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

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

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

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This European Standard was approved by CEN on 3 November 2001 and includes Amendment 1 approved by CEN on 23 July 2008.

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Foreword

This document (EN 792-7:2001+A1:2008) 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of an identical text or by endorsement, at the latest by March 2009, and conflicting national standards shall be withdrawn at the latest by December 2009.

This document includes Amendment 1, approved by CEN on 2008-07-23.

This document supersedes ⟨A1⟩ EN 792-7:2001 ⟨A1⟩.

The start and finish of text introduced or altered by amendment is indicated in the text by tags ⟨A1⟩ ⟨A1⟩.

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).

⟨A1⟩ For relationship with EU Directive(s), see informative Annexes ZA and ZB, which are integral parts of this document. ⟨A1⟩

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

⟨A1⟩ Annexes ZA and ZB ⟨A1⟩ (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, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

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).*

A1 EN ISO 15744:2008, *Hand-held non-electric power tools – Noise measurement code – Engineering method (grade 2) (ISO 15744:2002).* A1

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.

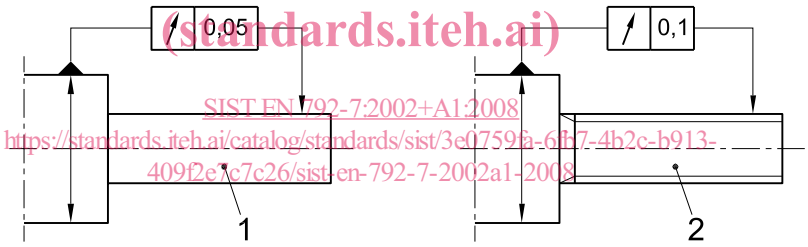
5.1.7 Attachment of abrasive product

The grinder shall be designed to prevent the abrasive product coming loose, for instance unscrewed by inertia and spun 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.

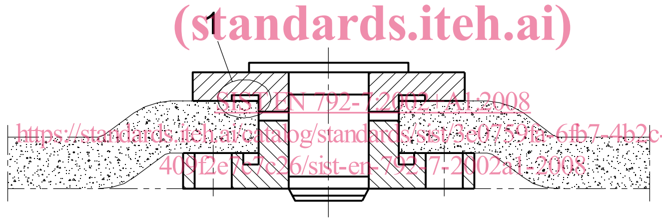
Annex F gives the principle design of flanges and will at the revision be completed with calculated dimensional values.

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.



Key

1 chamfer or recess

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.