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Varnostne zahteve za vezana brusilna sredstva

Safety requirements for bonded abrasive products

Sicherheitsanforderungen für Schleifkörper aus gebundenem Schleifmittel

Exigences de sécurité pour les produits abrasifs agglomérés

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ICS:

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Abrasives

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EUROPEAN STANDARD
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English Version

Safety requirements for bonded abrasive products

Exigences de sécurité pour les produits abrasifs
agglomérés

Sicherheitsanforderungen für Schleifwerkzeuge aus
gebundenem Schleifmittel

This European Standard was approved by CEN on 5 August 2019.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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European foreword

This document (EN 12413:2019) has been prepared by Technical Committee CEN/TC 143 “Machine tools — Safety”, the secretariat of which is held by SNV.

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of an identical text or by endorsement, at the latest by April 2020, and conflicting national standards shall be withdrawn at the latest by April 2020.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 12413:2007+A1:2011.

Significant technical differences between EN 12413:2007+A1:2011 and EN 12413:2019 are as follows:

- a) Clause 3 “Terms and definitions” has been revised;
- b) several modifications throughout the document have been done due to a change of concept regarding the terms “grinding” and “cutting-off” where the expression “grinding” does not include “cutting-off” anymore;
- c) the abbreviation “RE” for the “Restrictions of use” has been deleted;
- d) the type names in Table 6 have been checked and updated (the new edition of ISO 525 that is still under preparation will also include these revised types);
- e) in Table 6, the new Types 17R, 18B, 18P and 19R have been added;
- f) 6.2 “Scope of inspection by the manufacturer” has been moved to an informative Annex F “Recommended scope of the in-process inspection”;
- g) in Annex A, requirements for safety symbols (including symbols for personal protective equipment) have been added;
- h) in Table A.2, the following ‘restrictions to use’ including safety symbols have been added: “Only for grinding at an angle greater than 10°”. For the ‘restriction to use’ “Only permitted for totally enclosed working areas”, a safety symbol has been added;
- i) a new Table A.3 with symbols for personal protective equipment and a new safety symbol for “Do not use a damaged abrasive wheel” has been added;
- j) the three point side load test in C.3 has been deleted;
- k) Bibliography has been updated.

According to the CEN-CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

This document has been prepared to provide one means of conforming with essential safety requirements, e.g. of the General Product Safety Directive and associated EFTA regulations.

This document is addressed to designers, manufacturers and suppliers of the abrasive products described in the scope. In addition, it helps designers, manufacturers and suppliers of grinding machines in the selection of abrasive products, in order to reduce the risks and achieve conformity of the respective machinery with the essential health and safety requirements of the Machinery Directive.

The extent to which hazards are covered is indicated in the scope of this document.

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1 Scope

This document is applicable to rotating bonded abrasive products. It specifies requirements and/or measures for the removal or reduction of hazards resulting from the design and application of the abrasive products.

This document also contains procedures and tests for verification of compliance with the requirements as well as safety information for use, which is to be made available to the user by the manufacturer.

This document does not apply to superabrasive products and coated abrasive products.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN ISO 6103, *Bonded abrasive products - Permissible unbalances of grinding wheels as delivered - Static testing (ISO 6103)*

ISO 525, *Bonded abrasive products — General requirements*

ISO 13942, *Bonded abrasive products — Limit deviations and run-out tolerances*

3 Terms, definitions and symbols

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

3.1 General

3.1.1

bonded abrasive product

product consisting of abrasive grains held together by a bond

EXAMPLE Typical abrasive grains are aluminium oxide or silicon carbide.

Note 1 to entry: Types of bonded abrasive products are defined in ISO 525.

3.2 Grinding and cutting-off machines

3.2.1

stationary machine

machine being fixed in position during operation

Note 1 to entry: See for example EN ISO 16089.

Note 2 to entry: Included are fixed swing frame machines and mobile machines clamped firmly in position during use.

Note 3 to entry: Transportable machines are fixed in position during operation and therefore considered to be stationary machines.

EN 12413:2019 (E)**3.2.2****stationary machine with totally enclosed working area**

stationary machine being protected by separating guards in such a way that machining processes are carried out inside them and persons are protected against hazards

3.2.3**mobile machine**

machine not being fixed in position during operation

Note 1 to entry: Mobile machines are manually guided (but not hand-held) by the operator during use, e.g. floor grinding machines.

3.2.4**hand-held machine**

machine being held in the hand during operation

Note 1 to entry: Included are machines with flexible drives.

3.3 Grinding and cutting-off methods**3.3.1****peripheral grinding**

grinding with the periphery of the wheel with no or limited side loads

3.3.2**face grinding**

grinding with the face of the wheel

3.3.3**cutting-off**

cutting or slotting with the periphery of the cutting-off wheel

3.3.4**high pressure grinding**

grinding with high contact pressure for steel conditioning

3.4 Type of application**3.4.1****mechanically guided grinding and cutting-off**

process with feed movements of the abrasive product and/or the workpiece guided by mechanical means

Note 1 to entry: See Table 1.

3.4.2**manually guided grinding and cutting-off**

process with feed movements of the abrasive product and/or the workpiece manually guided by the operator

Note 1 to entry: See Table 1.

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3.4.3

hand-held grinding and cutting-off

process with the grinding or cutting-off machine entirely guided by the operator

Note 1 to entry: See Table 1.

Table 1 — Type of application

Type of machine	Type of application	Abrasive product	Workpiece
Stationary machines and stationary machines with totally enclosed working area	Mechanically guided grinding and cutting-off	Fixed	Mechanically guided
		Mechanically guided	Fixed
		Mechanically guided	Mechanically guided
Stationary and mobile machines	Manually guided grinding and cutting-off	Guided by the operator	Fixed
		Fixed	Guided by the operator
Hand-held machines	Hand-held grinding and cutting-off	Guided by the operator	Fixed

3.5 Symbols

For the purposes of this document, the symbols listed in Table 2 apply.

Table 2 — Symbols

Symbol	Designation	Definition	Unit
A	Impact resistance	Resistance of a rotating abrasive product to lateral impact	Nm
f_{br}	Bursting speed factor	Bursting speed divided by maximum operating speed: $f_{br} = \frac{v_{br}}{v_s}$	—
f_{pr}	Test speed factor	Safety test speed divided by maximum operating speed: $f_{pr} = \frac{v_{pr}}{v_s}$	—
F_{S1}	Single point side load	Resistance of a rotating abrasive product to lateral single point load	N
n_{ab}	Deflection speed of mounted points	Revolutions per minute at which the spindle of mounted points is deflecting under centrifugal force	1/min
n_{max}	Maximum permissible speed of rotation	Revolutions per minute of a new abrasive product at maximum operating speed	1/min

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Symbol	Designation	Definition	Unit
S_{ab}	Safety factor against spindle deflection for mounted points	Deflection speed divided by maximum permissible speed of rotation: $S_{ab} = \frac{n_{ab}}{n_{max}}$	—
S_{br}	Safety factor against bursting due to centrifugal force	Bursting speed divided by maximum operating speed, all squared: $S_{br} = \left(\frac{v_{br}}{v_s} \right)^2$	—
v_s	Maximum operating speed	Maximum permissible peripheral speed of a rotating abrasive product	m/s
v_{pr}	Safety test speed	Peripheral speed at which abrasive products are tested by the manufacturer	m/s
v_{br}	Bursting speed	Peripheral speed at which an abrasive product breaks due to centrifugal force	m/s
$v_{br, min}$	Minimum bursting speed	Peripheral speed which an abrasive product shall at least reach without bursting due to centrifugal force	m/s

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4 List of significant hazards

The significant hazards are listed in Table 3.

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Table 3 — List of significant hazards

Hazard designation	Hazardous situation (Examples)	Relevant clauses in this standard
Ejection of parts	1. Abrasive product breakage caused by	—
	— improper design	5.1, 5.2, 5.3 and Annex C
	— manufacturing defects	5.1
	— wrong selection	5.5, Clause 7 and Annex A
	— improper handling and storage	Clause 7
	— improper use (mounting and grinding process)	5.6, Clause 7 and Annex A
	2. Grinding debris	Clause 7
Vibration	Hand arm vibration on hand-held machines caused by	—
	— manufacturing defects	5.3 and 5.4
	— improper use	Clause 7
	— incorrect mounting	Clause 7

Hazard designation	Hazardous situation (Examples)	Relevant clauses in this standard
Kickback	Kickback effect of cutting-off wheels on hand-held machines caused by:	—
	— improper use	Clause 7
	— improper design	5.1, 5.2, 5.3 and Annex C
	— manufacturing defects	5.1
	— wrong selection	5.5, Clause 7 and Annex A
	— improper handling and storage	Clause 7

5 Safety requirements

5.1 General requirements

5.1.1 General

Abrasive products shall be designed and manufactured in such a way that they resist the forces and loads that are to be expected when used as intended. They shall not present visible faults and shall comply with the requirements listed in the following clauses.

5.1.2 Sequence of maximum operating speeds

Abrasive products shall be manufactured for maximum operating speeds according to the following sequence:

< 16 — 16 — 20 — 25 — 32 — 35 — 40 — 45 — 50 — 55 — 63 — 80 — 100 — 125 in m/s

The only exception to this is where the application requirements dictate an intermediate speed.

The manufacturer may select any of these speeds up to the maximum values shown in Table 6.

NOTE For conversion of peripheral speeds into speeds of rotation for different outside diameters D of the abrasive product, see Annex E.

5.2 Strength requirements

5.2.1 Safety factors

Abrasive products — with the exception of mounted points and wheels — shall have a safety factor against bursting due to centrifugal forces at their maximum operating speed as given in Table 4.

Table 4 — Safety factors

Type of machine	Type of abrasive product	Maximum operating speed v_s m/s	Safety factor S_{br}	Bursting speed factor f_{br}
Stationary machines	high pressure grinding wheels	≤ 80	3,50	1,87
	cutting-off wheels, manually guided cutting-off	≤ 100	3,50	1,87
	cutting-off wheels, only mechanically guided cutting-off	≤ 100	2,00	1,41
	all other types	all	3,00	1,73
Stationary machines totally enclosed	high pressure grinding wheels	≤ 100	3,00	1,73
	all other types	all	1,75	1,32
Mobile machines	grinding and cutting-off wheels	≤ 100	3,50	1,87
Hand-held machines	grinding wheels $D > 125$ mm	≤ 50	3,00	1,73
		$50 < v_s \leq 80$	3,50	1,87
	cutting-off wheels $D > 125$ mm	≤ 100	3,50	1,87
	all types $D \leq 125$ mm	≤ 80	3,00	1,73
		> 80	3,50	1,87

5.2.2 Safety factors for mounted points and wheels

Mounted points and wheels shall have a safety factor against bursting due to centrifugal forces of $S_{br} = 3$ at their maximum operating speed. The spindle shall have a safety factor against deflection of $S_{ab} = 1,3$. For further requirements, see Annex B.

5.2.3 Side load capacity

Depressed-centre wheels, straight cutting-off wheels and depressed-centre cutting-off wheels for the use on hand-held machines shall have a side load capacity according to Table 5.

Table 5 — Side load capacity of abrasive products for use on hand-held machines

Abrasive product	Maximum operating speed v_s m/s	Outside diameter D mm	Side load capacity	
			Single point side load F_{S1} N	Impact resistance A Nm
Depressed-centre grinding wheels (type 27 ^{a,b} and type 28 ^{a,c})	≤ 80	≥ 115	290	—
		150	290	4,5
		180	290	5,4
		230	290	6,9
Straight and depressed-centre cutting-off wheels (type 41 ^a and type 42 ^a)	≤ 80	≥ 115	40	—
		150	50	1,2
		180	50	1,5
		230	50	2,0
		300	125	5,4
		350/356	125	5,4
		400/406	125	5,4
Straight cutting-off wheels (type 41 ^a)	80 < v_s ≤ 125	115 < D ≤ 125	40	—
	80 < v_s ≤ 100	300	125	5,4
		350/356	125	5,4
		400/406	125	5,4

^a According to ISO 525.

^b With back-up pad where intended for the type of application.

^c Tested as a type 27.

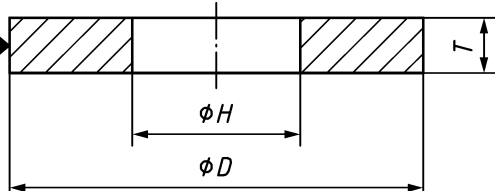
5.3 Dimensional requirements

5.3.1 Dimensional limitations and maximum operating speeds

Bonded abrasive products shall comply with the dimensional limitations and maximum operating speeds as specified in Table 6.

NOTE The arrow in the figures in Table 6 symbolizes the working face of the bonded abrasive product.

Table 6 — Dimensional limitations and maximum operating speed

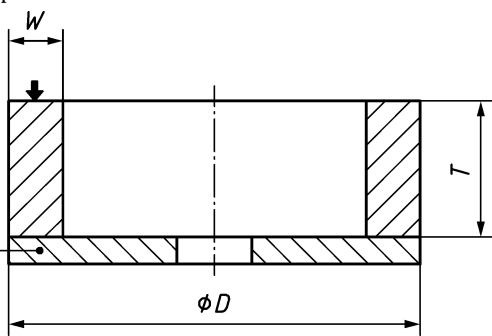
Shape, designation, dimensional letters	Type of machine ^a	Type of application ^a	Maximum operating speeds and dimensional limitations														
			Standard operating speeds									Special operating speeds					
			m/s									m/s					
			Dimensional limitations	Types of bond ^b								Dimensional limitations	Types of bond ^b				
V	B	BF		R	RF	E	MG	PL	V	B	BF		R	RF	PL		
Type 1 Straight grinding wheel  $D \times T \times H^b$	Stationary machines	Mechanically guided grinding	$H \leq 0,67 D$	40	50	63	50	—	40	25 ^c	50	$H \leq 0,67 D$	63	63	—	63	63
		Mechanically guided grinding, totally enclosed		—	—	—	—	—	—	—	$H \leq 0,50 D$	80	80	80	80	80	—
		Mechanically guided high pressure grinding	$H \leq 0,50 D$	—	80	—	—	—	—	—	—	—	—	—	—	—	—
		Mechanically guided high pressure grinding, totally enclosed	$H \leq 0,33 D$	—	—	—	—	—	—	—	$H \leq 0,33 D$	—	100	—	—	—	—
	Stationary and mobile machines	Manually guided grinding	$H \leq 0,67 D$	35	50	63	50	50	40	25 ^c	50	$H \leq 0,50 D$	—	63	—	63	63
										16 ^d	—	$H \leq 0,33 D$	—	—	80	—	80
	Hand-held machines	Hand-held grinding	$H \leq 0,25 D$	—	50	80	50	80	—	—	50	$H \leq 0,25 D$	—	63	—	63	—

^a Definitions see 3.2 and 3.4.

^b Types of bond and designation examples see ISO 525.

^c $D \leq 1\,000\text{ mm}$

^d $D > 1\,000\text{ mm}$

Shape, designation, dimensional letters	Type of machine ^a	Type of application ^a	Maximum operating speeds and dimensional limitations															
			Standard operating speeds								Special operating speeds							
			m/s								m/s							
			Dimensional limitations	Types of bond ^b							Dimensional limitations	Types of bond ^b						
V	B	BF		R	RF	E	MG	PL	V	B		BF	R	RF	PL			
Type 2 Cylinder grinding wheel, cemented or clamped to a back-plate  Key 1 back-plate $D \times T \times W^b$	Stationary machines	Mechanically guided grinding		32	40	—	—	—	—	25	40		63	63	—	—	—	50
		Manually guided grinding	$W < 0,17 D$	32	40	—	—	—	—	—	40	$W < 0,17 D$	—	50	—	—	—	50

^a Definitions see 3.2 and 3.4.

^b Types of bond and designation examples see ISO 525.

^a Definitions see 3.2 and 3.4.

^b Types of bond and designation examples see ISO 525.