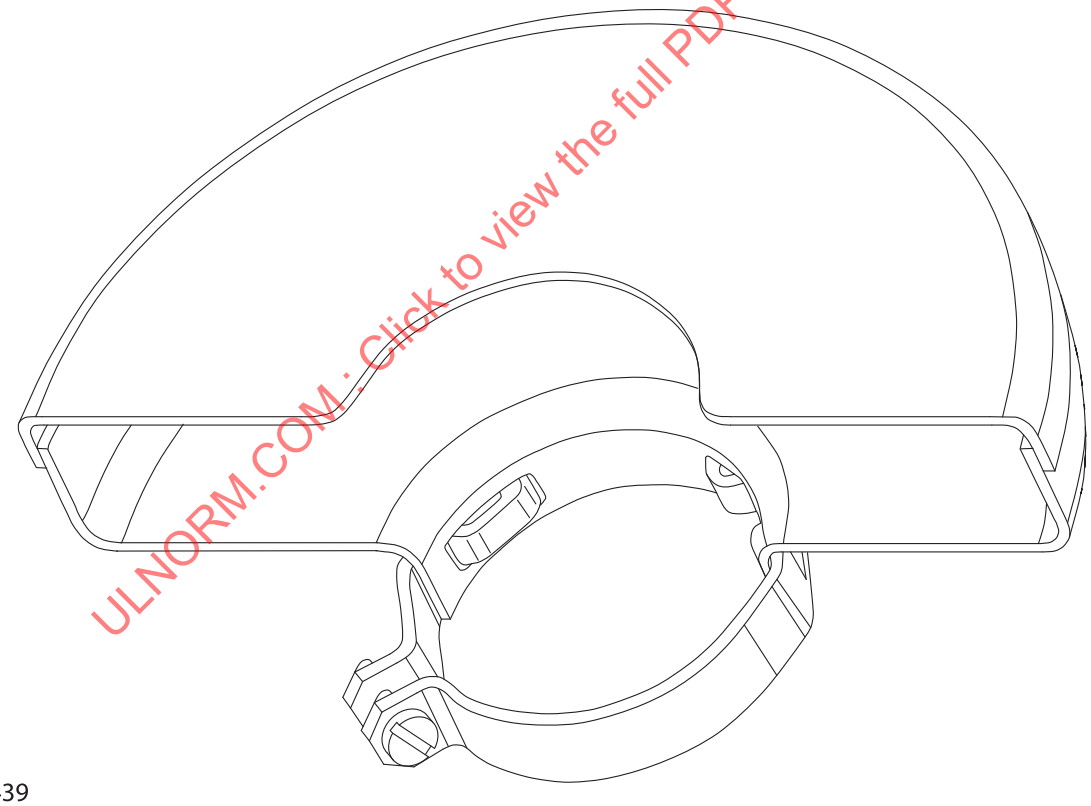


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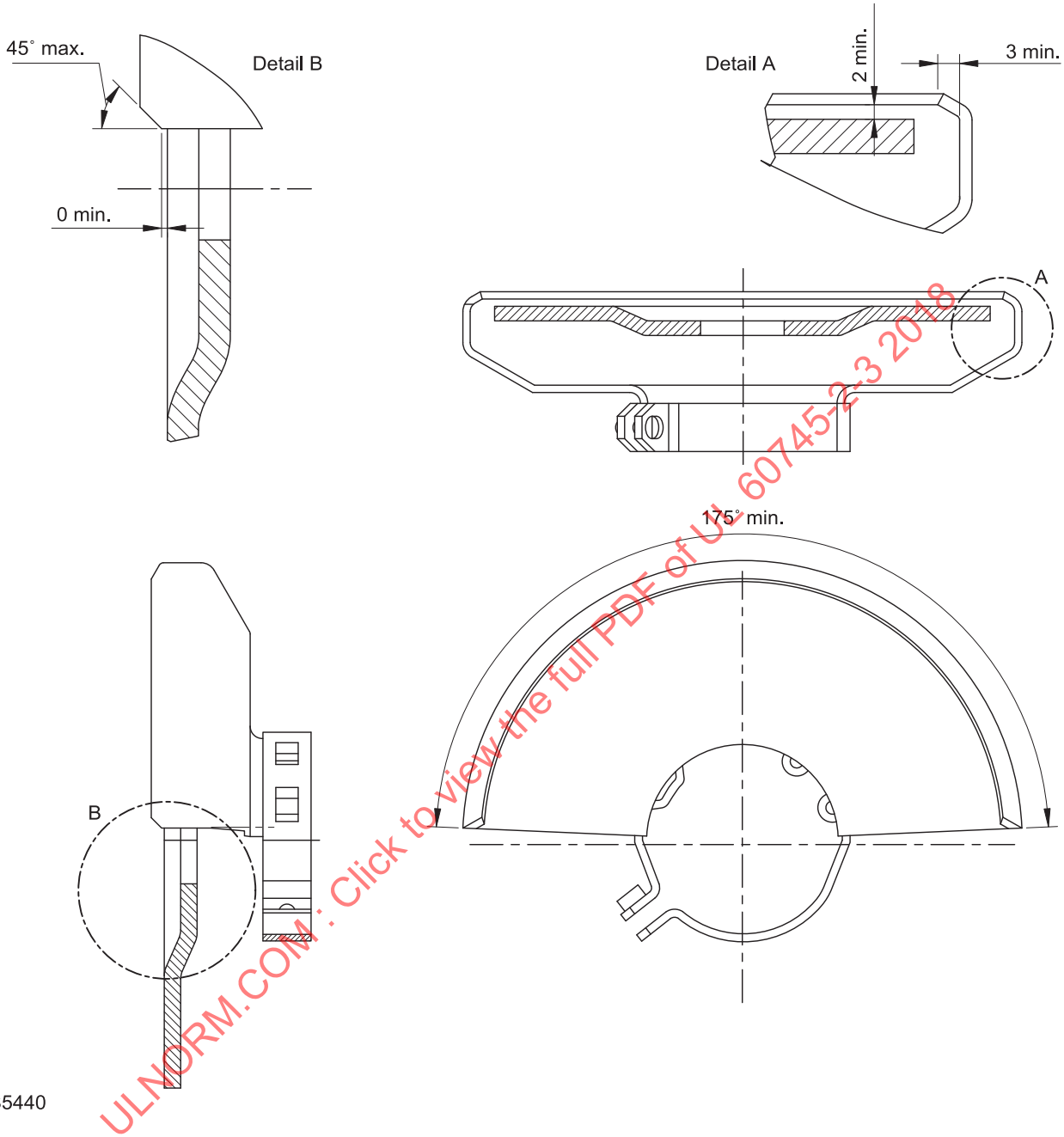
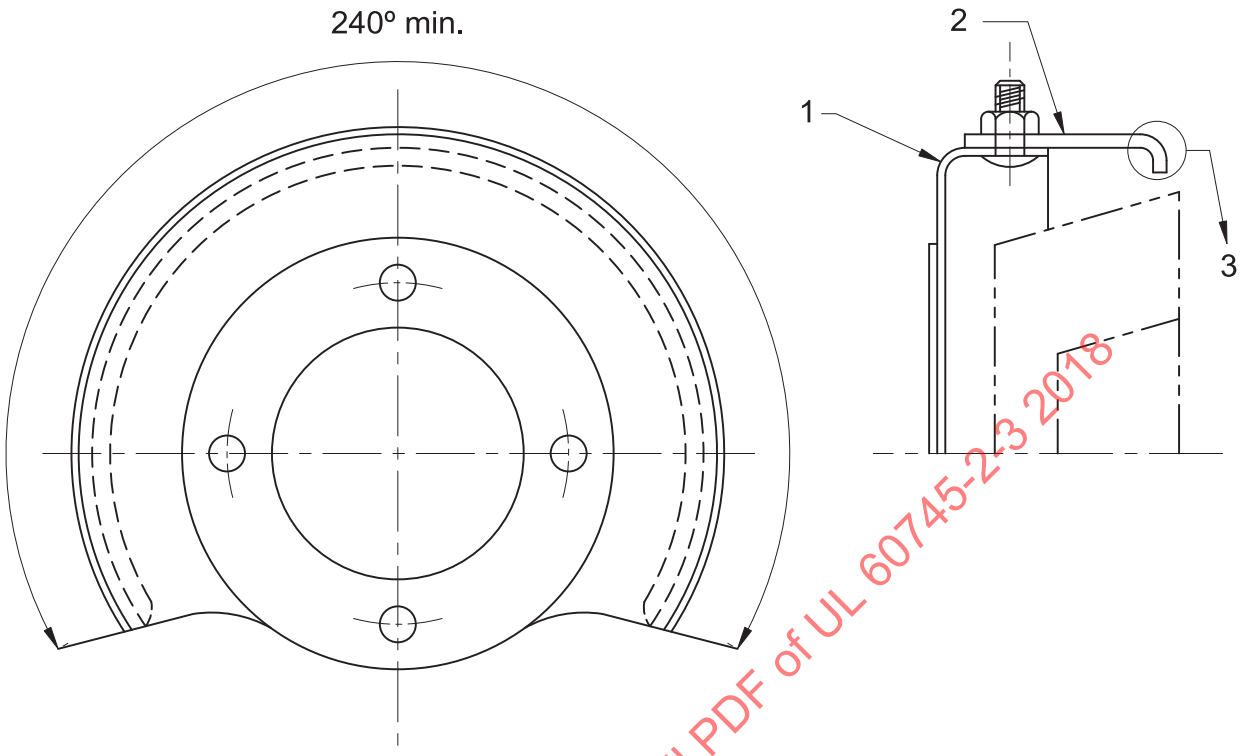
Figure 102 – Typical guard design with front lip for wheel Types 27, 28 and 29



Dimensions in millimeters

Figure 103 – Adjustable guard for cup wheel Types 6 and 11



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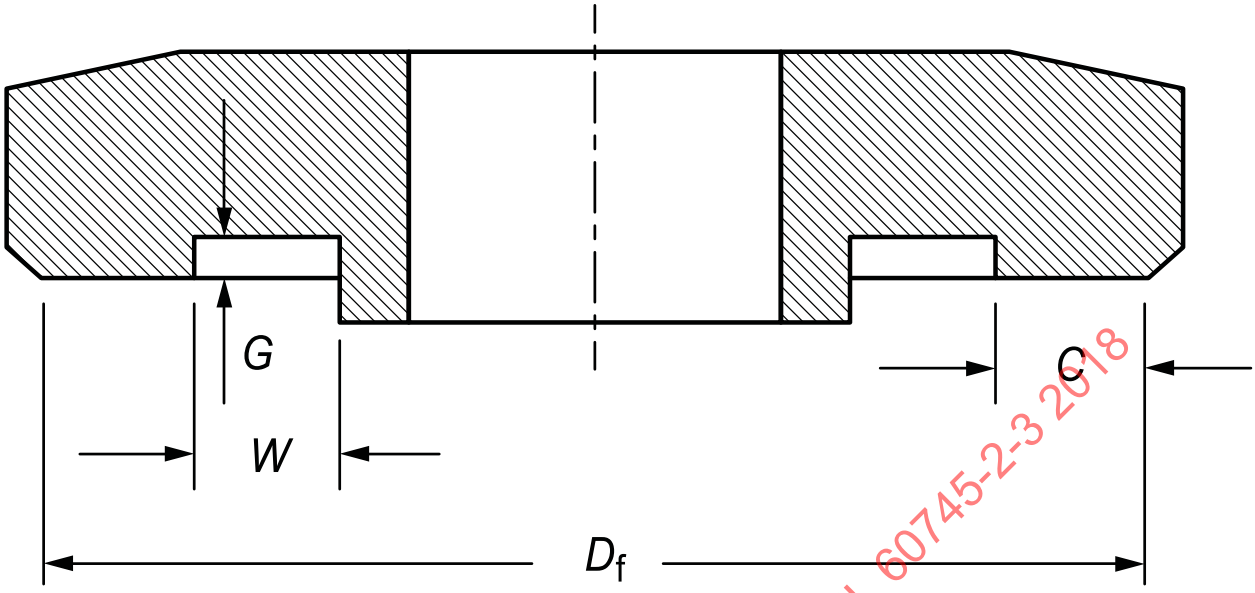
Key

1 Hood

2 Skirt (shell)

3 Lip (optional)

Figure 104 – Principal dimensions of FLANGES



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