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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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25.100.70 Brusiva Abrasives

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Safety requirements for bonded abrasive products

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This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 143.

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

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European foreword

This document (prEN 12413:2018) has been prepared by Technical Committee CEN/TC 143 “Machine tools — Safety”, the secretariat of which is held by SNV.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 12413:2007+A1:2011.

Significant technical differences between EN 12413:2007+A1:2011 and prEN 12413:2018 are as follows:

a) Clause 3 “terms and definitions” has been revised;

b) Clarification on the concept “grinding” and “cutting-off” has been given. The expression “grinding” does not include “cutting-off” which caused modifications throughout the document;

c) The abbreviation “RE” for the “Restrictions of use” has been deleted;

d) The type names in Table 6 have been checked to be in line with ISO 525 and adopted, if necessary;

e) Types 17R and 19R have been added in Table 6;

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 symbols have been added: “Do not use a damaged abrasive wheel” and “Only for grinding at an angle greater than 10°”. For the restriction to use “only permitted for totally enclosed working areas” a symbol has been added;

i) A new Table A.3 with symbols for personal protective equipment as examples has been added;

j) The three point side load test in C.3 has been deleted;

k) Bibliography has been updated.

Introduction

This European Standard 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 European Standard 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 European Standard.

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

3.1 Terms and definitions

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

3.1.1
bonded abrasive product
product consisting of abrasives e.g. aluminium oxide, silicon carbide held together by a bond

Note 1 to entry: Bonded abrasive products within the meaning of this standard are all products as defined, see for example by ISO 525.

3.1.2
Grinding and cutting-off machines
3.1.2.1
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.

3.1.2.2
stationary machine with totally enclosed working area
stationary machine being protected by separating guards in such way that machining processes including loading and unloading of workpieces are carried out inside them and persons are protected against hazards generated by bursting of an abrasive product

3.1.2.3
mobile machine
machines not being fixed in position during operation

Note 1 to entry: Mobile machines are manually guided (but not supported) by the operator during use, e.g. floor grinding machines, flexibly suspended swing-frame grinding machines.

3.1.2.4
hand-held machine
machine being held in the hand during the grinding process

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

Note 2 to entry: See for example EN ISO 11148-7, EN ISO 11148-9, EN 60745-2-3, EN 60745-2-22, EN 60745-2-23, EN 61029-2-4, EN 61029-2-10, EN 62841-3-4 and EN ISO 19432.

3.1.3
Grinding and cutting-off method
3.1.3.1
peripheral grinding
grinding with the periphery of the wheel with no or limited side loads

3.1.3.2
face grinding
grinding with the face of the wheel

3.1.3.3
cutting-off
cutting-off or slotting with the periphery of the cutting-off wheel

3.1.3.4
high pressure grinding
grinding with high contact pressure for steel conditioning

3.1.4
Type of application
3.1.4.1
mechanically guided grinding and cutting-off
feed movements of the grinding tool and/or the workpiece are guided by mechanical means

Note 1 to entry: See Table 1.

3.1.4.2
manually guided grinding and cutting-off
feed movements of the grinding tool and/or the workpiece are manually guided by the operator

Note 1 to entry: See Table 1.

3.1.4.3
hand-held grinding and cutting-off
grinding machine entirely guided by the operator

Note 1 to entry: See Table 1.

Table 1 — Type of application

Type of grinding machine	Type of application	Abrasive product	Workpiece
Stationary machines and stationary machines totally enclosed	Mechanically guided grinding and cutting-off	Fixed	Guided mechanically
		Guided mechanically	Fixed
		Guided mechanically	Guided mechanically
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

3.2 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}	Burst speed factor	Minimum bursting speed divided by maximum operating speed: $f_{br} = \frac{v_{br,min}}{v_s}$	—
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
S_{ab}	Safety factor against spindle deflection for mounted	Deflection speed divided by maximum permissible speed of rotation:	—

Symbol	Designation	Definition	Unit
	points	$S_{ab} = \frac{n_{ab}}{n_{max}}$	
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

4 List of significant hazards

The significant hazards are listed in Table 3.

Table 3 — List of significant hazards

Hazard designation	Hazardous situation (Examples)	Relevant clauses in this standard
Ejection of parts	**Wheel breakage caused by**	—
	— improper design	5.1, 5.2, 5.3 and Annex C
	— manufacturing defects	5.1
	— wrong selection	5.5, 7 and Annex A
	— improper handling and storage	7
	— improper use (mounting and grinding process)	5.6, 7 and Annex A
	Grinding debris	7
Vibration	**Hand arm vibration on hand-held machines caused by**	—
	— manufacturing defects	5.3 and 5.4
	— improper use	7
	— incorrect mounting	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 — 63 — 80 — 100 — 125 in m/s

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

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

NOTE For a conversion table for speeds of rotation and maximum operating speeds as a function of the outside diameter *D* of the abrasive products, 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}	Burst speed factor f_{br}
stationary machines	high pressure grinding wheels	≤ 80	3,50	1,87
	cutting-off wheels, manually guided cutting-off	≤ 80	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

Type of machine	Type of abrasive product	Maximum operating speed v_s m/s	Safety factor S_{br}	Burst speed factor f_{br}
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 grinding machines shall have a side load capacity according to Table 5.

Table 5 — Side load capacity of abrasive products for the 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

Abrasive product	Maximum operating speed	Outside diameter	Side load capacity	
			Single point side load	Impact resistance
	v_S	D	F_{S1}	A
	m/s	mm	N	Nm
Straight cutting-off wheels (type 41 [a])	$80 < v_S \leq 125$	$115 < D \leq 125$	40	—
	$80 < v_S \leq 100$	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.

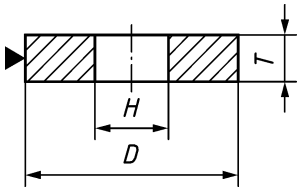
c Tested as a type 27.

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.

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 m/s								Special operating speeds 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 grinding 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	63
										16[d]		$H \leq 0{,}50\ D$	80	80	80	80	80	—
		Mechanically guided grinding totally enclosed		—	—	—	—	—	—	—	—	$H \leq 0{,}50\ D$	125	100	100	100	—	—
		Mechanically guided high pressure grinding	$H \leq 0{,}50\ D$	—	80	—	—	—	—	—	—	—	—	—	—	—	—	—
		Mechanically guided high pressure grinding totally enclosed		—	—	—	—	—	—	—	—	$H \leq 0{,}33\ D$	—	100	—	—	—	—
	Stationary and mobile grinding 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 grinding 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 3.3.

b Types of bond and designation examples see ISO 525.

c $D \leq 1\ 000$ mm

d $D > 1\ 000$ mm