



**SLOVENSKI STANDARD**  
**SIST EN 12413:2000**

**01-december-2000**

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**Safety requirements for bonded abrasive products**

Safety requirements for bonded abrasive products

Sicherheitsanforderungen für Schleifkörper aus gebundenem Schleifmittel

Exigences de sécurité pour les produits abrasifs agglomérés

**Ta slovenski standard je istoveten z: EN 12413:1999**

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**ICS:**

25.100.70      Brusiva      Abrasives

**SIST EN 12413:2000**      **en**

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ICS 25.100.70

English version

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gebundenem Schleifmittel

This European Standard was approved by CEN on 17 March 1999.

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 Central Secretariat 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 Central Secretariat has the same status as the official versions.

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

Central Secretariat: rue de Stassart, 36 B-1050 Brussels

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## Foreword

This European Standard has been prepared by Technical Committee CEN/TC 143 "Machine tools - Safety", the secretariat of which is held by UNI.

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of an identical text or by endorsement, at the latest by October 1999, and conflicting national standards shall be withdrawn at the latest by October 1999.

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 standard has been prepared to be a European standard to provide one means of conforming with the Essential safety requirements of the Machinery Directive and associated EFTA regulations.

This standard is addressed to designers, manufacturers and suppliers of the grinding tools described in the scope. In addition, it helps designers, manufacturers and suppliers of grinding machines in the selection of grinding tools, 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 grinding tools.

This standard contains also procedures and tests for verification of the 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 applies to bonded abrasive products with aluminium oxide, silicon carbide or zirconia alumina as abrasive. It does not apply to rotating superabrasives with diamond or cubic boron nitride as abrasive and also not for coated abrasive products.

## 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 reference subsequent amendments to, or revisions of, any of these publications apply to this European standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

ISO 525

Bonded abrasive products – General – Designation, marking, range of outside diameters and tolerances

ISO 6103

Bonded abrasive products – Static balancing of grinding wheels – Testing

ISO/DIS 13942

Bonded abrasive products – Limit deviations and run-out tolerances

## 3 Definitions and symbols

### 3.1 Bonded abrasive products

Bonded abrasive products are production tools that perform their task by cutting a chip or piece from the material being ground. They consist of abrasives and bond.

Bonded abrasive products within the meaning of this standard are all grinding wheels, cup wheels, cylinder wheels, segments and mounted wheels.

### 3.2 Abbreviations for Materials

For the purposes of this standard the following definitions and symbols apply:

**Table 1: Abrasives**

A	Aluminium oxide
C	Silicon carbide
Z	Zirconia Alumina

**Table 2: Grit**

Macro grits			Micro grits
coarse	medium	fine	very fine
4	30	70	230
5	36	80	240
6	40	90	280
7	46	100	320
8	54	120	360
10	60	150	400
12	-	180	500
14		220	600
16		800	
20		1000	
22		1200	
24		-	

**Table 5: Type of bond**

V	Vitrified bond
R	Rubber bond
RF	Reinforced rubber bond
B	Resinoid and other thermosetting organic bonds
BF	Resinoid bond fiber-reinforced
E	Shellac bond
MG	Magnesite bond
PL	Plastic bond

**Table 3: Hardness grade**

Hardness grade is designated by a letter of the alphabet. "A" being the softest and "Z" the hardest.

A	B	C	D	extremely soft
E	F	G	-	very soft
H	I	J	K	soft
L	M	N	O	medium
P	Q	R	S	hard
T	U	V	W	very hard
X	Y	Z	-	extremely hard

**Table 4: Structure**

Wheel structure may be designated by numbers, usually 0 to 14, with higher numbers indicating more open structure.

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### 3.3 Grinding machine

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#### 3.3.1 Stationary grinding machines

Machines are fixed to their position during operation due to their nature or their mechanical attachment. They also include for example fixed swing-frame grinding machines and mobile machines clamped firmly in position during use, e.g. track grinding machines.

#### 3.3.2 Mobile grinding machines

Machines which are manually guided (but not supported) by hand during use, e. g. floor grinding machines, flexibly suspended swing-frame grinding machines.

### 3.3.3 Hand-held grinding machines

Machines, including those with flexible drives, are held in the hand during the grinding process.

### 3.3.4 Stationary cutting-off machines

Machines are specifically designed for cutting-off or slotting applications. They also include transportable cutting-off machines, which are clamped firmly in position during use.

### 3.3.5 Mobile cutting-off machines

Machines which are guided (but not supported) by hand during the cutting process, e. g. floor saws, flexibly suspended swing-frame cutting-off machines.

### 3.3.6 Hand-held cutting-off machines

Machines which are held in the hand during cutting off applications.

### 3.3.7 Grinding- and cutting-off machines with totally enclosed working area

Stationary machines for mechanically guided grinding or cutting-off with operating areas which are protected in such a way by separating guards that machining processes including loading and unloading of workpieces can be carried out inside them and persons are protected against hazards generated by bursting of an abrasive product.

## 3.4 Type of application

See table 6

### 3.4.1 Mechanically guided grinding

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

### 3.4.2 Manually guided grinding

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

### 3.4.3 Hand-held grinding

The grinding machine is entirely guided by the operator's hands.

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## 3.5 Method of operation

### 3.5.1 Peripheral grinding

Grinding with the periphery of the wheel with no or limited side loads.

### 3.5.2 Face grinding

Grinding with the face of the wheel.

### 3.5.3 Cutting-off

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

### 3.5.4 High pressure grinding

Grinding with high contact pressure.

**Table 6: Type of application**

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

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### 3.6 Abbreviations for bonded abrasive products

Table 7: Abbreviations for bonded abrasive products

Symbol	Designation
A	Smallest width of a trapezoidal segment
B	Width of a segment
C	Thickness of a segment
D	Outside diameter of abrasive products
E	Thickness at bore of cup, dish, recessed and relieved wheels
F	Depth of the 1st recess
G	Depth of the 2nd recess
H	Abrasive product bore diameter, thread diameter of wheels with threaded insert
J	Smallest diameter of tapered cup, dish, tapered and hubbed grinding wheels
K	Internal diameter of recess of tapered cup and dish wheels
L	Length of a segment, length of thread bore of wheels with threaded insert
$L_0$	Overhang length of mounted wheels and points
$L_2$	Length of the spindle of mounted wheels and points
$L_3$	Clamping length of the spindle of mounted wheels and points
$L_r$	Unsupported length of the segments
N	Depth of the relief
P	Recess diameter
$S_d$	Diameter of spindle of mounted wheels and points
T	Overall thickness
$T_D$	Limits of deviation of outside diameter
$T_H$	Limits of deviation of bores diameter
$T_T$	Limits of deviation of the thickness
U	Smallest thickness of tapered, hubbed and depressed centre wheels, e. g. in Type 4 or Type 38
W	Rim width of cups, cylinders and dishes

### 3.7 Symbols for speed of rotation, speeds and safety factors

Table 8: Speed and test

Abbreviations	Designation	Definition	Unit
$n$	Speed of rotation	Revolutions per minute (rpm)	$\text{min}^{-1}$ or $\frac{1}{\text{min}}$
$n_{\text{ab}}$	Deflection speed of mounted points	Speed in rpm at which the spindle of mounted points is deflecting under centrifugal force	$\text{min}^{-1}$ or $\frac{1}{\text{min}}$
$n_{\text{max}}$	Maximum permissible speed of rotation	Revolutions per minute (rpm) of the new abrasive product at maximum peripheral operating speed	$\text{min}^{-1}$ or $\frac{1}{\text{min}}$
$v$	Peripheral surface speed	Speed at the periphery of the abrasive product	m/s
$v_s$	Maximum operating speed	The maximum permissible peripheral surface speed of a rotating abrasive product	m/s
$v_{\text{pr}}$	Safety test speed	Peripheral speed at which abrasive products are tested by the manufacturer	m/s
$f_{\text{pr}}$	Test speed factor	The ratio of the safety test speed, divided by the maximum operating speed	–
$v_{\text{br}}$	Bursting speed	The peripheral surface speed at which the abrasive product breaks under stress	m/s
$v_{\text{hr min}}$	Minimum bursting speed	Peripheral surface speed, which the abrasive product shall at least reach without bursting due to centrifugal force	m/s
$S$	Safety factor	The bursting speed, divided by the maximum operating speed, all squared. The formula for S is: $S = \left( \frac{v_{\text{br}}}{v_s} \right)^2$	–
$S_{\text{ah}}$	Safety factor of spindle deflection for mounted points	The ratio of the deflection speed, divided by the maximum permissible speed of rotation The formula is: $S_{\text{ah}} = \frac{n_{\text{ab}}}{n_{\text{max}}}$	–

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### 3.8 Other Symbols

**Table 9: Symbols**

Symbol	Designation	Unit
$A$	Working capacity	Nm
$F_{S1}$	Single point side load	N
$F_{S3}$	Three point side load	N
$R_c$	yield point	N/mm <sup>2</sup>
$\rho$	density	kg/dm <sup>3</sup>
▼	The grinding face of the abrasive product, see table 10.	–

### 3.9 Other Definitions

#### 3.9.1 Label

Labels contain essential information on the abrasive products to which they belong.

#### 3.9.2 Blotter

Blotters are placed between abrasive products and flanges.

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## 4 List of hazards

**Table 10: List of hazards**

Hazard designation	Hazardous situation (Examples)	Relevant clauses in this standard
Ejection of parts	1) Wheel breakage	
	– improper design, manufacturing defects	5.1, 5.2, 5.3, 5.7 und Annex C
	– manufacturing defects	6
	– wrong selection	5.5, 7 and Annex A
	– improper handling and storage	7
	– improper use (mounting and grinding process)	7, Annex A and Annex B
	2) Loosen of grinding particles	7
Vibration	Unbalanced caused by inadmissible out of balance	
	– manufacturing defecte	5.4 and 6
	– improper use, mounting	7

## 5 Requirements

### 5.1 General requirements

Abrasive products are subject to high stresses during grinding. Therefore they shall have specified safety factors and bursting speeds as a function of type of machine, type of application and maximum operating speed.

#### 5.1.1 Maximum operating speeds

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

< 16 – 16 – 20 – 25 – 32 – 35 – 40 – 50 – 63 – 80 – 100 – 125 – 140 – 160 in m/s

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.

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### 5.1.2 Safety factors

The safety factor against breaks under stress shall correspond to the values given in table 11.

**Table 11: Maximum operating speeds, safety factors and minimum bursting speeds for different types of machine and types of application**

Type of machine	Type of application	Maximum operating speed $v_s$ in m/s	Coefficient of Safety $S$	Minimum bursting speed $v_{br \min}$ in m/s
Stationary grinding machines	Mechanically guided grinding	< 16	3	–
		16	3	28
		20	3	35
		25	3	43
		32	3	55
		35	3	61
		40	3	69
		50	3	87
		63	3	109
		80	3	139
	Mechanically guided grinding, totally enclosed	40	1,75	53
		50	1,75	66
		63	1,75	83
		80	1,75	106
		100	1,75	132
		125	1,75	165
		140	1,75	185
		160	1,75	212
	Mechanically guided high-pressure grinding	63	3,5	118
		80	3,5	150
	Mechanically guided high-pressure grinding, totally enclosed	63	3	109
80		3	139	
100		3	173	
Stationary and mobile grinding machines	Manually guided grinding	< 16	3	–
		16	3	28
		20	3	35
		25	3	43
		32	3	55
		35	3	61
		40	3	69
		50	3	87
		63	3	109
		80	3,5	150
		(continued)		

Table 11 (concluded)

Type of machine	Type of application	Maximum operating speed $v_s$ in m/s	Coefficient of Safety $S$	Minimum bursting speed $v_{br \min}$ in m/s
Hand-held grinding machines	Hand-held grinding	16	3	28
		20	3	35
		25	3	43
		32	3	55
		35	3	61
		40	3	69
		50	3	87
		63	3,5	118
Stationary cutting-off machines	Mechanically guided cutting-off	80	3,5	150
		35	2	50
		40	2	57
		50	2	71
		63	2	89
		80	2	113
	Mechanically guided cutting-off, totally enclosed	100	2	141
		40	1,75	53
		50	1,75	66
		63	1,75	83
		80	1,75	106
		100	1,75	132
		125	1,75	165
		Stationary and mobile cutting-off machines	Manually guided grinding	63
80	3,5			150
Hand-held cutting-off machines	Hand-held cutting-off	50	3,5	94
		63	3,5	118
		80	3,5	150
		100	3,5	188

### 5.1.3 Side load capacity **iTeh STANDARD PREVIEW**

Depressed-centre wheels (type 27, type 28), straight cutting-off wheels (type 41), and depressed-centre cutting-off wheels (type 42) for hand-held applications shall have an adequate side load capacity.

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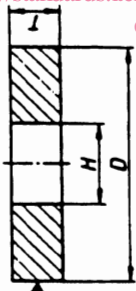
### 5.2 Dimensional limitations for standard grinding wheel shapes depending of type of machine, type of application and maximum operating speed

Bonded abrasive products shall comply with the dimensional limits as specified in table 12, as a function of the shape, type of machine, type of application and maximum operating speed. Where no operating speed has been specified by the user, the manufacturer shall design, test and mark the wheel according to table 12 below.

On specific request by the user, grinding wheels may be designed, tested and marked with a maximum operating speed not higher than the special maximum operating speeds as specified in table 12.

For totally-enclosed machines only, the speeds given in table 12 may be exceeded provided that the required safety factor has been met in table 11.

Table 12: Standard grinding wheel spaces depending of type of machine, type of application and maximum operating speed

Shape, Designation, Dimensional	Type of machine <sup>1)</sup>	Type of application <sup>1)</sup>	Maximum operating speeds and dimensional limitations																
			Standard operating speeds in m/s						Special operating speeds in m/s										
			V	B	BF	R	RF	E	MG	PL	Dimensional limitations	V	B	BF	R	RF	PL		
Type 1 Straight grinding wheel 	Stationary grinding machines Stationary and mobile grinding machines Hand-held grinding machines	Mechanically guided grinding Mechanically guided grinding totally enclosed Mechanically guided high pressure grinding Mechanically guided high pressure grinding totally enclosed	H ≤ 0,67 D	40	50	63	50	-	40	25 <sup>*)</sup>	50	-	-	-	63	63	63		
			H ≤ 0,50 D	-	-	-	-	-	-	-	-	125	100	100	100	-	-	-	
			H ≤ 0,50 D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			H ≤ 0,33 D	-	-	-	-	-	-	-	-	-	100	-	-	-	-	-	-
DxTxH <sup>2)</sup>	Stationary and mobile grinding machines Hand-held grinding machines	Manually guided grinding Hand-held grinding	H ≤ 0,67 D	35	50	63	50	50	40	25 <sup>*)</sup>	50	-	-	-	63	63	63		
			H ≤ 0,50 D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
			H ≤ 0,33 D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			H ≤ 0,25 D	-	50	80	50	80	-	-	-	-	63	-	-	63	-	-	-

<sup>\*)</sup> D ≤ 1 000 mm

<sup>\*\*)</sup> D > 1 000 mm

<sup>1)</sup> Definitions see 3.3 and 3.4

<sup>2)</sup> Designation of characteristics, see ISO 525

(continued)