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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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Foreword

This document (EN 12413:2007+A1:2011) 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of an identical text or by endorsement, at the latest by September 2011, and conflicting national standards shall be withdrawn at the latest by September 2011.

This document includes Amendment 1, approved by CEN on 2011-01-17.

This document supersedes ⟨A1⟩ EN 12413:2007 ⟨A1⟩.

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

Significant technical differences between ⟨A1⟩ EN 12413:2007 ⟨A1⟩ and EN 12413:1999 are as follows:

a) deletion of different abbreviations in Table 1 to Table 4 and Table 7;

b) deletion of 140 m/s and 160 m/s in Clause 5.1.1;

c) revision of Table 11 "Maximum operating speeds, safety factors and minimum bursting speeds for different types of machine and types of application". In the revised Table 11 (now Table 4) are there only relations between the range of v_s, the safety factor S_{br} and burst speed factor f_{br};

d) in Clause 5.1.3 "Side load capacity" (new Clause 5.2.3) are the relevant values for the different tests depending on v_s and the outside diameter of the abrasive product;

e) extension of requirements in Clause 5.6 "Blotters", Annex B "Blotters" (normative) is completely deleted;

f) revision of Clause 6 in accordance with rules for the structure and drafting of CEN/CENELEC publications;

g) Table 13 "Safety test speeds" deleted and revision of Table 14 "Scope of the inspection";

h) revision of Clause 7 "Information for use";

i) content of Table A.2 "Colour codes and design of colour codes" to change as additional marking in Annex D (informative);

j) in Table A.3 "Restrictions of use", RE2 deleted and RE8 included;

k) Figures A.1, A.2 and Clause A.4 "Design of the marking" deleted;

l) revision of Annex C (normative), [now Annex B (informative)], Mounted points only as an example calculation of the maximum permissible speed of rotation;

m) extension of Annex D (informative), [now Annex C (normative)], with additional requirements concerning the verification methods for side load capacity.

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

n) in 6.2, Table 7, the requirements for the scope of inspection of "all other abrasive products" have been changed. ⟨A1⟩

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

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

This 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 safety requirements of the Machinery Directive.

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

1 Scope

This standard 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 standard 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.

The hazards taken into consideration are listed in Clause 4 of this standard.

This standard does not apply to superabrasives and coated abrasive products.

2 Normative references

The following referenced documents are indispensable for the application 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 6103:2005)*

ISO 525, *Bonded abrasive products — General requirements*

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

3 Definitions and symbols

3.1 Bonded abrasive products

Products consisting of abrasives e.g. aluminium oxide, silicon carbide held together by a bond.

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

3.2 Grinding machines

3.2.1 Stationary machines

Machines that are fixed in position during operation, see for example EN 13218. Included are fixed swing-frame machines and mobile machines clamped firmly in position during use.

3.2.2 Mobile machines

Machines that are not fixed in position during operation. They are manually guided (but not supported) by hand during use, e.g. floor grinding machines, flexibly suspended swing-frame grinding machines.

3.2.3 Hand-held machines

Machines, including those with flexible drives that are held in the hand during the grinding process, see for example EN 792-7, EN 792-9, EN 60745-2-3 and EN ISO 19432.

3.2.4 Machines with totally enclosed working area

Stationary machines that are protected in such a way by separating guards 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.

3.3 Grinding method

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-off 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 General

See Table 1.

3.4.2 Mechanically guided grinding

Feed movements of the grinding tool and/or the workpiece are guided by mechanical means.

3.4.3 Manually guided grinding

Feed movements of the grinding tool and/or the workpiece are manually guided by the operator.

3.4.4 Hand-held grinding

Grinding machine is entirely guided by the operator's hands.

Table 1 — Type of application

Type of grinding machine	Type of application	Abrasive product	Workpiece
Stationary machines	Mechanically guided grinding	Fixed	Guided mechanically
		Guided mechanically	Fixed
		Guided mechanically	Guided mechanically
Stationary and mobile machines	Manually guided grinding	Guided by hand	Fixed
		Fixed	Guided by hand
Hand-held machines	Hand-held grinding	Guided by hand	Fixed

3.5 Symbols

Table 2 — Symbols

Abbreviations	Designation	Definition	Unit
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 the new abrasive product at maximum operating speed	1/min
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
f_{pr}	Test speed factor	Safety test speed divided by maximum operating speed: $f_{pr} = \frac{v_{pr}}{v_s}$	—
f_{br}	Burst speed factor	Minimum bursting speed divided by maximum operating speed: $f_{br} = \frac{v_{br\,min}}{v_s}$	—
v_{br}	Bursting speed	Peripheral speed at which the abrasive product breaks due to centrifugal force	m/s
$v_{br\,min}$	Minimum bursting speed	Peripheral speed, which the abrasive product shall at least reach without bursting due to centrifugal force	m/s
S_{br}	Safety factor against bursting due to centrifugal force	Bursting speed divided by maximum operating speed, all squared: $S_{br} = \left(\frac{v_{br}}{v_s}\right)^2$	—
S_{ab}	Safety factor of spindle deflection for mounted points	Deflection speed divided by maximum permissible speed of rotation: $S_{ab} = \frac{n_{ab}}{n_{max}}$	—
A	Impact resistance	Resistance of a rotating abrasive product to lateral impact	Nm
F_{S1}	Single point side load	Resistance of a rotating abrasive product to lateral single point load	N
F_{S3}	Three point side load	Resistance of a rotating abrasive product to lateral three point load	N

4 List of significant hazards

Table 3 — List of significant hazards

Hazard designation	Hazardous situation (Examples)	Relevant clauses in this standard
Ejection of parts	1. 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
	2. 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 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 Maximum operating speeds

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

< 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.

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 wheels and points — 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	3,5	1,87
	Cutting-off wheels	≤ 80	3,5[a]	1,87
		≤ 100	2,0	1,41
	All other types	all	3,0	1,73
Stationary machines totally enclosed	High pressure grinding wheels	≤ 100	3,0	1,73
	All other types	all	1,75	1,32
Mobile machines	Grinding and cutting-off wheels	≤ 100	3,5	1,87
Hand-held machines	Grinding wheels $D > 125$ mm	≤ 50	3,0	1,73
		$50 < v_s \leq 80$	3,5	1,87
	Cutting-off wheels $D > 125$ mm	≤ 100	3,5	1,87
	All types $D \leq 125$ mm	≤ 80	3,0	1,73
		> 80	3,5	1,87

[a] Only manually guided cutting-off.

5.2.2 Safety factors for mounted wheels and points

Mounted wheels and points 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	Outside diameter	Side load capacity		
			Single point side load test	Three point side load test	Impact test
			Single point side load	Three point side load	Impact resistance
	v_s	D	F_{S1}	F_{S3}	A
	m/s	mm	N	N	Nm
Depressed-centre grinding wheels (type 27[a], type 28[a] and type 29[b])	≤ 80	≥ 115	290	—	—
		150	290	—	4,5
		180	290	—	5,4
		230	290	—	6,9
Straight and depressed-centre cutting-off wheels (type 41 and type 42)[a]	≤ 80	≥ 115	40	—	—
		150	50	—	1,2
		180	50	—	1,5
		230	50	—	2,0
		300	125	150	5,4
		350/356	125	150	5,4
		400/406	125	150	5,4
	80 < v_s ≤ 100	300	125	150	5,4
		350/356	125	150	5,4
		400/406	125	150	5,4

[a] According to ISO 525.

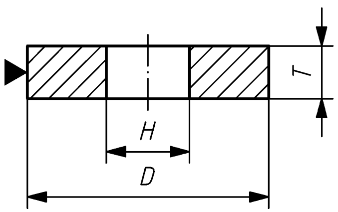
[b] With back-up pad as intended for the type of application.

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 speeds

Shape, designation, dimensional letters	Type of machine[a]	Type of application[a]	Maximum operating speeds and dimensional limitations — Standard operating speeds m/s — Dimensional limitations	Types of bond[b] V	B	BF	R	RF	E	MG	PL	Special operating speeds m/s — Dimensional limitations	Types of bond[b] V	B	BF	R	RF	PL
Type 1 Straight grinding wheel	Stationary grinding machines	Mechanically guided grinding	$H \leq 0{,}67\ D$	40	50	63	50	—	40	25*)	50	$H \leq 0{,}67\ D$	63	63	—	63	63	63
										16**)		$H \leq 0{,}50\ D$	80	80	80	80	80	—
		Mechanically guided grinding totally enclosed	$H \leq 0{,}67\ D$	—	—	—	—	—	—	—	—	$H \leq 0{,}50\ D$	125	100	100	100	—	—
		Mechanically guided high pressure grinding	$H \leq 0{,}50\ D$	—	80	—	—	—	—	—	—	—	—	—	—	—	—	—
		Mechanically guided high pressure grinding totally enclosed	$H \leq 0{,}50\ D$	—	—	—	—	—	—	—	—	$H \leq 0{,}33\ D$	—	100	—	—	—	—
	Stationary and mobile grinding machines	Manually guided grinding	$H \leq 0{,}67\ D$	35	50	63	50	50	40	25*)	50	$H \leq 0{,}50\ D$	—	63	—	63	63	—
										16**)		$H \leq 0{,}33\ D$	—	—	80	—	80	—
$D \times T \times H$[b]	Hand-held grinding machines	Hand-held grinding	$H \leq 0{,}25\ D$	—	50	80	50	80	—	—	50	$H \leq 0{,}25\ D$	—	63	—	63	—	—

*) $D \leq 1\ 000$ mm

**) $D > 1\ 000$ mm

[a] Definitions see 3.2 and 3.3.

[b] Types of bond and designation examples see ISO 525.

(continued)