BRITISH STANDARD

BS EN
792-7:2001

Hand-held non-electric power tools — Safety requirements —

Part 7: Grinders

The European Standard EN 792-7:2001 has the status of a British Standard

ICS 25.140.10; 25.140.99

National foreword

This British Standard is the official English language version of EN 792-7:2001.

The UK participation in its preparation was entrusted to Technical Committee MCE/8, Compressors, pneumatic tools, pneumatic machines and vacuum technology, which has the responsibility to:

— aid enquirers to understand the text;

— present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;

— monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this committee can be obtained on request to its secretary.

Cross-references

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EUROPEAN STANDARD

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English version

Hand-held non-electric power tools - Safety requirements - Part 7: Grinders

Machines portatives à moteur non électrique - Prescriptions de sécurité - Partie 7: Meuleuses

Handgehaltene nicht-elektrisch betriebene Maschinen - Sicherheitsanforderungen - Teil 7: Schleifmaschinen für Schleifkörper

This European Standard was approved by CEN on 3 November 2001.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Management Centre has the same status as the official versions.

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CONTENTS

Foreword

This European Standard has been prepared by Technical Committee CEN/TC 255 "Hand-held non-electric power tools - Safety", the secretariat of which is held by SIS.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by June 2002, and conflicting national standards shall be withdrawn at the latest by June 2002.

This European Standards supersedes EN 68:1977.

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative annex ZA, which is an integral part of this standard.

The "European Committee of Manufacturers of Compressors, Vacuum Pumps and Pneumatic Tools", PNEUROP, has given substantial contributions to this standard.

The standard has been created in close co-operation with CENELEC/TC 61F with the aim of achieving requirements for mechanical safety in the EN 50144 series, which are similar for hand-held electric and non-electric power tools.

NOTE Other technical committees in CEN dealing with hand-held power tools have been asked to follow the safety requirements as in EN 792.

The annexes to this part of the standard are:

Annex A (informative) Examples of grinders covered by this standard
Annex B (informative) Symbols for labels and signs
Annex C (informative) List of abrasive products for hand-held grinders
Annex D (normative) Design, material and thickness of guards
Annex E (informative) Example of calculating procedure of clamping force
Annex F (informative) Example of flanges
Annex ZA (informative) Relationship of this European Standard with EC Directives.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

0 Introduction

This European standard is a type C standard as stated in EN 1070.

The machinery concerned and the extent to which hazards, hazardous situations and events are covered are indicated in the scope of this standard.

When provisions of this type C standard are different from those which are stated in type A or B standards, the provisions of this type C standard take precedence over the provisions of other standards, for machines that have been designed and built according to the provisions of this type C standard.

EN 792 consists of a number of independent parts for individual types of hand-held non-electric power tools.

Other European Standards deal with safety rules for hand-held power tools used in e. g. the following fields:

- agriculture and forestry such as chain saws, hedge-trimmers, brush cutters, grass trimmers;
- construction and building such as cutting-off power tools, concrete vibrators;
- food industry, such as fowl secateurs, sheep shears.

Endeavours have been made to achieve co-ordination with the relevant Technical Committees so that the safety requirements are compatible.

This standard is divided in the following Parts:

Part 1: Assembly power tools for non-threaded mechanical fasteners (former Part 14)
Part 2: Cutting-off and crimping power tools (former Part 15)
Part 3: Drills and tappers
Part 4: Non-rotary percussive power tools
Part 5: Rotary, percussive power drills
Part 6: Assembly power tools for threaded fasteners
Part 7: Grinders
Part 8: Sanders and polishers
Part 9: Die grinders
Part 10: Compression power tools
Part 11: Nibblers and shears
Part 12: Small circular, small oscillating and reciprocating saws
Part 13: Fastener driving tools

Certain Parts of EN 792 cover hand-held non-electric power tools, driven by internal combustion engines powered by gaseous or liquid fuel. In these parts, the safety aspects relating to internal combustion engines are found in a normative annex.

The Parts are type C standards and refer to pertinent European Standards of type A and B where such standards are applicable.

1 Scope

This European Standard applies to hand-held non-electric power tools driven by rotary or linear motors, powered by compressed air or hydraulic fluid and intended to be used by one operator and supported by:

- the operator's hand or hands;
- a harness;
- a suspension, e. g. a balancer.

This European Standard applies to hand-held non-electric power tools intended for grinding and cutting-off, with bonded, coated and super abrasive products for use on all kinds of materials.

This European Standard lists the significant hazards caused by such power tools and specifies safety requirements valid for different aspects of safety during their foreseeable lifetime.

This part of the standard covers power tools used with:

- abrasive products with a peripheral operating speed less than or equal to 80 m/s;
- cutting-off wheels with a peripheral operating speed less than or equal to100 m/s;
- abrasive products with outside nominal diameter less than or equal to 230 mm;
- cutting-off wheels with outside nominal diameter less than or equal to 300 mm;
- wire brushes.

This Part of the standard does not apply to:

- die grinders with collets which are treated in EN 792-9;
- polishers and sanders which are treated in EN 792-8;
- cutting-off machines used for construction, rescue purposes which are driven by an internal combustion engine which are treated in EN 1454.

There are no grinders covered by this Part of this European Standard driven by internal combustion engines.

Typical abrasive products used together with hand-held grinders are listed in annex C.

Special requirements and modifications on a hand-held power tool for the purpose of mounting it in a fixture are not covered by this part.

NOTE At the date of publication no grinders driven by internal combustion engines are known.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text, and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of the publications referred to in this European Standard are valid only when they are incorporated in this standard by amendment or revision. For undated references the latest edition of the publication referred to, applies (including amendments).

EN 292-1:1991, *Safety of machinery - Basic concepts, general principles for design - Part 1: Basic terminology, methodology.*

EN 292-2:1991, *Safety of machinery - Basic concepts, general principles for design - Part 2: Technical principles and specifications.*

EN 563, *Safety of machinery - Temperatures of touchable surfaces - Ergonomics data to establish temperature limit values for hot surfaces.*

CR 1030-1, *Hand-arm vibrations - Guidelines for vibration hazards reduction - Part 1: Engineering methods by design of machinery.*

EN 1127-1, *Explosive atmospheres – Explosion prevention and protection – Part 1: Basic concepts and methodology.*

EN 10111, *Continuously hot-rolled low carbon sheet and strip for cold bending - Technical delivery conditions.*

EN 10130, *Cold rolled low carbon steel flat products for cold forming - Technical delivery conditions.*

EN 12096, *Mechanical vibration - Declaration and verification of vibration emission values.*

EN 28662-1, *Hand-held portable power tools - Measurement of vibration at the handle -Part 1: General (ISO 8662–1:1998).*

EN ISO 4871, *Acoustics - Declaration and verification of noise emission values of machinery and equipment.*

EN ISO 8662-4, *Hand-held portable power tools - Measurement of vibration at the handle -Part 4: Grinders*.

EN ISO 11688-1, *Acoustics - Recommended practice for the design of low-noise machinery and equipment - Part 1: Planning (ISO/TR 11688-1:1995).*

EN ISO 11688-2, *Acoustics - Recommended practice for the design of low-noise machinery and equipment - Part 2: Introduction to the physics of low-noise design (ISO/TR 11688-2:1998).*

EN ISO 14163, *Acoustics - Guidelines for noise control by silencers (ISO 14163:1998).*

prEN ISO 15744, *Hand-held non-electric powertools – Noise measurement code – Engineering method (grade 2) (ISO/DIS 15744:1999).*

ISO 525, *Bonded abrasive products - General requirements.*

3 Terms and definitions

For the purposes of this European Standard, the following terms and definitions apply.

3.1 General terms and definitions

3.1.1
hand-held power tool
machine driven by rotary or linear motors powered by compressed air, hydraulic fluid, gaseous or liquid fuel, electricity or stored energy (e.g. by a spring) to do mechanical work and so designed that the motor and the mechanism form an assembly that can easily be brought to its place of operation. The hand-held power tool is operated by one or two hands

NOTE Hand-held power tools driven by compressed air or gas are called pneumatic tools. Hand-held power tools driven by hydraulic liquid are called hydraulic tools.

3.1.2
rotary power tool
hand-held power tool the machine spindle of which rotates

3.1.3
inserted tool
tool inserted in the hand-held power tool to perform the intended work

3.1.4
service tool
tool intended for performing maintenance or service on the hand-held power tool

3.1.5
control device
device to start and stop the hand-held power tool or to change the direction of the rotation or to control the functional characteristics such as speed and power

3.1.6
maximum operating pressure
maximum pressure that a hand-held power tool may be operated at, as specified by the manufacturer

3.2 Terms and definitions related to grinders

3.2.1
grinder
power tool driving a rotating spindle on which an abrasive product is mounted

NOTE A grinder equipped with a cutting off wheel is often called a cutting off machine.

3.2.2
machine spindle
shaft of the grinder which supports, locates and drives the abrasive product

3.2.3
rated speed, r/min
maximum rotational speed of the machine spindle, in revolutions per minute under operating conditions with the abrasive product mounted and at the upper limit of the energy supply, e.g. pressure or flow, as specified by the manufacturer

3.2.4
maximum operating speed
maximum peripheral speed of an abrasive product, given in m/s, as specified by the manufacturer of the abrasive product

3.2.5
flange
disc, normally of metal, mounted on the machine spindle to support and clamp the abrasive product

3.2.6
flange set
means provided to clamp an unthreaded abrasive product, on the rotating machine spindle

3.2.7
backing flange
flange fixed to the machine spindle and having an unrecessed flat surface against which an abrasive product is screwed, e.g. a cup wheel, a cone or a plug

NOTE The terms backing, back flange or fixed flange are terms also used.

3.2.8
flange contact diameter, d_f
outside diameter of the contact surface of a flange

3.2.9
guard
device which partly encloses the abrasive product

3.2.10
blotter
thin piece of a compressible material placed between the abrasive product and the flange of the grinder

3.2.11
tightening torque
torque for tightening the clamping device to fasten the abrasive product to the machine spindle

For other terms, see EN 1070 and also ISO 3857-3 and ISO 5391. For examples of grinders see annex A.

4 List of significant hazards

The following significant hazards can occur in the use of grinders.

Table 1 - List of significant hazards

Significant hazard type	Reference to safety requirement	
	By design or guarding	Information for use
4.1 Mechanical hazards		
- cutting	5.1.1, 5.1.3	
- drawing in or trapping (caused by hair, clothing etc. getting entangled in a rotating power tool)	5.1.6	6.2.2
- friction or abrasion hazard	5.1.1	
- loss of stability	5.1.2	
- whipping hose		6.2.2
- ejection from high pressure hydraulic systems	5.1.4	
- ejection of parts due to:		
. cracked abrasive product	5.1.6	6.2.2
. incorrect mounting of the abrasive product	5.1.7, 5.1.8	
. misuse of grinder		6.2.2
. overspeed of grinder	5.1.5	
. use of incorrect flanges	5.1.9	
. use of wrong abrasive product		6.2.2
- hose and hose coupling specifications		6.2.2
4.2 Electrical hazards		6.2.2
4.3 Thermal hazards	5.2	
- explosions		6.2.2
- health damage due to hot or cold surfaces	5.2	
4.4 Hazards caused by noise	5.3	6.2.2
4.5 Hazards generated by vibration	5.4	6.2.2
4.6 Hazards generated by materials and substances processed, used or exhausted		
- inhalation of harmful dust	5.5.2	
- formation of explosive dust		6.2.2
- sparks		6.2.2
- exhaust air	5.5.1	6.2.2
- lubricants	5.5.3	
- hydraulic fluid		6.2.2
4.7 Hazards caused by neglecting ergonomic principles		
- repetitive strain injuries	5.6.1	6.2.2
- unsuitable postures	5.6.1, 5.6.2, 5.6.3,	
- inadequate grip design and tool balance	5.6.1	6.2.2
- neglected use of personal protection equipment	5.6.1	6.2.2
4.8 Hazards caused by failure of energy supply		
- unexpected return of energy supply after a breakdown		6.2.2
- incorrect hydraulic fluid flow and outlet pressure		6.2.2
4.9 Hazards caused by missing and/or incorrectly positioned safety related means		
- start and stop device	5.7.1	
- unintentional start	5.7.2	6.2.2

5 Safety requirements and measures

5.1 Mechanical safety

5.1.1 Surfaces, edges and corners

Accessible parts of the power tool, except the insert tool, shall not have sharp edges or angles or rough or abrasive surfaces, see 3.1 of EN 292-2:1991.

5.1.2 Supporting surface and stability

The power tool shall be so designed that it can be laid aside and remain in stable position on a plane surface.

5.1.3 Run-down time

The run-down time, after the stop command has been given, shall be as short as possible.

5.1.4 High pressure ejection

Hydraulic systems of the power tool shall be enclosed so as to give protection against high pressure fluid ejection.

5.1.5 Speed control

The rated speed of the grinder shall not be exceeded under the conditions marked on the power tool. It shall be possible to measure rotational speed by a tachometer.

At no load, the speed may exceed the rated speed by no more than 10 % at rated input values and with an unworn wheel mounted.

The speed control device of a grinder shall be designed to prevent incorrect assembly. The speed control device shall be manufactured of non-corrodable material.

5.1.6 Guards

Grinders shall be equipped with guards to protect against:

- accidental contact with the abrasive product;
- ejection of fragments of the abrasive product;
- sparks and debris.

Guards are not mandatory, but recommended, for cones and plugs with the diameter less than 50 mm and for wire brushes

For internal grinding guards are not needed.

The guards shall fulfil the following requirements:

- be designed so that in case of an abrasive product burst the guard shall reduce the risk of injury to the operator and remain attached to the grinder

- be located so that the risk of accidental contact between the operator and the abrasive product during intended use is minimized

- the clearance between the inside of the guard and the periphery of a new abrasive product shall be:

max. 8 mm and min. 3 mm for nominal diameter ≤ 125 mm
max. 10 mm and min. 6 mm for nominal diameter > 125 mm

The design, material and thickness of guards is specified in annex D.

If the specification of design, material and thickness in annex D is not followed, the guard shall withstand the test as specified in 7.4.

If other material than steel plate is used, it shall be equally suitable for all working conditions.

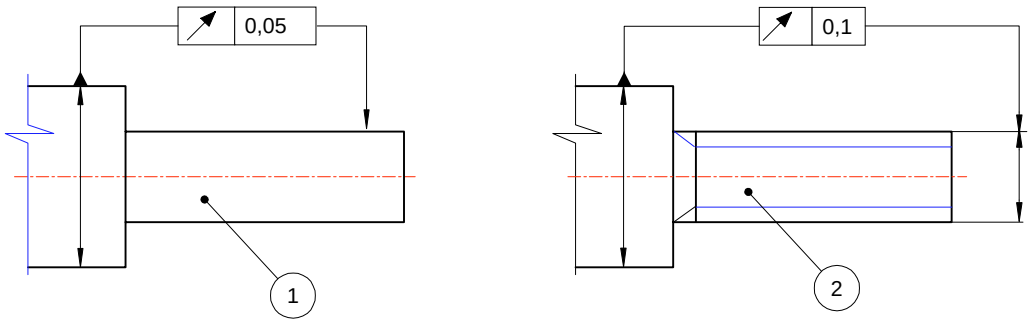
5.1.7 Attachment of abrasive product

The grinder shall be designed to prevent the abrasive product coming loose, for instance unscrewed by inertia and spinned off, after the stop comment has been given.

5.1.8 Spindles

Spindles shall be designed so that they locate the abrasive product. Machine spindles shall be made resistant to impact.

The direction of the spindle threads shall be such that any clamping device, collet or wheel with threaded hole shall tend to tighten during grinding.



Key
1 Machine spindle
2 Machine spindle with threads

Figure 1 - Maximum spindle run-out

For spindles, that locates a plain bore wheel, the diameter shall have the tolerance of concentricity of 0,05 mm maximum total indicator reading to the true running centre of the spindle. See Figure 1.

For spindles with a threaded portion intended for locating abrasive products with threaded bores, the pitch diameter of the thread shall have the tolerance of concentricity of effective diameter of 0,1 mm maximum total indicator reading to the true axis of the spindle.

The diameter of the part, which locates the abrasive product shall have a tolerance of e8 or better.

For grinders intended to be used with threaded hole wheels, the manufacturer shall give information of the spindle thread size on the grinder, preferably on the spindle.

5.1.9 Flanges

Flanges shall be designed that they clamp and locate each type of abrasive product securely to the grinder and provide true running under operation.

Flanges shall be tested for deformation under load according to 7.3.

Annex E can serve as a base for the calculation of flanges and the tightening torque.

Annex F gives the principle design of flanges and will at the revision be completed with calculated dimensional values.

Flanges in a set shall have the same contact diameter and shall have equal contact surface, except for abrasive products of types 27, 28 and 42 which are allowed to use a backing flange with a diameter larger than that of the clamping nut, see Figures F.7 a) and F.7 b).
For grinding wheel type 41 the flanges shall have the same external diameter and the backing flange may have a larger contact surface than the outer flange. See Figure F.7 c).

Backing flanges (normally fixed) may have a larger contact surface than the outer flange if this arrangement fulfils the requirement of absorbing the grinding forces (type S 6 and 11) See Figure F.3.

All flanges shall have a chamfer or recess around the centre hole to prevent pieces of the abrasive product from splintering due to high edge pressure arising when clamping it. See Figure 2. Backing flanges to be used with threaded bore abrasive products shall not be recessed, unless the abrasive product has a riveted anchor plate. See Figures F.4 and F.5.

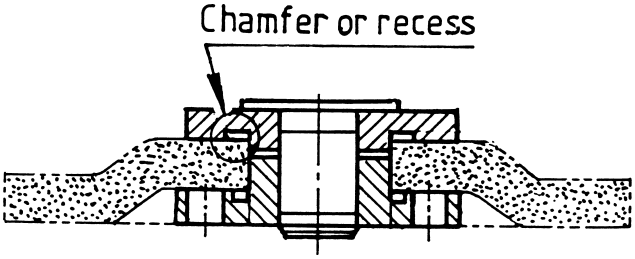


Figure 2 - Example of chamfer or recess on a flange

At least one of the flanges shall be keyed, screwed, shrunk or otherwise secured to prevent rotation relative to the machine spindle.

The contact surface of the flanges (both set of flanges and backing flanges) shall run true with a tolerance giving a total indicator reading of max. 0,1 % of the diameter at the position of the indicator. The indicator shall be positioned near the outside diameter.
The steel in the flanges shall have a minimum tensile strength of 430 N/mm^2. Other materials may be used, in which case the flange shall be tested and fulfil the requirement of clause 7.3.

The part of the flanges which locates and guides the abrasive products with unthreaded holes shall have the same tolerances as specified in 5.1.8.

5.2 Thermal safety

Parts of the grinder which are held during use or can be inadvertently touched shall follow the provisions of EN 563.

Low temperatures shall be avoided by design.

NOTE The limit values for low temperatures are studied by CEN/TC 122.

Power tools for use in potentially explosive atmospheres should comply with EN 1127-1. However because the suitability of a power tool for use in potentially explosive atmospheres will depend not only on the power tool but the inserted tool and the workpiece, it is not possible to give any detailed advice in this standard.

5.3 Noise

5.3.1 General

The emission of noise from a hand-held power tool shall be kept as low as possible.

The noise emission from using hand-held power tools emanates from three main sources:

- the hand-held power tool itself:
- the inserted tool:
- the workpiece.

NOTE Generally, the manufacturer has no possibility of influencing the noise emitted by the processed workpiece.

5.3.2 Noise emitted by the hand-held power tool

The noise emitted by the hand-held power tool itself can be divided into:

- noise from the motor:
- noise from exhaust air at pneumatic tools:
- vibration induced noise.

The noise from the exhaust of air is one major contributor of noise from pneumatic driven hand-held power tools. A silencer, conforming to EN ISO 14163, of good design will reduce this noise.

The principles contained in EN ISO 11688-1 and EN ISO 11688-2 should be followed to reduce the noise emitted by the power tool.

NOTE The exhaust air can also be piped away in a hose away from the operator, however this method has limitations in practice.

To control the radiation of structure borne noise, vibration isolation and additional damping close to the source can be applied.
To control the air borne noise emission caused by the radiation of structure borne noise, vibration isolation and additional damping close to the source can be applied.
The criterion for assessing the efficiency of noise reduction measures are the actual noise emission values from the machine in relation to other machines of the same family and not the nature of the reduction measures themselves.

5.4 Vibration

Vibration at the handle of a hand-held power tool shall be kept as low as possible.
The principles contained in CR 1030-1 should be followed to reduce the vibration emitted by the power tool.

5.5 Materials and substances processed, used or exhausted

5.5.1 Exhaust air

For grinders driven with compressed air the exhaust air shall be directed in such a way that it cannot cause a hazard to the operator and so that any secondary effects are minimized, e.g. blowing the dust and reflected air or gas from the workpiece onto the operator.

5.5.2 Dust

It shall be possible to connect to grinders a dust collecting device or to use a dust suppression device.

NOTE Because the risks arising from dust will depend on the materials being processed it is not possible to give technical requirements for collection and disposal of the dust in this standard.

5.5.3 Lubricants

Lubricants for grinders, specified by the manufacturer, shall not cause hazards to the operator or the environment.

5.6 Ergonomics

5.6.1 Design of the handle

Handles and other parts used for gripping the grinder shall be designed to ensure that the operator is able to grip the grinder correctly and to perform the expected work. Handles shall suit the functional anatomy of the hand and the dimensions of the hands of the operator population. See 3.6 of EN 292-2:1991 and EN 614-1.
Angle and vertical grinders shall have provision for mounting a second handle, when the power out put is over 0,5 kW.

Power tools having a mass greater than 2 kg (including the inserted tool) shall be capable of being supported by two hands whilst being lifted or operated.

The strength of a removable handle and the nature of fixing it shall be appropriate to the intended principal use.

5.6.2 Control device

The control device shall be adapted to the handle so that it can be held in the run position.

For grinders, which are intended to be started frequently or are intended to be used for precision work, the trigger force shall be small.

For grinders which are normally used in operations of long duration the force to keep the start device in the run position shall be small.

For further information on trigger forces for control devices, see EN 894-3.

5.6.3 Suspension device

Provision shall be made, where appropriate, to enable the attachment to the grinder of a suspension device. The fitting of a suspension device shall not introduce an additional hazard.

5.7 Safety related measures and means

5.7.1 Start and stop device

Grinders shall be equipped with a single control device to start or stop them. It shall be arranged near the handle so that the operator can activate it without releasing the grip on the handles.

The start and stop device shall be so designed that the inserted tool ceases to be powered when the start and stop device is released. Without manual effort it shall, when released, move to the stop position, i.e. be of the type "hold to run".

The start and stop device shall be in the stop position or immediately move to the stop position when the grinder is connected to the energy supply.

It shall not be possible to lock the start and stop device in the running position.

5.7.2 Unintentional start

The start and stop device shall be so designed, positioned or guarded that the risk of unintentional start is avoided.

Two separate and dissimilar actions to start the grinder are required for:

- angle grinders intended for wheels with a nominal diameter exceeding 125 mm;

- straight grinders intended for wheels with a nominal diameter exceeding; 100 mm;

- vertical grinders intended for wheels with a nominal diameter exceeding 100 mm.

Verification shall be made according to 7.5.

6 Information for use

6.1 Marking, signs and written warnings

Grinders shall be marked with the following information:

- name and address of the manufacturer;
- designation of series or type;
- serial number or batch number;
- year of manufacture;
- the rated rotational speed of the spindle, in revolutions per minute (r/min);
- maximum operating pressure for pneumatic tools or maximum pressure and flow; for hydraulic tools;
- the spindle thread size. (Marking can preferably be made on the spindle itself. This concerns grinders intended for use with threaded hole wheels).

The direction of rotation shall be permanently marked by an arrow.

Grinders shall be permanently marked with a graphical symbol, stating that the operator's instruction shall be read before work starts, according to annex B.

Other graphical symbols that can be used are shown in annex B.

6.2 Instruction for use

6.2.1 General

The instructions for use shall be drawn up by the manufacturer and contain:

- operator's instruction;
- maintenance instructions.

The operator's instructions shall be drawn up according to 5.5.2, A.1.7.4 and A.2.2 of EN 292-2:1991. Concerning residual risks see 5.5 of EN 292-1:1991.

6.2.2 Operator's instruction

a) General precautions

The operator's instruction shall include a description of the correct use of the grinder and make reference to the appropriate inserted tools.

The operator's instruction shall state that any other use is forbidden.

Foreseeable misuse of the grinder, which experience has shown to occur, shall be warned against.

The operator's instruction shall give the declared noise emission values of the machine and give reference to the noise test code and to the basic noise emission standards on which the determination of these values are based (see 7.1).

The operator's instruction shall give information on vibrations in the handles.

The reference numbers of the applied standard for vibration measurements shall be given.

The operator's instruction shall recommend the use of ear protectors and eye protection.

The operator's instruction shall give the following general information:

- list of all accessories to be used with the grinder;
- safe storage of the grinder;
- the running on of the abrasive product after the start and stop device has been released.

The stopping time, if longer than 5 s, shall be stated, and it shall be recommended to put the grinder in a stable position

- that only lubricants recommended by the manufacturer shall be used;
- that only hydraulic fluids according to the manufacturer's specification shall be used.

NOTE It is recommended to check with the manufacturer if non-flammable hydraulic fluids can be used.

Information shall be given for hydraulic grinders on:

- the design and dimensions of couplings;
- specification of hoses with regard to pressure and flow;
- maximum flow;
- maximum inlet pressure;
- maximum inlet temperature of the inlet fluid;

b) Potential hazards

Warning shall be given:

- against cutting and severing;
- against drawing in or trapping of long hair, loose clothing;
- against eye injuries;
- against the risk of a whipping compressed air hose.

c) Abrasive product

Information shall be given to:

- ensure safe clamping of the abrasive product to the power tool;

- check that maximum operating speed of the abrasive product converted to revolutions per minute is equal to or greater than the rated speed of the spindle;

- ensure that the abrasive product dimensions are compatible with the grinder and that the abrasive product fits the spindle;

- ensure that the thread type and size of the abrasive product exactly matches the thread type and size of the spindle;

- store and handle the abrasive product with care in accordance with manufacturer's instructions;

-inspect the abrasive product before use, warn against the use of chipped, cracked or otherwise defective products;

- use blotters when they are provided with the bonded abrasive product;

- ensure that the abrasive product is correctly mounted and tightened before use and to run the power tool at no-load speed for 30 s in a safe position, to stop immediately if considerable vibration or other defects are detected and to determine the cause of these defects;

- prevent the spindle end from touching the bottom of the hole of cups, cones or plugs with threaded holes, intended to be mounted on machine spindles, by giving dimensions and other relevant data for them;

- not use separate reducing bushings or adapters for abrasive products with too large holes, if they are not supplied by the manufacturers of abrasive products and when bushings are used make sure that the flange is properly clamped.

d) Guards

Information shall be given to:

- ensure that the guard is in place, is in good condition and is correctly mounted and that it shall be regularly inspected.

NOTE Internal grinding may not require a guard, providing the work piece encloses the abrasive product.

e) Correct function of grinder

Information shall be given to:

- check regularly that the speed of the grinder is not higher than that marked on it. These speed checks shall be carried out without the abrasive product mounted and in accordance with the instructions given by the manufacturer;

- check that all connections, such as for hoses are in good condition and are properly installed;

- check that the flanges as specified by the manufacturer are used and are in good condition e.g. free from cracks and burrs and are plane;

- check that the spindle and spindle threads are not damaged or worn.

f) Correct working with the grinder

Information shall be given:

- that grinders shall not be used in potentially explosive atmospheres;

- to check that the work piece is properly supported or fixed;

- that when cutting-off, the workpiece shall be so supported that the slot is kept at constant or increasing width during the whole operation;

- if the abrasive product get jammed in a cut slot, shut off the grinder and ease the wheel free. Check that the wheel is still correctly secured and not damaged before continuing the operation;

- that a cutting-off wheel shall not be used for side grinding;

- to ensure that sparks and debrises resulting from use do not create a hazard;

- to warn against that working in certain materials creates emission of dust and fumes. Reduction of risk to operator´s health is achieved e.g. by dust collectors and personal protective devices. See also EN 626.

- that working in certain materials creates emission of dust and fumes, causing a potentially explosive environment;

- that the operator shall pay attention that no bystanders are in the vicinity;

- that personal protective equipment such as gloves, apron and helmet shall be used;

- to examine the abrasive product thoroughly before re-use, if the power tool, fitted with an abrasive product, has been dropped;

- to disconnect the grinder from the energy supply before changing abrasive product and servicing;

- to release the start and stop device in the case of an interruption of the energy supply.

6.2.3 Maintenance instruction

The maintenance instruction shall contain:

- instruction to keep the grinder safe by regular maintenance;

- information on when the regular maintenance shall be carried out; for instance after a specified time of operation, a specified number of cycles/operations, a stated number of times per year;

- instructions for disposal so as not to impose hazards to personnel and the environment;

- adequate instructions for the safe maintenance and repair of the grinder;

- a list of the service operations that the user should carry out;

- instructions for lubrication, if required;

- requirement of checking the speed after each service and maintenance without the abrasive product on the spindle;

- warning that special care has to be taken when assembling the speed governor and any other protective device;

- regular inspection of spindles, threads and clamping devices in respect of wear and tolerances for location of abrasive products.

For hydraulic grinders, the following particular instructions shall be given:

- hoses and safety valves shall be checked at a specified frequency;
- information on how the condition of the hose can be determined;
- on appropriate procedures for the dismantling of the power tool.

7 Verification

7.1 Noise

Compliance with the safety requirements and measures (5.3 and 6.2.2) shall be verified as follows: the noise emisson values such as the emission sound pressure level at the workstation and the sound power level shall be determined according to prEN ISO 15744 and declared as dual-number declaration according to EN ISO 4871.

7.2 Vibration

Compliance with 5.4 and 6.2.2 shall be verified as follows:

The vibration level at the handle of the grinder shall be measured and stated according to EN 28662-1 and EN ISO 8662-4.

The vibration value shall be declared according to EN 12096.

7.3 Test of deformation of flanges

Flanges shall be tested according to the following procedure:

- the abrasive product shall be replaced on the grinder by a steel disc having equal dimensions and shape as the abrasive product;

- the clamping nut shall be tightened with a test torque as specified in Table 1;

- 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 flange is not accepted, if the feeler gauge can be pushed underneath the flange, by more than 1 mm or by more than 1/5 of the rim of the clamping area, *r*, whichever is the smaller value. Example of *r* can be found in Annex F.

Table 1 - Torque for testing of flanges

Spindle thread size		**Test torque** Nm
Metric threads	UN-threads	
M 10	3/8" - 24 UNF	25
M 12	1/2” -13 UNC	45
M 14		65
M 16	5/8" - 11 UNC	100
M 20	3/4” - UNC	200

7.4 Test of guards

Guards, unless manufactured according to annex D, shall be tested according to the following procedure:

- the guard shall be mounted on a grinder which shall be fixed in a stable position;

- three guards shall be tested. At each test a new abrasive product shall be burst;

- the burst shall be caused by altering the abrasive product so that it will break into three approximately equally sized pieces at the test speed;

- the test speed shall be according to Table 2;

- the abrasive product used in the test shall have the same shape, mass and strength as the largest abrasive product allowed to be used on the grinder with the guard to be tested.

Table 2 - Test speeds for test of guards

Type of speed control	Test speed
Grinder without speed governor	Free speed at 7 bar
Grinder with speed governor and without overspeed shut-off device	Max attainable speed at 7 bar
Grinder with speed governor and with overspeed shut-off device	Speed, at which the shut-off device releases, at 7 bar

Acceptance criteria:

- all fragments shall be contained or deflected through an arc of 180° (small granules are not considered fragments). See Figure 3;

- the guard shall not be separated from the grinder. No fasteners or mounting hardware may enter the no-fragment zone. Deformation of the guard and/or movement in the mounting is acceptable.

If all three guards satisfy the acceptance criteria, the design is acceptable.

If one of the three guards fails, then three more guards shall be tested. If all three of the second set satisfy the criteria the guard design is acceptable.

This test is dangerous and shall be carried out in a properly designed and equipped test facility. The test shall be performed inside a fully protected enclosure which can contain all of the abrasive fragments and debris.

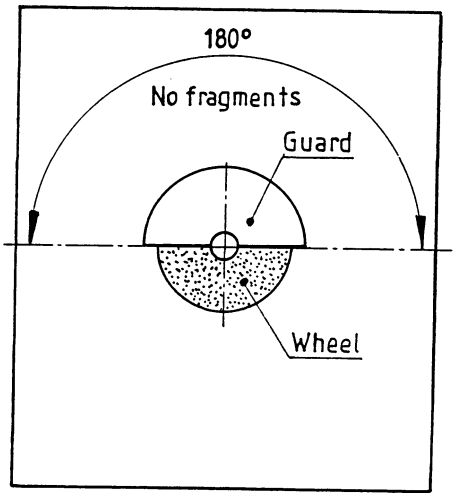


Figure 3 - Test of guards - No-fragment area

7.5 Unintentional start

Compliance with 5.7.2 shall be established by the following test:

The grinders for which two separate and dissimilar actions to start are required shall be checked by visual inspection.

The grinder shall be connected to the energy supply and be placed in any possible position and pulled over the horizontal plane by its hose.

Operation of the start and stop device shall then not occur.

7.6 Structure of verification of safety requirements

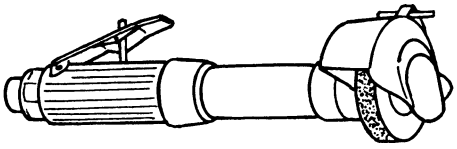
Table 3 - Structure of verification of safety requirements

Safety requirement	Visual inspection	Functional test	Measurement	Reference to clauses of this standard or to other standards
5.1.1 Surfaces, edges and angles	X			
5.1.2 Supporting surface and stability	X	X		
5.1.3 Run-down time			X	
5.1.4 High pressure ejection	X			
5.1.5 Speed control			X	
5.1.6 Guards	X			7.4
5.1.7 Attachment of abrasive product	X	X	X	
5.1.8 Spindle		X		
5.1.9 Flanges		X	X	7.3
5.2 Thermal safety			X	EN 563
5.3 Noise			X	prEN ISO 15744 7.1
5.4 Vibration			X	EN 28662-1 and EN ISO 8662-4 7.2
5.5.2 Dust	X	X		
5.6.1 Design of the handle	X			
5.6.2 Control device	X	X		
5.6.3 Suspension device	X	X		
5.7.1 Start and stop device		X		

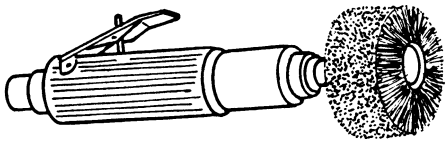
Safety requirement	Visual inspection	Functional test	Measurement	Reference to clauses of this standard or to other standards
5.7.2 Unintentional start	X	X		7.5

Annex A
(informative)

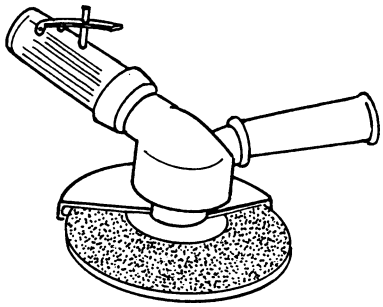
Examples of grinders covered by this standard



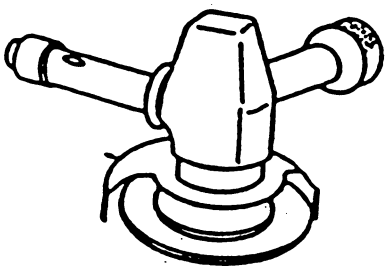
E grinders (straight)
F meuleuse droite
D Geradschleifmaschine



E wire brushes
F brosse
D Drahtbürste



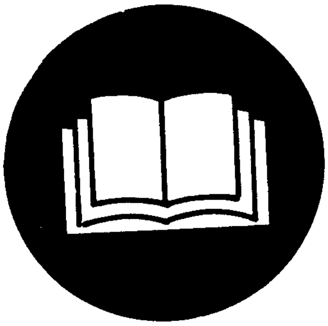
E grinder (angle)
F meuleuse d'angle
D Winkelschleifmaschine



E grinder (vertical)
F meuleuse vertical
D Vertikalschleifmaschine

Annex B
(informative)

Symbols for labels and signs

Symbol	Significance	Colours	Correspond-ing standard
B.1 	The operator's instruction shall be read before work starts	Background: blue Symbol: white	
B.2 	Hearing protection shall be worn	Background: blue Symbol: white	ISO 3864 EN 61310
B.3 	Eye protection shall be used or safety glasses worn	Background: blue Symbol: white	ISO 3864 EN 61310
B.4 	Direction of rotation	Background: optional Symbol: black	

Annex C
(informative)

List of abrasive products for hand-held grinders

Three types of abrasive products are included, bonded, coated and super, of which the latter are coated with diamonds or cubic boron nitride.

B = resinoid bond
BF= fibre-reinforced resinoid bond
M = metal bond

Table C.1 - Bonded abrasive products

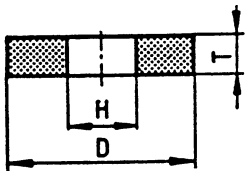
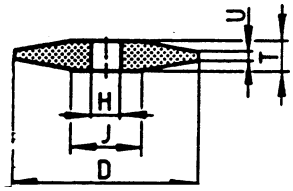
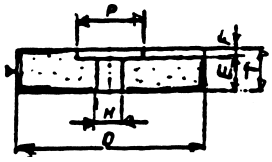
Type according to ISO 525	**Description, shape,designation**	**Type of bonding**	**Max. operating speed m/s**	**Dimension limits mm**	**Guard according to figure**	**Applicable standards**
Type 1	Straight grinding wheel 	B	≤ 50	D ≤ 200	D.2	ISO 603-12
	D x T x H	BF	≤ 80		D.3a	
Type 4	Wheel ,tapered on both sides 	B	≤ 50	D ≤ 200	D.2	ISO 603-12
	D x T x H x U	BF	≤ 80		D.3a	
Type 5	Wheel, recessed on one side 	B	≤ 50	D ≤ 200	D.2	ISO 603-12
	D x T x H x E - P x F	BF	≤ 80		D.3a	

Table C.1 (continued)

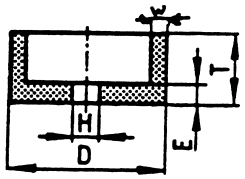
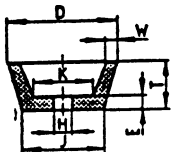
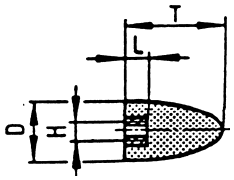
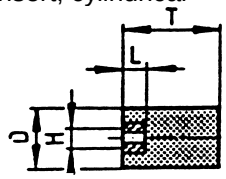
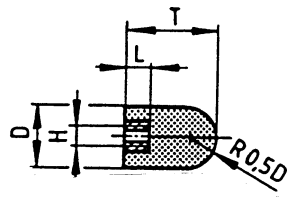
Type 6	Straight cup  	B	≤ 50	D ≤ 150	D.4	ISO 603-13 ISO 603-14
Type 11	Flaring cup  D/J x T x H - W x E x K	B	≤ 50	D ≤ 180	D.4	ISO 603-14
Type 16	Abrasive with threaded insert, tapered  D x T x H	B	≤ 50	D ≤ 80	D.1	ISO 603-12
Type 18	Abrasive with threaded insert, cylindrical  D x T x H	B	≤ 50	D ≤ 80	D.1	ISO 603-12
Type 18 R	Abrasive with threaded insert, cylindrical and rounded  D x T x H	B	≤ 50	D ≤ 80	D.1	ISO 603-12

Table C.1 (continued)

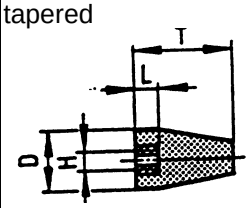
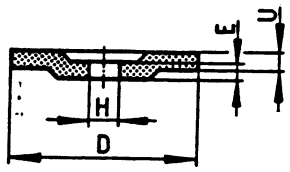
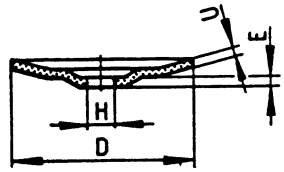
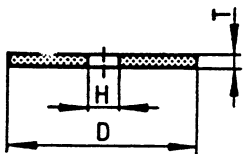
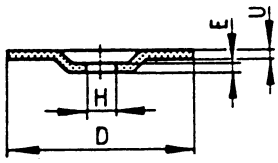
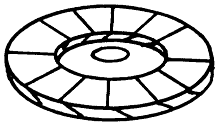
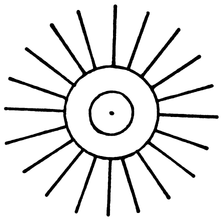
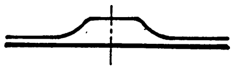
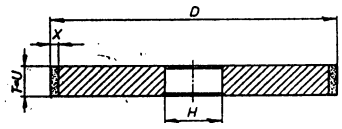
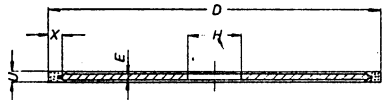
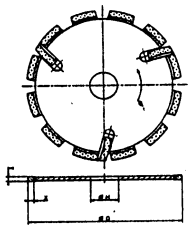
Type 19	Abrasive with threaded insert, cylindrical and tapered  D x T x H	B	≤ 50	D ≤ 80	D.1	ISO 603-12
Type 27	Depressed centre grinding wheel  D x U x H	BF	≤ 80	D ≤ 230	D.3a D.3b	ISO 603-14
Type 28	Depressed centre grinding wheel saucer shape  	B	≤ 80	D < 230	D.3a D.3b	ISO 603-14
Type 41	Straight cutting-off wheel  D x T x H D x U x H	BF Body: Metal Textile BF	≤ 80	D ≤ 300	D.3a D.3b	ISO 603-16
Type 42	Depressed centre cutting off wheel  D x U x H	BF	≤ 80	D ≤ 230	D.3a D.3b	ISO 603-16
Other dimensions and tolerances of the diameters, see ISO 603 and ISO 525.						

Table C.2 - Coated abrasive products

Type [1]	**Description, shape, designation**	**Type of bonding**	**Max operating speed** [2] **m/s**	**Dimension limits mm**	**Guard according to Figure**	**Applicable standards**
Type D1	Flap disc  D x U x H	Coated Body: Metal, textile	≤ 80	D ≤ 230	D.3a	
Type D2	Flap wheel  D x U x H	Coated	≤ 40	D ≤ 230	D.3a	
Type D3	Vulcan disc 	Coated	≤ 80	D ≤ 230	No guard	

[1] Type numbers do not refer to any standard for the time being.
[2] According to FEPA

Table C.3 - Super abrasive products

Type [1]	**Description, shape, designation**	**Type of bonding**	**Max operating speed**[2] **m/s**	**Dimension limits mm**	**Guards according to Figure**	**Applicable standards**
Type D4	Straight grinding wheel  D x T x H - U - X	M	≤ 80	D ≤ 230	C 3a	
Type D5	Cutting-off wheel  D x T x H - U - X	M	≤ 100	D ≤ 300	C 3a	
Type D6	Cutting-off wheel with segments  D x U x H - U - X	M	≤ 80	D ≤ 150	C 3a	

[1] Type numbers do not refer to any standard for the time being.
[2] According to FEPA

Annex D
(normative)

Design, material and thickness of guards

D.1 Design and thickness

D.1.1 General

The minimum thickness of the guards, for abrasive products with a maximum operating speed less than or equal to 80 m/s, are found in the Tables D.1 to D4.
Other types or designs of guards than those mentioned here may be used, if they provide the same protection and if they are tested and fulfil the requirements according to 7.4.

D.1.2 Guard without front lip, without curtain and without segment curtain

For abrasive products of type 16, 18, 18R and 19, the guard shall cover at least the length of the abrasive product. See Figure D.1

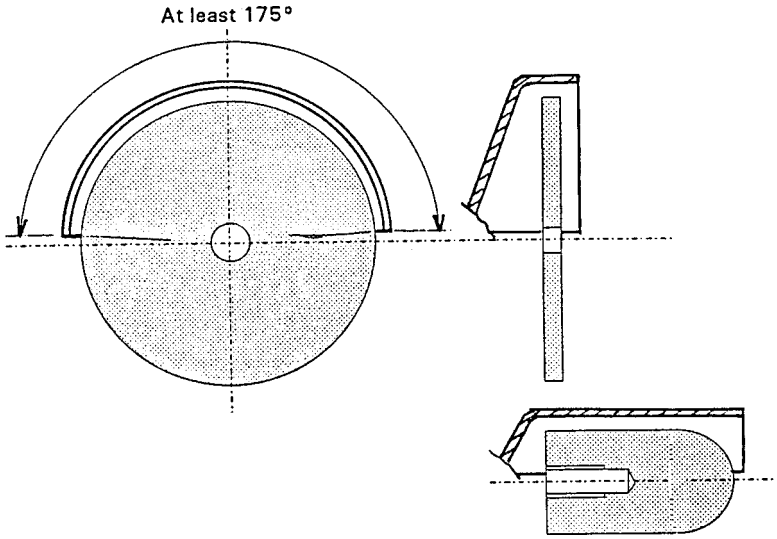


Figure D.1 - Guard without front lip, without curtain and without segment curtain

Table D.1 - Minimum thickness for guards without front lip, curtain and segment curtain

Type of abrasive product	External diameter of abrasive product mm	Minimum thickness of the guard mm
type 16, 18, 18R, 19	$D \leq 80$	1,5
Radial wire brushes		
type D2	$D \leq 150$	1,5
	$150 < D \leq 230$	2

D.1.3 Guard with front curtain

For non-reinforced plain grinding wheels of type 1, 4 and 5 at least 175° of the abrasive wheel periphery and both sides shall be covered by the guard. The front curtain shall be designed to facilitate easy replacement of the wheel. See Figure D.2

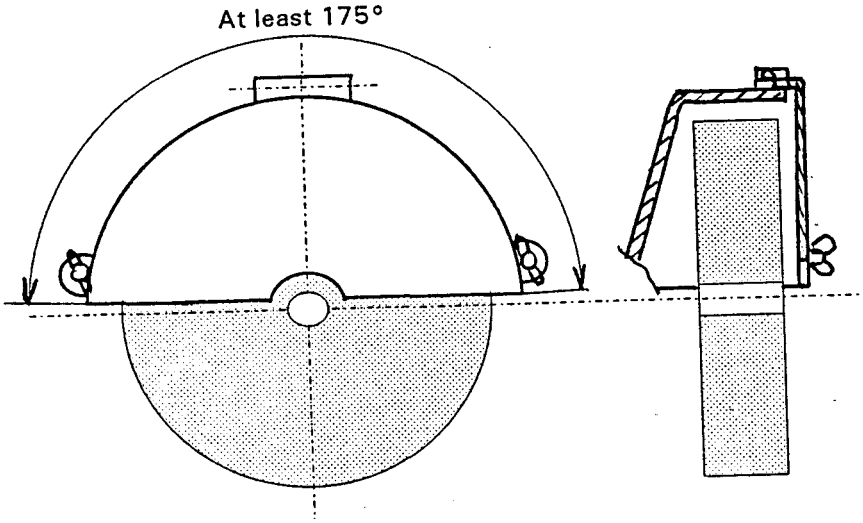


Figure D.2 - Guard with front curtain

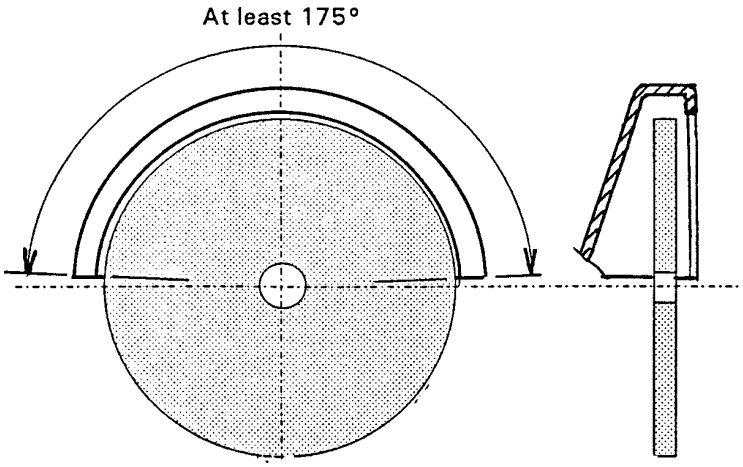
Table D.2 - Minimum thickness for guards with front curtain

Type of abrasive product	External diameter of abrasive product mm	Minimum thickness of the guard mm
type 1, 4, 5 with resinoid bond	$D \leq 150$	1,5
	$150 < D \leq 200$	2

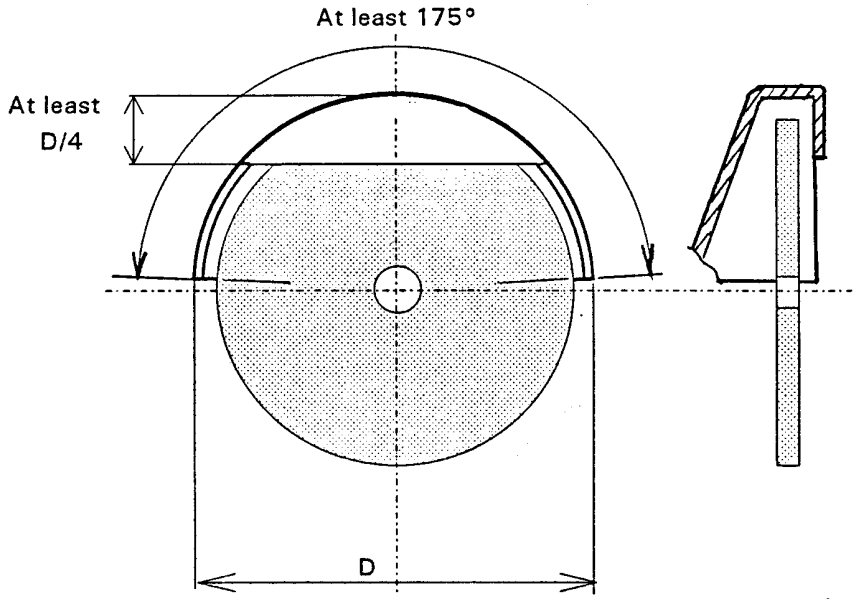
D.1.4 Guard with front lip or with curtain segment

For reinforced grinding wheels of type 1, 4 and 5 (other than cutting-off wheels) and for flap wheels at least 175° of the abrasive wheel periphery and the side towards the power tool shall be covered by the guard. The guard shall have a front lip. See Figure D.3 a).

For reinforced depressed centre wheels of type 27 and 28, straight cutting-off wheels of type 41 and depressed centre cutting-off wheels of type 42, at least 175° of the wheel shall be covered by the guard. The guard shall be positioned on the power tool so that it is located between the operator and the wheel during use. Guards for grinding wheels with a diameter larger than 130 mm, shall have a front lip of at least 5 mm or a curtain segment with a minimum height of 1/4 of the diameter. See Figures D.3 a) and b).



a) Guard with front lip



b) Guard with curtain segment

Figure D.3 - Guards

Table D.3 - Minimum thickness for guards with front lip and with segment curtain

Type of abrasive product	External diameter of abrasive product mm	Minimum thickness of the guard mm
type 1, 4, 5, with fiber-reinforced bond	$D \leq 150$	2
	$150 < D \leq 200$	2,5
type 27, 28, 41, 42 type D1, D4,D5,D6	$D \leq 150$	1,5
type 27, 28, 41, 42 type D1, D4,D5	$150 < D \leq 230$	2
type 41 type D5	$230 < D \leq 300$	2,5

D.1.5 Adjustable guard

For straight and flaring cups of type 6 and 11 the periphery shall be enclosed and preferably also the back face. The guard shall be adjustable to compensate for the wear of the abrasive product and to restrict the exposure of it to a minimum. See Figure D.4.

Straight and flaring cups of type 6 and 11 with an incorporated safety back of at least 1/3 of the thickness of the abrasive product, T, need no guard. However, a guard is recommended when it does not prevent proper use of the grinder.

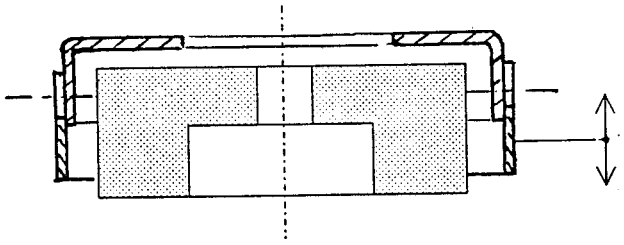


Figure D.4 - Adjustable guard

Table D.4 - Minimum thickness for adjustable guards

Type of abrasive product	External diameter of abrasive product mm	Minimum thickness of the guard mm
type 6	$D \leq 150$	2
type 11	$D \leq 180$	2

D.2 Material of guards

Guards shall be made of steel plate according to EN 10111 and EN 10130 with a tensile strength of 270 N/mm^2 to 450 N/mm^2 and a minimum elongation of 28 % (gauge length 50 mm) or of other material with comparable characteristics.

Annex E
(informative)

Example of calculating procedure of clamping force

E.1 Calculation of maximum total force and required clamping force

This calculation procedure is based on the same principles as for stationary grinding machines.

For calculation of the clamping forces and tightening torque of screws for clamping. The forces, which affect the clamping device, shall be considered. See Figure E.1.

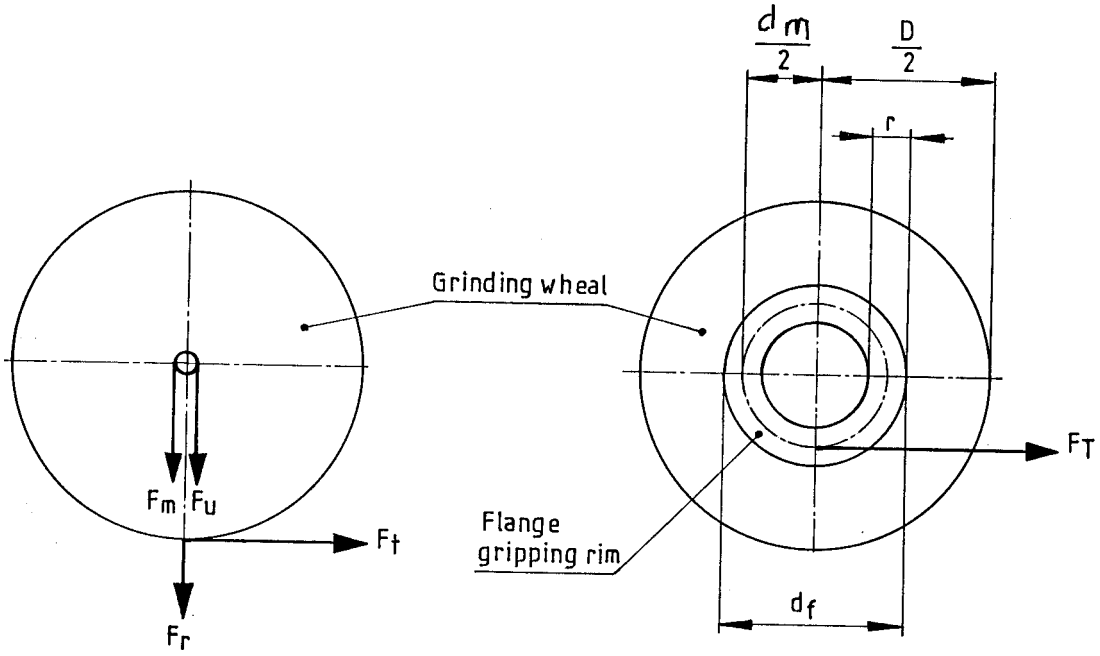


Figure E.1 - Forces of an abrasive product when grinding

For calculation the following symbols are required:

- d_f is the outside diameters of flanges, in meter
- D is the outside diameter of the abrasive product, in meter
- H is the bore diameter, in meter
- r is the width of the rim of the clamping area, in meter
- T is the thickness of the grinding wheel, in meter
- v is the maximum operating speed of the grinding wheel, in meter per second
- P is the power of the grinding machine spindle drive, in Watt
- ζ_m is the density of the grinding wheel, in kg/m^3

E.1.1 Total force, F_{tot}

The largest total force will be when the four forces are acting in the same direction:

$$F_{tot} = + F_m + F_u + F_T + F_r \qquad \text{(E.1)}$$

E.1.2 Forces due to the grinding operation, F_r, F_t

$$F_t = \frac{P}{v} \cdot k_1 \quad \text{(E.2)}$$

$$F_r = k \cdot F_t \quad \text{(E.3)}$$

where

- F_r is the perpendicular force from grinding operation, in Newton
- F_t is the tangential force from the grinding operation , in Newton
- k is the factor by experience for rough grinding (normally between 3 and 5)
- k_1 is the safety factor (normally 2,5)
- P is the power of grinder at the machine spindle, in Watt
- v is the operational speed of the grinding wheel, in meter per second

E.1.3 Shearing force, F_T

The tangential force F_t transformed to the mean radius of the clamping area d_m where it generates the shearing force F_T.

$$F_T \cdot 0{,}5 d_m = F_t \cdot 0{,}5 D \quad \text{(E.4)}$$

E.1.4 Force due to the weight of the abrasive product, F_m

$$F_m = M \cdot g = V \cdot \zeta_m \cdot g \quad \text{(E.5)}$$

$$M = V \cdot \zeta_m \quad \text{(E.6)}$$

where

- g is the gravity 9,81, in meters per square second, m/s^2
- M is the mass of the grinding wheel, in kilograms, kg
- V is the volume of the grinding wheel, in cubic metres, m^3
- ζ_m is the density of the grinding wheel, in kilograms per cubic metres, kg/m^3

E.1.5 Force due to the unbalance of the grinding wheel, F_u

The force F_u is due to the unevenness of mass distribution in the grinding wheel and is directed towards the centre of the wheel deduced from movements of particles in a bent orbit.

$$F_u = c \cdot m_u \cdot \frac{v^2}{R} = c \cdot m_u \cdot \frac{2v^2}{D} \quad \text{(E.7)}$$

where

- c is 10^{-3} according to ISO 6103
- D is the outside diameter of the abrasive product, in meter
- m_u is the "unbalance mass", in grams metres, gm
- R is the constant radius orbit
- v is the operational speed, in metres per second, m/s

The unbalance mass is $m_u = k\sqrt{M}$ according to ISO 6103. Where M is in grams and k is a value due to abrasive product type and operating speed.

E.2 Required clamping force between the flanges, F_{req}

Required clamping force between the flanges, with only one flange driven:

$$F_{req} = F_{tot} \cdot \frac{S}{\mu_c} \qquad \text{(E.8)}$$

where

F_{req} is the required force, in Newton
S is the safety factor against slipping
μ_c is the coefficient of friction between the surface of the flanges, blotter and the grinding wheel.

μ_c = 0,2 for blotter made of paper against steel

$\mu_c \geq$ 0,2 without steel bushing
μ_c < 0,15 for steel against steel

S is the safety factor against slipping and is due to the clamping conditions, where the designer of the grinder have to consider for instance the following facts:
- one or two flanges driving,
- flange geometry,
- flange and roughness of clamping area,
- tightening methods,
- vibrations,
- impacts

E.3 Clamping area and surface pressure between the flanges and the grinding wheel, P_a

$$P_a = \frac{F_{req}}{A_c} \qquad \text{(E.9)}$$

$$A_c = \frac{\pi}{4} \cdot \left(d_0^2 - d_i^2 \right) \qquad \text{(E.10)}$$

where

P_a is the surface pressure, in Newton per square meter (N/m^2)
F_{req} is the required clamping force, in Newton (N)
A_c is the clamping area, in square meters (m^2)
d_o is the outside diameter of flange, in meters (m)
d_i is the inside diameter of flange, in meters (m)

The maximum permissible P_a shall be specified by the manufacturer of the abrasive product.

Ensure that $P_a \cdot A_c > F_{req}$ after having calculated and chosen the dimensions that define the clamping area.

Annex F
(informative)

Example of flanges

This annex shows the principle design for flanges to be used with different types of abrasive products listed in annex C. In a later revision it will be completed with values for the dimensions.

F.1 Grinding wheel of type 1 and grinding wheel recessed on one side of type 5

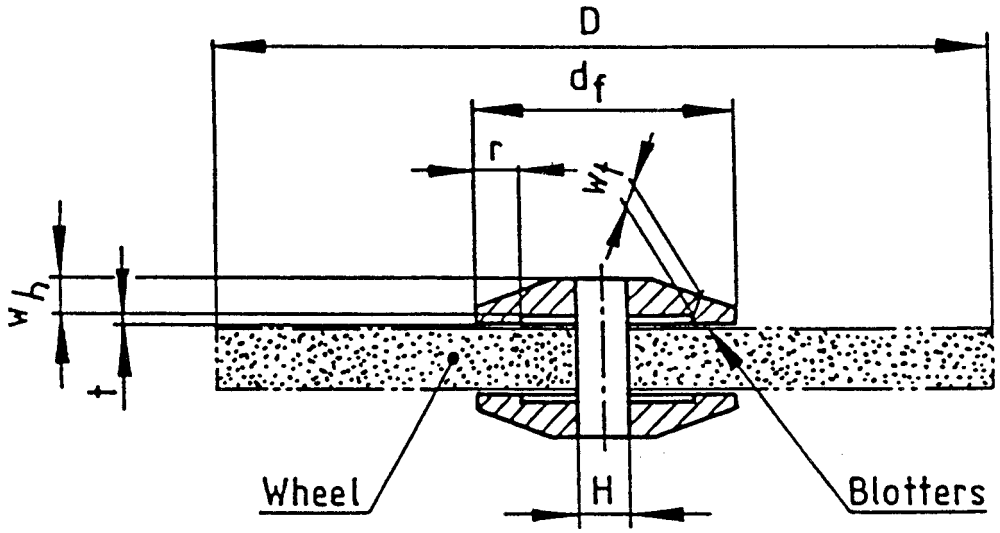


Figure F.1 - Flange for straight grinding wheels of type 1 and grinding wheel recessed on one side of type 5

F.2 Grinding wheel of type 4

One of the flanges has to be fixed mounted on the spindle. Care shall be taken that the flange is not in contact with the grinding wheel at the bore edge. Blotters are not allowed.

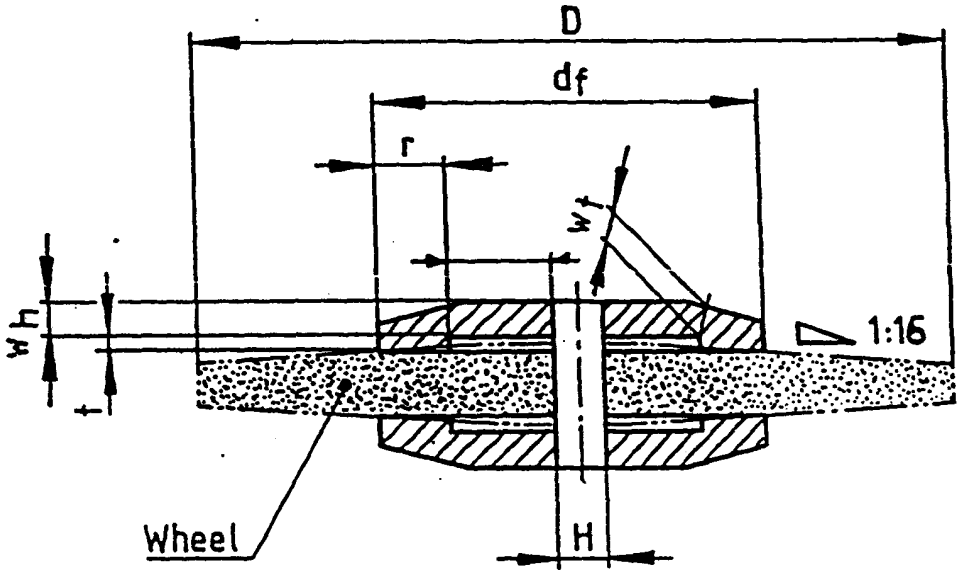


Figure F.2 - Flange for wheels tapered on both sides of type 4

F.3 Straight cup of type 6 and flaring cup of type 11, without threaded insert

The fixed backing flange for cups is intended to absorb the forces from the grinding process.

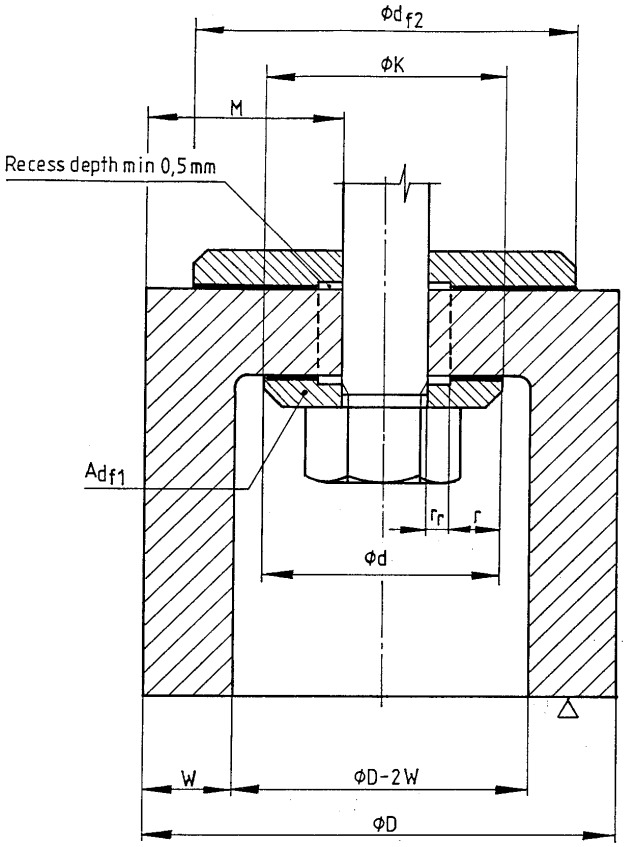
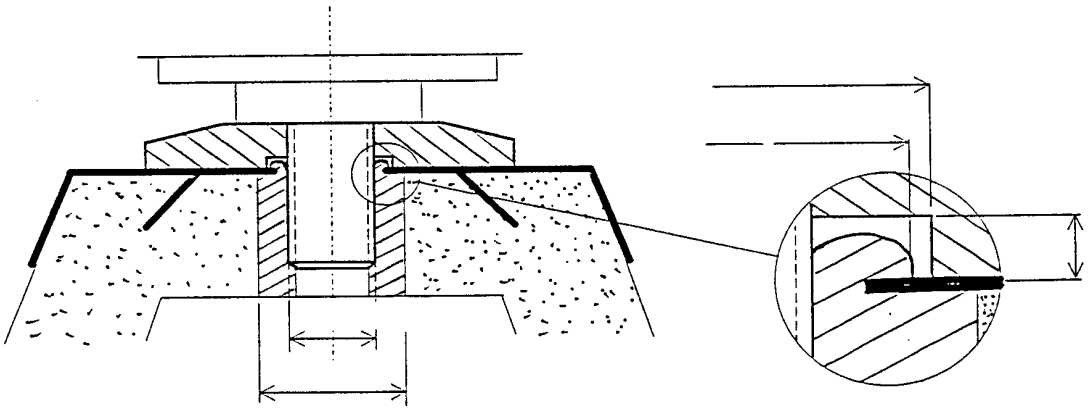


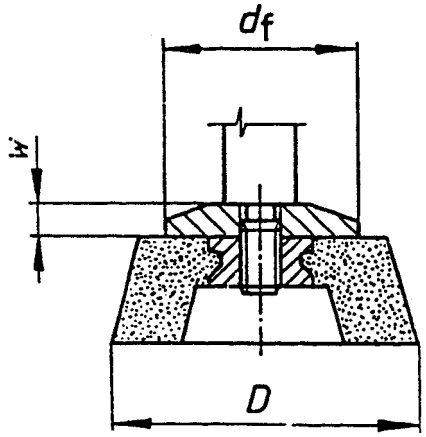
Figure F.3 - Recessed flange for cups without threaded insert

F.4 Flaring cup of type 11 with threaded insert

A smaller recess than the diameter of the nut in the backing flange shall be used.



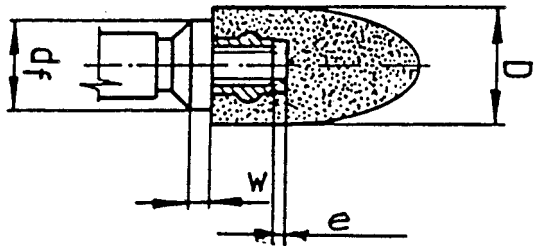
a) Rear flange with a recess for abrasive products of type 6 and 11with an insert riveted on an anchor plate



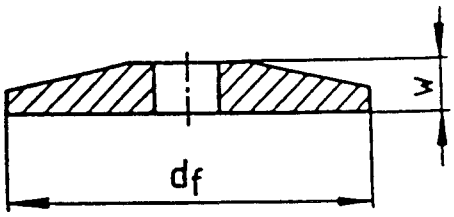
b) Unrecessed flange for cups with threaded inserts of type 6 and 11

Figure F.4 - Flanges

F.5 Plugs and cones of type 16, 18, 18 R and 19



a) Unrecessed flange plugs of type 16, 18, 18 R and 19 with thread inserts



b) Unrecessed flange for cones and for abrasive products of type 6, 11 16, 18, 18R and 19 with threaded inserts

Figure F.5 - Unrecessed flange

F.6 Depressed centre grinding wheel of type 27 and 28, straight cutting-off wheel of type 4.1 and depressed centre cutting-off wheel of type 42

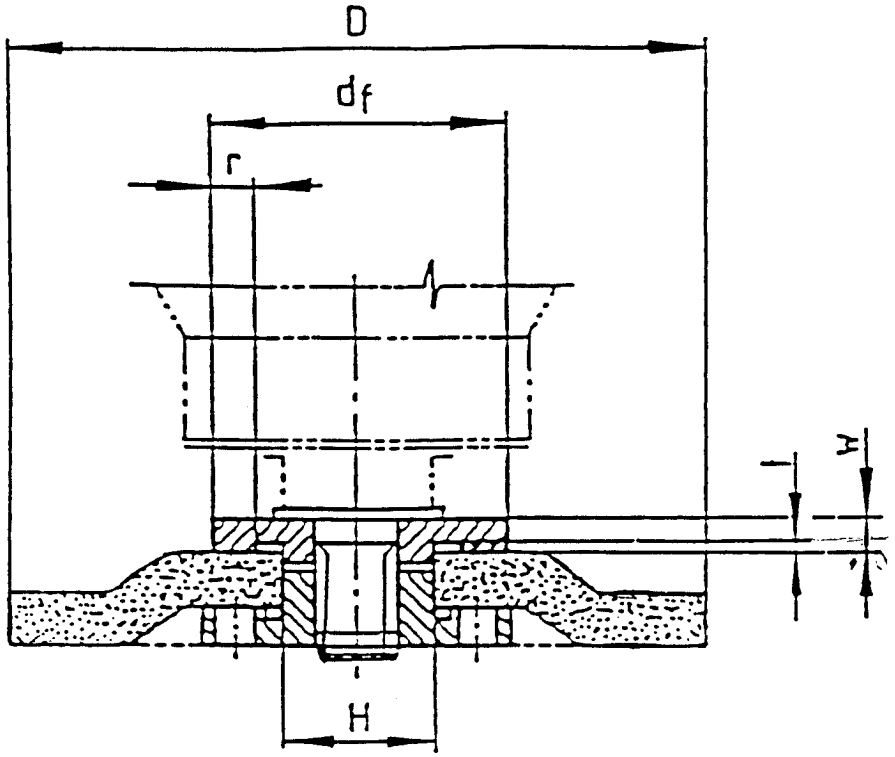


Figure F.6.a - Example of flange assembly for reinforced depressed centre wheel of type 27 and 28,

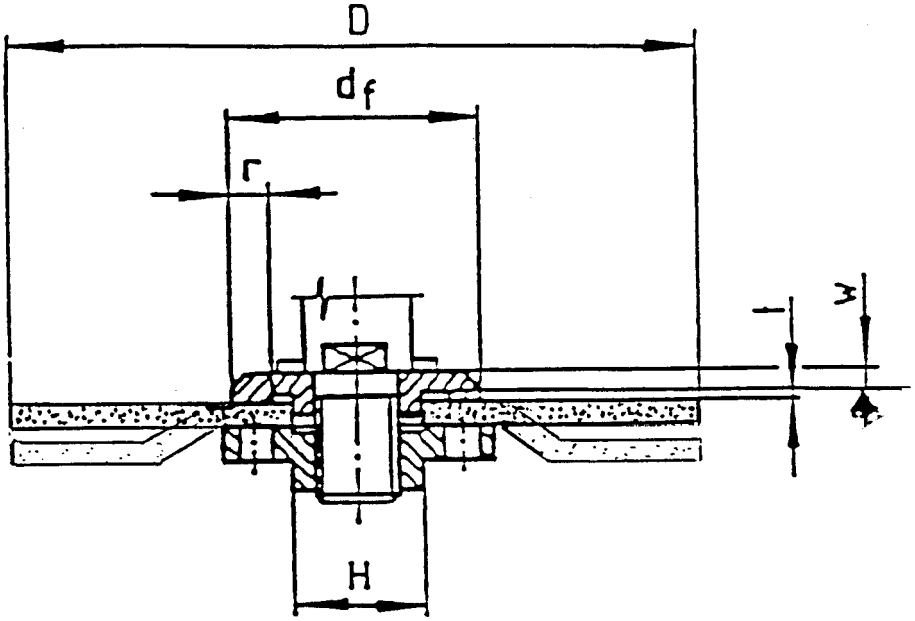


Figure F.6.b - Example of flange assembly for reinforced straight cutting-off wheels of type 41 (D ≤ 230 mm) and depressed-centre cutting-off wheels of type 42

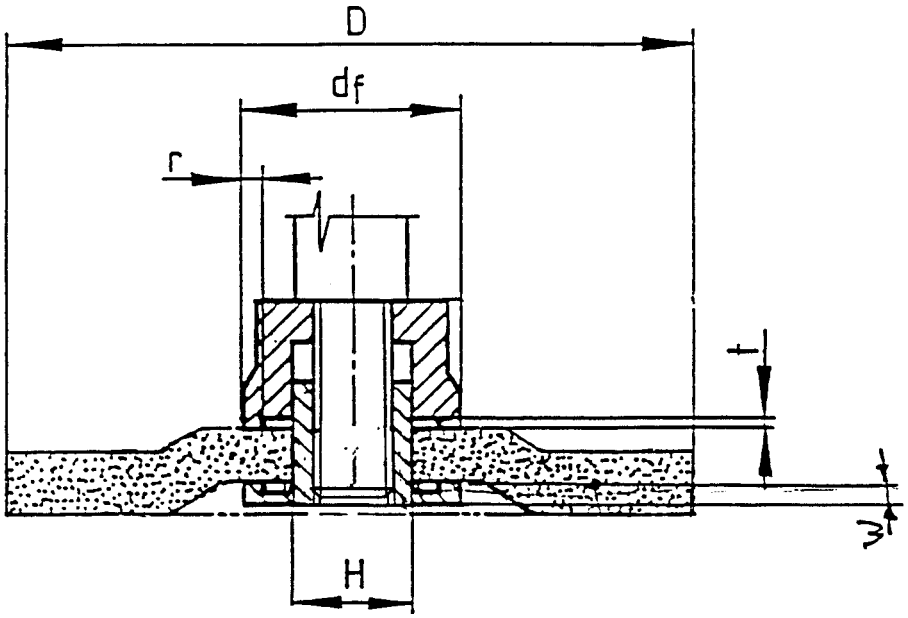


Figure F.6.c - Example of flange assembly for reinforced depressed centre cutting-off wheels of type 27 and 28

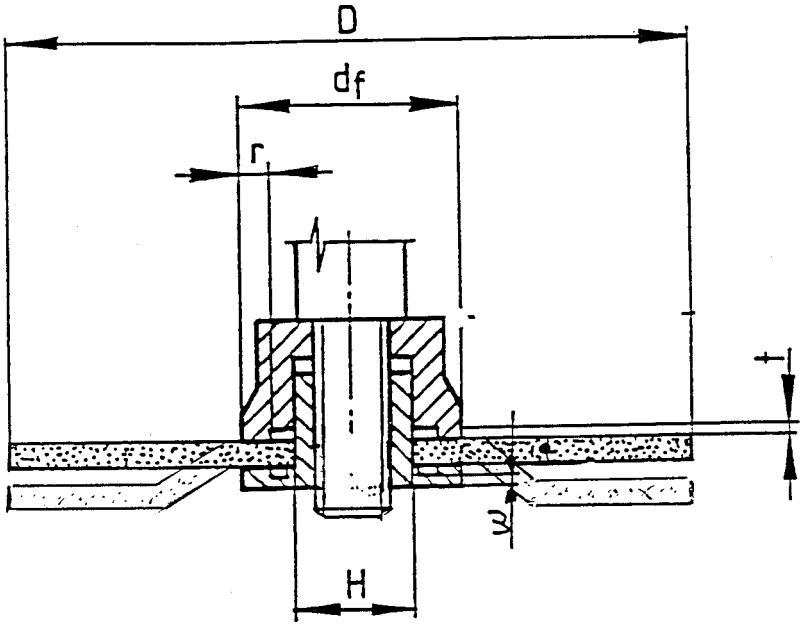
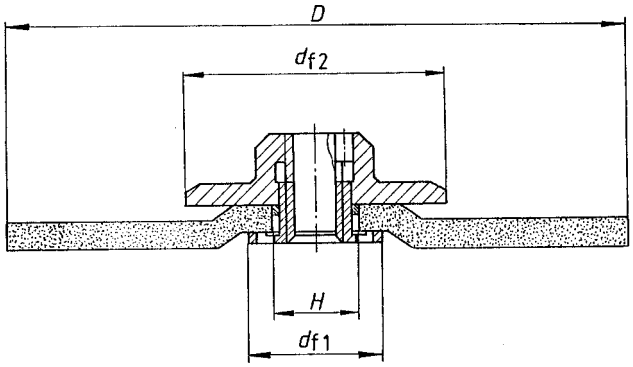


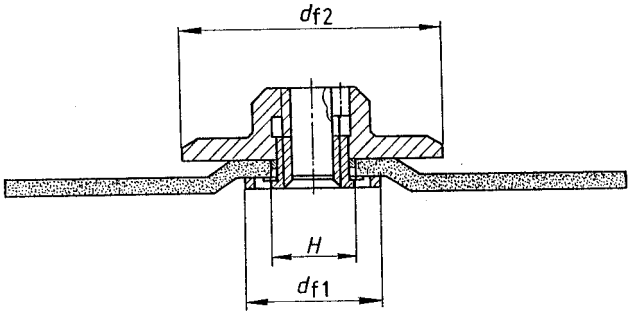
Figure F.6.d - Example of flange assembly for reinforced straight cutting-off wheels of type 41
(D ≤ 230 mm) and depressed-centre cutting-off wheels of type 42

F.7 Combined flange assembly for grinding wheels of type 27, 28, 41 and 42

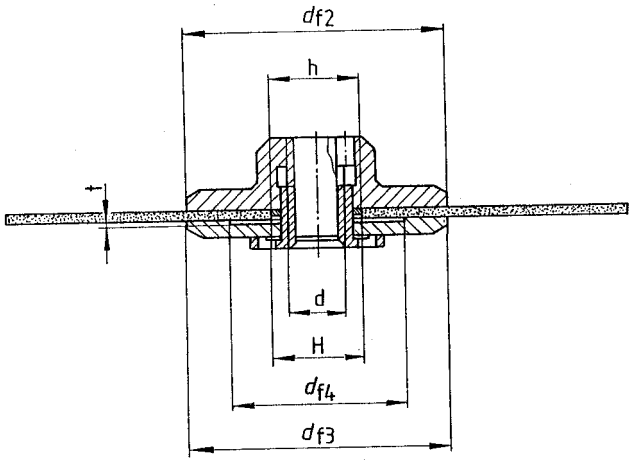
The backing flange shall have so large diameter that it can be used for the largest cutting- off wheel diameter.



a) Grinding wheel of type 27 and 28



b) Grinding wheel of type 42



c) Grinding wheel of type 41

Figure F.7 - Grinding wheel

Annex ZA
(informative)

Relationship of this European Standard with EC Directives

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association and supports essential requirements of EC Directive(s):

Machinery Directive 98/37/EC, amended by Directive 98/79/EC.

Compliance with this standard provides one means of conforming with the specific essential requirements of the Directive concerned and associated EFTA regulations.

WARNING: Other requirements and other EC Directives may be applicable to the product(s) falling within the scope of this standard.

Bibliography

The documents listed in this bibliography are not referred to as normative in the text of this standard, however they have a bearing on the specifications and are listed for information. It has to be recognised that this is not an exhaustive list.

EN 574, *Safety of machinery - Two-hand control devices -Functional aspects - Principles of design.*

EN 614-1, *Safety of machinery - Ergonomic design principles - Part 1: Terminology and general principles.*

EN 626, *Safety of machinery - Principles for machinery manufacturers on the reduction of risk to health from hazardous substances emitted by machinery.*

EN 894-3, *Safety of machinery – Ergonomics requirements for the design of displays and control actuators- Part 3: Control actuators.*

EN 982, *Safety requirements for fluid power systems and components – Hydraulics.*

EN 983, *Safety requirements for fluid power systems and components – Pneumatics.*

EN 1070, *Safety of machinery – Terminology.*

EN 1454, *Portable, hand-held, internal combustion cutting-off machines – Safety.*

EN ISO 11690-1, *Acoustics - Recommended practice for the design of low-noise workplaces - Part 1: Noise control strategies.*

EN ISO 11690-2*, Acoustics - Recommended practice for the design of low-noise workplaces - Part 2: Noise control measures.*

EN ISO 11690-3*, Acoustics - Recommended practice for the design of low-noise workplaces - Part 3: Sound propagation and noise prediction in workrooms.*

EN 50144-1, *Hand-held motor operated tools - Part 1: General specifications.*

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ISO 603-13, *Bonded abrasive products - Grinding wheel dimensions - Part 13: Grinding wheels for deburring and fettling on a vertical grinder (and ISO 603-13:1999/Cor 1:1999).*

ISO 603-14, *Bonded abrasive products - Grinding wheel dimensions - Part 14: Grinding wheels for deburring and fettling/snagging on an angle grinder (and ISO 603-14:1999/Cor 1:1999).*

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ISO 2787, *Rotary and percussive pneumatic tools - Performance tests.*

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ISO 3857-3, *Compressors, Pneumatic tools and machines, Vocabulary - Part 3: Pneumatic tools and machines.*

ISO 5391, *Pneumatic tools and machines – Vocabulary.*

EN 61310-1, *Safety of machinery - Indicating, marking and actuating principles - Part 1: Requirements for visual, audible and tactile symbols (IEC 61310-1:1995).*

EN 61310-2, *Safety of machinery - Indicating, marking and actuating principles - Part 2: Requirements for marking (IEC 61310-2:1995).*

E.H.T.M.A. *Recommendations for the correct use of hand-held or portable hydraulic tools and associated portable power sources, June 1991*

E.H.T.M.A. publications can be obtained from:

European Hydraulic Tool Manufacturer's Association
2 Pines Close, Woodfield Park
Amersham, Buckinghamshire HP3 5QW
England

FEPA Safety Code

FEPA publications can be obtained from:

Federation of European Producers of Abrasive Products, FEPA
20 Avenue Reille
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