

THE QUALITY OF EXPERIENCE



LA QUALITÀ DELL'ESPERIENZA THE QUALITY OF EXPERIENCE

CERIN ha iniziato la sua attività nel 1971 ed è oggi una delle imprese più affermate e di maggior successo in Italia nel campo degli **utensili di precisione in metallo duro**.

Nel corso degli anni Cerin è diventata leader nel settore, affermandosi nei mercati di tutto il mondo per qualità del prodotto, efficienza e flessibilità della sua struttura interna e per l'intenso impegno del suo settore ricerca e sviluppo orientato allo sviluppo di nuovi prodotti.

È sempre disponibile un servizio di assistenza tecnica e commerciale per soddisfare le esigenze dei clienti.

L'azienda è certificata
ISO 9001:2015.

CERIN has been present on the market since 1971 and currently represents one of the most well known and well reputed **Italian manufacturer of carbide precision tools**.

During the years CERIN has become leader in the field and have been known on the domestic and international markets as high quality manufacturer thanks, above all, to the constant commitment focused to the main purpose: total customer's satisfaction pursued through: Quality of the Products, Efficiency of the inner structure, Services available for the clientele and Research and Development engaged in new products development.

A service of technical and commercial assistance is always available to meet customer needs.

*The company is
ISO 9001:2015 certified.*









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Qualità di metallo duro - Campo di applicazione e gradi

Carbide features - Field of applications and grades

Materiali in acciaio Qualità MD	Acciai inossidabili Qualità MD	Materiali in ghisa Qualità MD	Acciai temprati Qualità MD	Caratteristiche	
Steels Carbide grade	Stainless steels Carbide grade	Cast irons Carbide grade	Hardened steels Carbide grade	Durezza	Resistenza
				Hardness	Toughness
P01 - P05	M01 - M05	K01 - K05	H01 - H05	↑↑	↓↓
P10 - P15	M10 - M15	K10 - K15	H10 - H15		
P20 - P25	M20 - M25	K20 - K25	H20 - H25		
P30 - P35	M30 - M35	K30 - K35	H30	↑↑	↓↓
P40 - P45	M40	K40			
P50					

I metalli duri a grana fine e superfine con struttura WC/Co sono ideali per quasi tutte le lavorazioni ad asportazione di truciolo. Grazie alla straordinaria durezza e resistenza alla flessione, con maggiore durata utile dell'utensile, si possono portare sia la velocità di taglio e l'avanzamento a livello superiore rispetto ai metalli duri convenzionali. La struttura a grana fine permette anche di migliorare le superfici e la precisione del taglio..

Tungstencarbide/Cobalt structured hard metals of fine and extra fine grain are suited at best for almost all cutting tasks. By means of extraordinary hardness and good flexural strength «with longest tool life» higher cutting speeds and feeds can be driven as with conventional carbides. Also better surfaces and sharpness of cutting edges can be attained by the use of fine grain structured carbides.

Dimensione dei grani nella gamma micron e submicron

Grain size range of micron and submicron grades

Descrizione Description	Dimensione del grano di carburo (µm) Carbide grain size (µm)
Grana fine nano Nano fine grain	< 0,2 (=200nm)
Grana ultrafine Ultrafine grain	0,2 - 0,5
Grana superfine micro Micro grain	0,5 - 0,8
Grana fine Fine grain	0,8 - 1,3
Grana media Medium grain	1,3 - 2,5
Grana grossa Coarse grain	2,5 - 6,0
Grana extra grossa Extra coarse grain	> 6,0

Qualità standard metallo duro Cerin

Cerin standard carbide grades

Qualità Cerin Cerin carbide grade	Qualità di metallo duro Carbide grade	Metallo duro - Caratteristiche Carbide properties
CK 05-10 MG	K05	Grana fine con ≤ 6% Co - idonea per rivestimento diamantato Fine grain with ≤ 6% Co suitable for diamond coating
CK 10-20 MG	K10-K20	Grana fine qualità universale - buona durezza e tenacità Fine grain for common use - Good hardness and toughness
CK 20-30 MG	K20-K30	Grana fine - qualità universale - buona durezza e resistenza alla flessione Fine grain for common use - Good hardness and bending strength
CK 30 M	K30	Qualità standard per ghisa - buona durezza - per materiali a truciolo corto Standard cast iron grade - Good hardness - Short chipping materials
CK 10-30UF	K10-K30	Grana superfine per materiali ≤ 67 HRC - Superfine grain for materials ≤ 67 HRC -

Temperature di rivestimento / Protezione antiusura e antifrizione per metallo duro

Coating temperatures / Wear protection and anti-friction coatings for hard materials

Denominazione in breve <i>Short term</i>	Temperatura di processo <i>Process-Temperature</i>	Campo di applicazione <i>Range of applications</i>
PVD - deposizione fisica da vapore <i>PVD - Physical Vapour Deposition</i>	200° - 550°	Utensili di truciatura in metallo duro integrale <i>Carbide cutting tools</i>
CVD - deposizione chimica da vapore <i>CVD - Chemical Vapour Deposition</i>	400° - 800°	Inserti affilati <i>Ground inserts</i>
■ MT/HT-CVD - CVD a temperatura media e alta ■ MT/HT-CVD - Medium/High temperature CVD	700° - 1100°	Inserti <i>Inserts</i>

■ A causa dell'alta temperatura di processo esiste il pericolo di fragilità dei taglienti dell'utensile

■ Due to high process temperatures there is a risk of embrittlement of cutting edges

Rivestimenti e applicazioni standard

Standard coatings and range of applications

Denominazione	Tipo rivestimento	Composizione	Struttura strati	Micro durezza HV 0,05	Massima temperatura impiego °C	Coeff. attrito u acciaio	Spessore rivestimento (µm)
<i>Description</i>	<i>Coating Class</i>	<i>Composition</i>	<i>Coating Structure</i>	<i>Micro Hardness HV 0,05</i>	<i>Maximum application temperature °C</i>	<i>Friction coefficient against steel</i>	<i>Coating Thickness (µm)</i>
A Cer-T	Supernitruro	TIALN	Monostrato	3500	900	0,4	2-4
B Cer-X	Supernitruro	TIALN	Monostrato	2700	900	0,5	2-5
C Cer-A	Supernitruro	TIALN	Monostrato	2700	900	0,5	2-5
D Cer-D	Diamante	SP3	Monostrato	10000	600	0,05	6-8
E Cer-P	Boro	TIB2	Monostrato	3500	900	0,4	1-3
F Cer-Drl	Supernitruro	TIALCN	Multistrato	3200	600	0,25	2-5
G Cer-Al	Boro	TIB2	Monostrato	3500	900	0,4	1-3
H Cer-H	Supernitruro	TIALN	Monostrato	2700	900	0,5	2-5
U Cer-CrN	Mat. duro	TiN	Monostrato	2500	520	0,4	2-5
V Cer-TiCN	Mat. duro	TiCN	Multistrato	3000	420	0,3	2-5
Z Cer-TiN	Mat. duro	TIALCN	Multistrato	3200	600	0,25	2-5

Materiali da lavorare - Confronto in base a resistenza, trazione e durezza

Workpiece materials - Comparison of tensile strength and hardness

N/mm ²	HRC	HB	Hv10
≤ 255		≤ 76	≤ 80
≤ 400		≤ 119	≤ 125
≤ 705		≤ 209	≤ 220
≤ 850	≤ 24,8	≤ 252	≤ 265
≤ 1125	≤ 35,5	≤ 333	≤ 350
≤ 1420	≤ 44,5	≤ 418	≤ 440
≤ 1630	≤ 49,1	≤ 475	≤ 500
≤ 2030	≤ 55,7	≤ 580	≤ 610
	46,1 - 60,1		437 - 700
	48,4 - 63,3		490 - 780
	54,1 - 66,4		580 - 880

Raccomandazione di applicazione di utensile in metallo duro integrale, con e senza rivestimento

Recommendation for use of carbide tools with and without coating

N/mm ²	HRC	Lime rotative Rotary burs	Frese a candela End mills	Punte Drills	Alesatori Reamers	Svasatori Countersinks
≤ 255		◇	◇	◇	◇	◇
≤ 400		◇	◇	◇	◇	◇
≤ 705		◇	□	□	◇	◇
≤ 850	≤ 24,8	◇	□	□	□	◇
≤ 1125	≤ 35,5	◇	□	□	□	◇
≤ 1420	≤ 44,5	□	▲	□	□	□
≤ 1630	≤ 49,1	□	▲	□	□	□
≤ 2030	≤ 55,7	□	▲	▲	▲	▲
	46,1 - 60,1	□	▲	▲	▲	▲
	48,4 - 63,3	▲	▲	▲	▲	▲
	54,1 - 66,4	▲	▲	▲	▲	▲

◇ Non rivestiti / *Uncoated* □ con e senza rivestimento / *with and without coating* ▲ solo con rivestimento / *with coating only*

Gli utensili in metallo duro integrale (VHM) rivestiti hanno un valore di attrito minore rispetto agli utensili non rivestiti. Nella produzione di serie sono possibili significative riduzioni di costo con gli utensili rivestiti, grazie ai parametri di taglio più elevati e ad una maggiore durata.

Coated carbide tools do have minor friction coefficient than uncoated tools.

In series production significant cost reductions are possible by using coated tools with higher cutting parameters.

Cerin produce utensili in metallo duro integrale per tutti i materiali lavorabili a macchina
Cerin manufacture solid carbide tools for almost all kind of machinable materials

Codice colori per i differenti gruppi dei materiali
Colour code for different groups of workpiece - materials

Gruppo Group A	Alluminio - Leghe d'alluminio - Leghe leggere rinforzate con fibre MMC Leghe di alluminio fucinate - Leghe di alluminio fuse Rame - Leghe di rame - Ottone - Bronzo Magnesio - Leghe di magnesio fucinate e fuse
	<i>Aluminium - Aluminium alloys - MMC Reinforced fibres light metal alloys Wrought aluminium alloys - Cast aluminium alloys Copper - Copper alloys - Brass - Bronze Magnesium - Magnesium wrought and cast alloys</i>
Gruppo Group B	Plastiche - Policarbonato - Plexiglas - GFK - CFK - AFK - Termoidurenti - Termoplastici Legno duro - Gomma dura - Materiali non ferrosi - Cartone pressato
	<i>Plastics - Polycarbonate - Plexiglass - GFK - CFK - AFK - Thermosets - Thermoplastics Hard wood - Hard rubber - Nonferrous materials - Pressed carton</i>
Gruppo Group C	Ferro dolce - Acciai da costruzione - Acciai automatici - Acciai legati - Acciai da nitrurazione Acciai per utensili - Acciai speciali - Acciai temprati
	<i>Soft iron - Construction steel - Machine steel - Alloyed steel - Nitrided steel Tool steels - Special steels - Hardened steels</i>
Gruppo Group D	Acciai resistenti alla corrosione e agli acidi - Acciai resistenti al calore Acciai inossidabili
	<i>Corrosion and acid resistant steels - Heat-resistant steels Stainless steel</i>
Gruppo Group E	Leghe di nichel/cobalto Titanio - Leghe di titanio
	<i>Nickel/Cobalt alloys Titanium - Titanium alloys</i>
Gruppo Group F	Ghisa - Ghisa malleabile - Ghisa temprata Ghisa sferoidale e vermicolare
	<i>Cast irons - Malleable cast irons - Hard cast iron Graphite for electrodes</i>
Gruppo Group G	Leghe di rame-tungsteno per elettrodi Grafite per elettrodi
	<i>Tungsten-copper alloys for electrodes Graphite for electrodes</i>

Non esitate a rivolgervi a noi se un materiale da voi lavorato non figura nell'elenco.
If any type of material processed by you is not listed, please contact us.

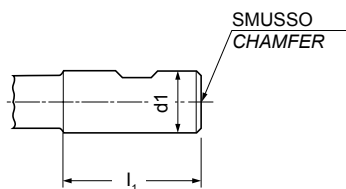
10

Versioni del gambo (per utensili di foratura e fresatura) DIN 6535

Shank design (for drilling and milling tools) DIN 6535

Gambo cilindrico liscio - Forma HA

Straight cylindrical shank - Shape HA



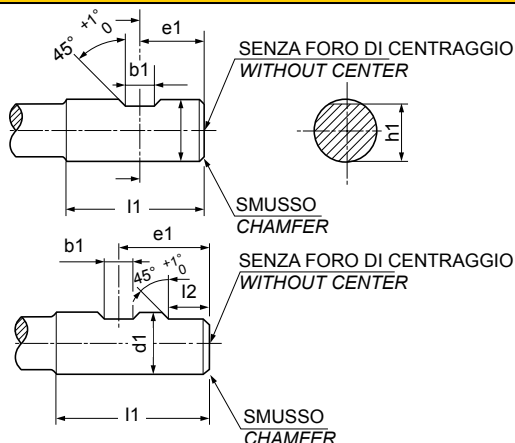
d ₁ h6	l ₁ +2	d ₁ h6	l ₁ +2	d ₁ h6	l ₁ +2
	0		0		0
2	28	8	36	18	48
3	28	10	40	20	50
4	28	12	45	25	56
5	28	14	45	32	60
6	36	16	48		

Gambo cilindrico - Forma HB (Weldon flat)

Cylindrical shank - Shape HB

con un piano Weldon di trascinamento - d₁ = da 6 a 20 mm
one Weldon flat - d₁ = 6 to 20 mm

con due piani Weldon di trascinamento - d₁ = da 25 a 32 mm
two Weldon flats - d₁ = 25 to 32 mm



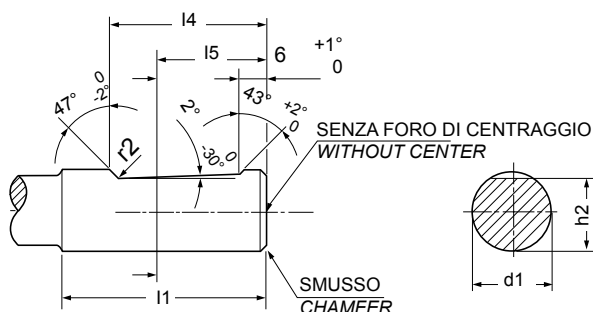
d ₁ h6	b ₁ +0,05 0	e ₁ 0 -1	h ₁ h11	l ₁ +2 0	l ₂ +1 0
6	4,2	18	5,1	36	
8	5,5	18	6,9	36	
10	7	20	8,5	40	
12	8	22,5	10,4	45	
14	8	22,5	12,7	45	
16	10	24	14,2	48	
18	10	24	16,2	48	
20	11	25	18,2	50	
25	12	32	23	56	17
32	14	36	32	60	19

Gambo cilindrico - Forma HE (Witzle-Notch)

Cylindrical shank - Shape HE

con un piano di serraggio inclinato - d₁ = da 6 a 20 mm
one slope flat - d₁ = 6 to 20 mm

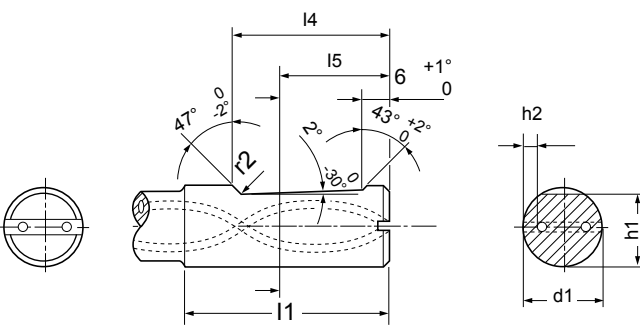
con un piano di serraggio inclinato - d₁ = da 25 a 32 mm
one slope flat - d₁ = 25 to 32 mm



d ₁ h6	(b ₂)	(b ₃)	h ₂ h11	(h ₃)	l ₁ +2 0	l ₄ 0 -1	l ₅ Nenn- maß	r ₂ min.
6	4,3		5,1		36	25	18	1,2
8	5,5		6,9		36	25	18	1,2
10	7,1		8,5		40	28	20	1,2
12	8,2		10,4		45	33	22,5	1,2
14	8,1		12,7		45	33	22,5	1,2
16	10,1		14,2		48	36	24	1,6
18	10,8		16,2		48	36	24	1,6
20	11,4		18,2		50	38	25	1,6
25	13,8	9,3	23,0	24,1	56	44	32	1,6
32	15,5	9,9	30,0	31,2	60	48	35	1,6

Misura nominale
Nominal size

Versioni del gambo (per utensili di foratura e fresatura) simile a DIN 6535
Shank design (for drilling and milling tools) similar to DIN 6535

Gambo cilindrico - Forma HEK Cylindrical shank - Shape HEK							
con un piano di serraggio inclinato - d1 = da 6 a 20 mm one slope flat - d ₁ = 6 to 20 mm							
con un piano di serraggio inclinato - d1 = da 25 a 32 mm one slope flat - d ₁ = 25 to 32 mm							
	d ₁ h6	l ₁ +2 0	l ₄ 0 -1	l ₅ Misura nominale	h ₁ h11	r ₂	h ₂ min.
	6	36	25	18	5,3	1,2	1,3
	8	36	25	18	7,1	1,2	1,5
	10	40	28	20	8,9	1,2	1,8
	12	45	33	22,5	10,9	1,2	2,0
	14	45	33	22,5	12,4	1,2	2,5
	16	48	36	24	14,5	1,6	2,5
	18	48	36	24	16,2	1,6	2,8
	20	50	38	25	18,2	1,6	3
	25	56	44	32	23	1,6	3,7
	32	60	48	35	30	1,6	4,5

Misura nominale
Nominal size

Versione del gambo con penna di trascinamento DIN 1809
Shank with drive tenon DIN 1809

d ₁		b	l	r	v
da/ from	a/ up to	h12	$\pm IT16^1$		
3	3,5	1,6	2,2	0,2	0,05
3,5	4	2	2,2	0,2	0,05
4	4,5	2,2	2,5	0,2	0,05
4,5	5,5	2,5	2,5	0,2	0,05
5,5	6,5	3	3	0,2	0,05
6,5	8	3,5	3,5	0,2	0,06
8	9,5	4,5	4,5	0,4	0,06
9,5	11	5	5	0,4	0,06
11	13	6	6	0,4	0,06
13	15	7	7	0,4	0,08
15	18	8	8	0,4	0,08
18	21	10	10	0,4	0,08
21	24	11	11	0,6	0,10
24	27	13	13	0,6	0,10
27	30	14	14	0,6	0,10
30	34	16	16	0,6	0,10
34	38	18	18	0,6	0,10
38	42	20	19	0,6	0,15
42	46	22	20	1,0	0,15
46	50	24	22	1,0	0,15



Lime rotative
Rotary burs

UTENSILI - GRUPPO 1 TOOL - GROUP 1

LIME ROTATIVE STANDARD / STANDARD ROTARY BURS

Forma Shape	Dimensioni gambo Shank dimensions	N° ident. Code	Pagina Page	
ZYA Cilindrica senza tagliente frontale <i>Cylindrical without end cut</i>	Ø 3,00 mm Standard / <i>Standard</i> Lungh. gambo / <i>Shank length</i> 100 mm Lungh. gambo / <i>Shank length</i> 150 mm Lungh. gambo / <i>Shank length</i> 300 mm	40 30 30-100 30-150 30-300	41 41 55 57 59	
ZYA/ST Cilindrica con tagliente frontale <i>Cylindrical with end cut</i>	Ø 3,00 mm Standard / <i>Standard</i> Lungh. gambo / <i>Shank length</i> 100 mm Lungh. gambo / <i>Shank length</i> 150 mm Lungh. gambo / <i>Shank length</i> 300 mm	40-ST 30-ST 30-ST100 30-ST150 30-ST300	42 42 55 57 59	 
WRC Cilindrica a testa raggiata <i>Cylindrical radius end</i>	Ø 3,00 mm Standard / <i>Standard</i> Lungh. gambo / <i>Shank length</i> 100 mm Lungh. gambo / <i>Shank length</i> 150 mm Lungh. gambo / <i>Shank length</i> 300 mm	41 31 31-100 31-150 31-300	43 43 55 57 59	
KEL Conica a testa raggiata <i>Taper radius end</i>	Ø 3,00 mm Standard / <i>Standard</i> Lungh. gambo / <i>Shank length</i> 100 mm Lungh. gambo / <i>Shank length</i> 150 mm Lungh. gambo / <i>Shank length</i> 300 mm	42 32 32-100 32-150 32-300	44 44 55 57 59	
RBF Ad ogiva a testa raggiata <i>Tree with radius end</i>	Ø 3,00 mm Standard / <i>Standard</i> Lungh. gambo / <i>Shank length</i> 100 mm Lungh. gambo / <i>Shank length</i> 150 mm Lungh. gambo / <i>Shank length</i> 300 mm	43 33 33-100 33-150 33-300	45 45 56 58 60	
SPG Ad ogiva con vertice a spigolo <i>Tree with pointed end</i>	Ø 3,00 mm Standard / <i>Standard</i> Lungh. gambo / <i>Shank length</i> 100 mm Lungh. gambo / <i>Shank length</i> 150 mm Lungh. gambo / <i>Shank length</i> 300 mm	44 34 34-100 34-150 34-300	46 46 56 58 60	
SKM Conica <i>Conical</i>	Ø 3,00 mm Standard / <i>Standard</i>	45 35	47 47	
KSK-90° Conica a 90° <i>90° Conical</i>	Ø 3,00 mm Standard / <i>Standard</i>	46-90° 36-90°	48 48	

01

UTENSILI - GRUPPO 1

TOOL - GROUP 1

LIME ROTATIVE STANDARD / STANDARD ROTARY BURS

Forma Shape	Dimensioni gambo Shank dimensions	N° ident. Code	Pagina Page	
KSJ-60° Conica a 60° 60° Conical	Ø 3,00 mm	46-60°	49	
	Standard / Standard	36-60°	49	
TRE Ovale Oval	Ø 3,00 mm	47	50	
	Standard / Standard	37	50	
	Lungh. gambo / Shank length 100 mm	37-100	56	
	Lungh. gambo / Shank length 150 mm	37-150	58	
	Lungh. gambo / Shank length 300 mm	37-300	60	
KUD Sferica Ball	Ø 3,00 mm	48	51	
	Standard / Standard	38	51	
	Lungh. gambo / Shank length 100 mm	38-100	56	
	Lungh. gambo / Shank length 150 mm	38-150	58	
	Lungh. gambo / Shank length 300 mm	38-300	60	
WKN Tronco-conica Inverted cone without end cut	Ø 3,00 mm	49	52	
	Standard / Standard	39	52	
WKN/ST Tronco-conica con tagliente al centro Inverted cone with end cut	Ø 3,00 mm	49-ST	53	
	Standard / Standard	39-ST	53	

01

SET E ACCESSORI / SETS & ACCESSORIES

Forma Shape	Dimensioni gambo Shank dimensions	N° ident. Code	Pagina Page	
Set Sets	Nr. 10	10	54	
	Nr. 11	11	54	
	Nr. 12	12	54	
Smerigliatrice pneumatica Air grinding unit	Nr. 13	13	54	

LIME PER STAMPI E MATRICI - WN / MOULD, TOOL AND DIE MAKING ROTARY BURS - INTERNAL STANDARD

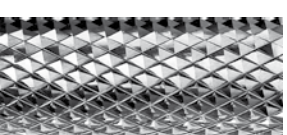
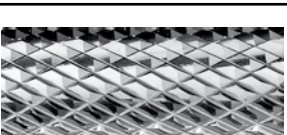
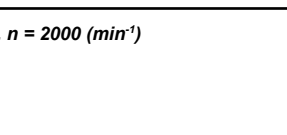
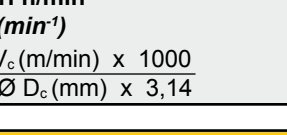
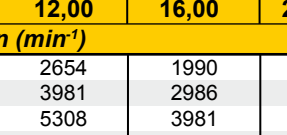
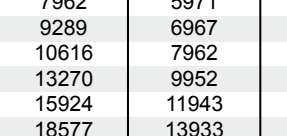
Forma Shape	Dimensioni gambo Shank dimensions	N° ident.. Code	Pagina Page	
Cilindrica Cylindrical	Tagliente tipo 4 Cut type	40ST-4	61-62	
Cilindrica Cylindrical	Tagliente tipo 6 Cut type	40ST-6	61-62	

LIME ROTATIVE SPECIALI - WN / SPECIAL ROTARY BURS - INTERNAL STANDARD

Forma Shape	Dimensioni gambo Shank dimensions	N° ident.. Code	Pagina Page	
Lime per canalini Groove cutters	WN - 6,00 mm Internal standard	114-90°	63	
Lime a disco raggiate Radius groove cutters	WN - 6,00 mm Norma interna 6,00 mm Internal standard 6,00 mm	115	64	
Lime a disco cilindriche Disc cutters	WN - 6,00 mm Norma interna 6,00 mm Internal standard 6,00 mm	116	64	

Velocità di taglio (valori approssimativi) per lime rotative Cerin

Cutting speeds (approximative values) for Cerin rotary burs

Materiale Material	VHM V _c (m/min)	Cer-T V _c (m/min)	Tipo tagliente Cut type	
< 400 N/mm ²	800 - 1000	800 - 1000	Tagliente tipo 1 Cut type 1	
< 705 N/mm ²	600 - 800	800 - 1000		
Titanio e leghe di titanio Titan Titanlegierungen	max n = 2000 (min ⁻¹)			①
< 400 N/mm ²	650 - 800	650 - 1000	Tagliente tipo 2 Cut type 2	
< 850 N/mm ²	500 - 650	600 - 800		
Titanio e leghe di titanio Titan Titanlegierungen	max n = 2000 (min ⁻¹)			②
< 705 N/mm ²	500 - 650	600 - 800	Tagliente tipo 3 Cut type 3	
< 1125 N/mm ²	400 - 500	400 - 600		
< 46 HRC	200 - 450	300 - 500		
Titanio e leghe di titanio Titan Titanlegierungen	max n = 2000 (min ⁻¹)			
< 850 N/mm ²	450 - 650	500 - 750	Tagliente tipo 4 Cut type 4	
< 1125 N/mm ²	350 - 500	400 - 600		
< 46 HRC	250 - 350	250 - 500		
< 418 HB	200 - 350	300 - 450		
Titan Titanlegierungen	max n = 2000 (min ⁻¹)			④
< 1125 N/mm ²	350 - 600	400 - 600	Tagliente tipo 5 Cut type 5	
< 1450 N/mm ²	250 - 300	250 - 400		
< 2050 N/mm ²	150 - 250	150 - 300		
< 66HRC	150 - 300	200 - 400		
Titan Titanlegierungen	max n = 2000 (min ⁻¹)			⑤
< 705 N/mm ²	500 - 650	600 - 800	Tagliente tipo 6 Cut type 6	
< 1125 N/mm ²	300 - 500	400 - 600		
< 46 HRC	200 - 450	300 - 500		
Titanio e leghe di titanio Titan Titanlegierungen	max n = 2000 (min ⁻¹)			

* Attenzione! Titanio e leghe di titanio max. n = 2000 (giri/min⁻¹) * Attention! Titanium and Titanium alloys max. n = 2000 (min⁻¹)

Velocità di taglio V_c (m/min) - Numero di giri n (min⁻¹)

Cutting speeds V_c (m/min) - Revolution per minute n (min⁻¹)

Formule di calcolo: Velocità di taglio V_c (m/min) - Numero di giri n/min

Formula: cutting speed V_c (m/min) - Revolution per minute n (min⁻¹)

$$V_c \text{ (m/min)} = \frac{\varnothing D_c \text{ (mm)} \times 3,14 \times n \text{ (min}^{-1}\text{)}}{1000}$$

$$n \text{ (min}^{-1}\text{)} = \frac{V_c \text{ (m/min)} \times 1000}{\varnothing D_c \text{ (mm)} \times 3,14}$$

V _c (m/min)	D _c (mm)								
	3,00	4,00	5,00	6,00	8,00	10,00	12,00	16,00	20,00
Numero giri n (min ⁻¹) / Revolution per minute n (min ⁻¹)									
100	10616	7962	6369	5308	3981	3185	2654	1990	1592
150	15924	11943	9554	7962	5971	4777	3981	2986	2389
200	21231	15924	12739	10616	7962	6369	5308	3981	3185
250	26539	19904	15924	13270	9952	7962	6635	4976	3981
300	31847	23885	19108	15924	11943	9554	7962	5971	4777
350	37155	27866	22293	18577	13933	11146	9289	6967	5573
400	42463	31847	25478	21231	15924	12739	10616	7962	6369
500	53079	39809	31847	26539	19904	15924	13270	9952	7962
600	63694	47771	38217	31847	23885	19108	15924	11943	9554
700	74310	55732	44586	37155	27866	22293	18577	13933	11146
800	84926	63694	50955	42463	31847	25478	21231	15924	12739
900	95541	71656	57325	47771	35828	28662	23885	17914	14331
1000	106157	79618	63694	53079	39809	31847	26539	19904	15924

* Attenzione! Titanio e leghe di titanio max. n = 2000 (min⁻¹)

* Attention! Titanium and Titanium alloys max. n = 2000 (min⁻¹)

Tipologie taglienti per lime rotative Cerin

Cut types of Cerin rotary burs

Tagliente tipo 1 - Alluminio

Cut type 1 - Aluminium



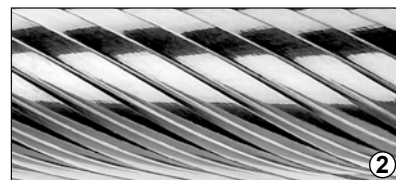
Particolarmente indicata per alluminio, magnesio, plastiche e gomma dura.

Buona efficienza di taglio ed elevata asportazione di materiale. Lo speciale disegno della geometria di questo tagliente facilita l'evacuazione del truciolo, impedendo l'intasamento dell'utensile.

Particularly suitable for working on aluminium, magnesium, plastic, and hard rubber. Gives high cutter efficiency, with good removal of material. The specific features of this type of cut facilitate rapid removal of chips preventing these from clogging the tool.

Tagliente tipo 2 - Grossa

Cut type 2 - Course

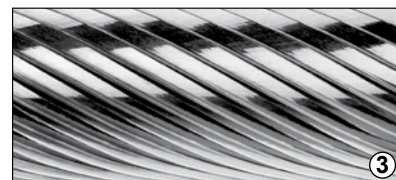


Tagliente intermedio fra la 1 e la 3. Particolarmente indicata per metalli leggeri, bronzo, ottone, stagno, zinco, rame e altri materiali facilmente lavorabili. Per i materiali a truciolo lungo questa dentatura deve essere impiegata con scanalature rompitruciolo.

This type of cut is intermediate between cut 1 and cut 3 and it is recommended for soft materials, bronze, brass, tin, zinc, copper and other easily removable materials. For long chipping material this cut should be used with chip breaker.

Tagliente tipo 3 - Media / standard

Cut type 3 - Medium

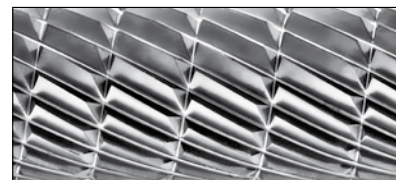


Il tagliente standard è idoneo per acciaio (anche temperato) fino a circa 56 HRC, acciaio fuso, leghe d'acciaio, cordoni di saldatura e quasi tutti i materiali metallici. Questo utensile permette di ottenere risultati ottimali e superfici di buona qualità.

Standard cut. Suitable for steel (including tempered) cast steel, weld seams, and in general almost all metallic materials. Together with optimum efficiency, it gives a good surface finish.

Rompitruciolo

Chip breaker



L'uso del rompitruciolo è consigliato per materiali a truciolo lungo, per poter produrre trucioli corti. Tutti gli utensili con le dentature 1-2-3 e 5 possono essere forniti con rompitruciolo, su richiesta e con una piccola maggiorazione di prezzo.

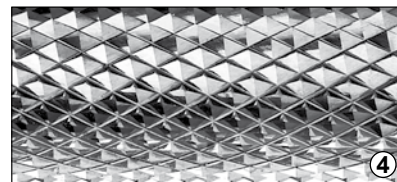
This can be executed on all single cut file cutters. Use is recommended for working of materials which produce long chips. Upon request, Cerin rotary burs with cut type 1-2-3 and 5 can be supplied with chip breaker with a small additional price.

Tipologie taglienti per lime rotative Cerin

Cut types of Cerin rotary burs

Tagliente tipo 4 - Diamante

Cut type 4 - Diamond

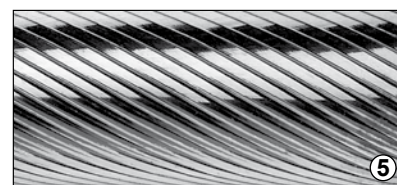


Tagliente idoneo per ghisa grigia, acciai altamente legati, acciai inossidabili, al nichel-cromo e al manganese. La speciale geometria del tagliente consente un'elevata penetrazione nel materiale con una maggiore capacità di asportazione di un tagliente standard. Evita la formazione di trucioli veri e propri, polverizzando il materiale rimosso, permettendo così di lavorare senza problemi.

Recommended for high alloy steel, stainless steel, magnesium alloys, grey cast iron and CrNi steels. Its particular geometry allows considerable material penetration with a removal capacity greater than the standard cut. It avoids the formation of true proper chips pulverising the removed material and thus avoiding the associated disadvantage for the operator during working.

Tagliente tipo 5 - Fine

Cut type 5 - Fine

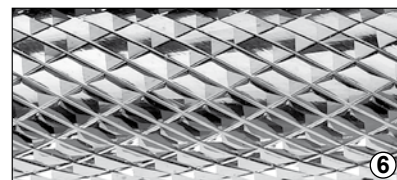


Tagliente consigliato per lavorazioni di acciai temprati fino a 66 HRC e per ottenere elevate finiture superficiali.

Fine cut. Particularly suitable for tempered steel up to 66 HRC and for obtaining high surface finish.

Tagliente tipo 6 - Doppio taglio incrociato

Cut type 6 - Double cut

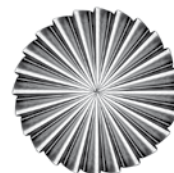


Tagliente universale per quasi tutti i materiali metallici, anche per acciai temprati e resistenti alla corrosione. Riduce le vibrazioni permettendo un miglior controllo del taglio durante la lavorazione. Elevata capacità di taglio con finiture di ottima qualità.

Universal cut suitable for working on almost metallic materials, including tempered steels and corrosion resistant material. Reduces vibration and gives a better control of the cutter during working. Considerable removal capacity with good surface finish.

Tagliente frontale

Frontal teeth



Le lime rotative Cerin tipo 30 e 39 possono essere fornite su richiesta con dentatura frontale.

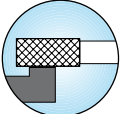
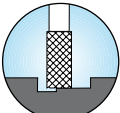
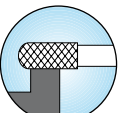
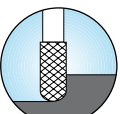
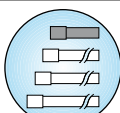
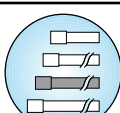
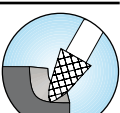
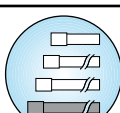
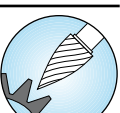
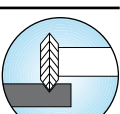
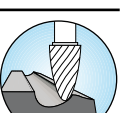
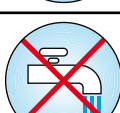
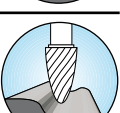
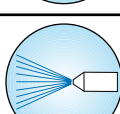
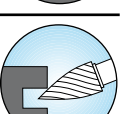
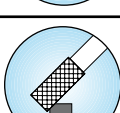
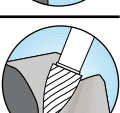
Si consigliano quando devono essere effettuate delle leggere asportazioni di testa.

Cerin rotary burs type 30 and 39 can be supplied with end cut upon request.

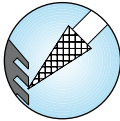
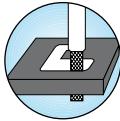
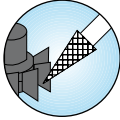
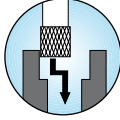
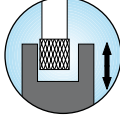
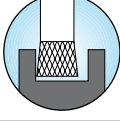
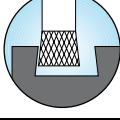
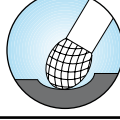
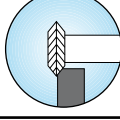
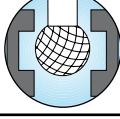
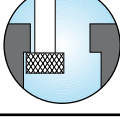
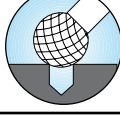
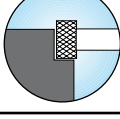
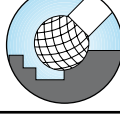
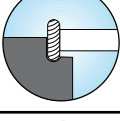
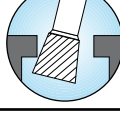
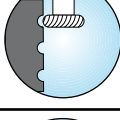
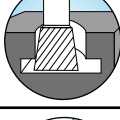
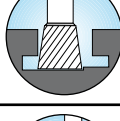
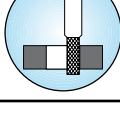
Used if frontal material has to be removed.

DESCRIZIONE DEI PITTOGRAMMI (SIMBOLI) ICONS (SYMBOLS) DESCRIPTION

01

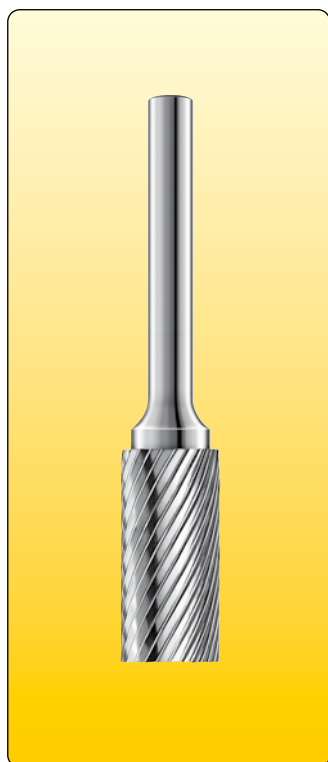
Qualità metallo duro <i>Carbide grade</i>		Esempio di lavorazione <i>Application example</i>	
Qualità metallo duro <i>Carbide grade</i>		Esempio di lavorazione <i>Application example</i>	
Dimensioni simili a DIN 8033 <i>Dimensions similar to DIN 8033</i>		Esempio di lavorazione <i>Application example</i>	
Norma interna (WN) <i>Internal standard (WN)</i>		Esempio di lavorazione <i>Application example</i>	
Lunghezza utensile <i>Tool length</i>		Esempio di lavorazione <i>Application example</i>	
Lunghezza utensile <i>Tool length</i>		Esempio di lavorazione <i>Application example</i>	
Lunghezza utensile <i>Tool length</i>		Esempio di lavorazione <i>Application example</i>	
Lunghezza utensile <i>Tool length</i>		Esempio di lavorazione <i>Application example</i>	
Attenzione! Riduzione velocità di taglio <i>Attention! Reduced cutting speed</i>		Esempio di lavorazione <i>Application example</i>	
Con emulsione <i>With emulsion</i>		Esempio di lavorazione <i>Application example</i>	
Lavorazione a secco <i>Dry machining</i>		Esempio di lavorazione <i>Application example</i>	
Con aria <i>With compressed air</i>		Esempio di lavorazione <i>Application example</i>	
Esempio di lavorazione <i>Application example</i>		Esempio di lavorazione <i>Application example</i>	

DESCRIZIONE DEI PITTOGRAMMI (SIMBOLI) ICONS (SYMBOLS) DESCRIPTION

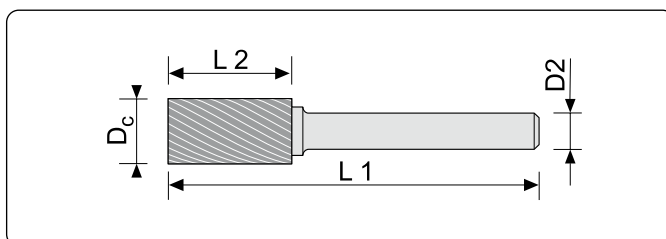
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Esempio di lavorazione <i>Application example</i>		Esempio di lavorazione <i>Application example</i>	
Esempio di lavorazione <i>Application example</i>		Esempio di lavorazione <i>Application example</i>	
Esempio di lavorazione <i>Application example</i>		Esempio di lavorazione <i>Application example</i>	
Esempio di lavorazione <i>Application example</i>		Esempio di lavorazione <i>Application example</i>	
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Esempio di lavorazione <i>Application example</i>		Esempio di lavorazione <i>Application example</i>	
Esempio di lavorazione <i>Application example</i>		Esempio di lavorazione <i>Application example</i>	
Esempio di lavorazione <i>Application example</i>			
Esempio di lavorazione <i>Application example</i>			

01

Forma ZYA - cilindrica senza tagliente frontale Shape ZYA - Cylindrical without end cut



Disponibile su richiesta anche con rivestimento Cer-T
Cer-T coating upon request



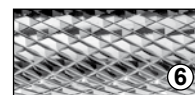
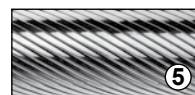
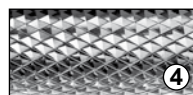
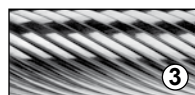
1.
01



D _c	L2	L1	D2	Tagliente tipo / Cut type						40	30
				1	2	3	4	5	6		
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2	10	40	3,00	-	●	●	●	●	●	4020/...	
2,5	12	40	3,00	-	●	●	●	●	●	4025/...	
3	13	40	3,00	-	●	●	●	●	●	4033/...	
4	10	45	3,00	-	●	●	●	●	●	4043/...	
5	12	47	3,00	-	●	●	●	●	●	4053/...	
6	13	48	3,00	-	●	●	●	●	●	4063/...	
4	13	50	6,00	●	●	●	●	●	●		300406/...
6	16	50	6,00	●	●	●	●	●	●		300606/...
8	20	65	6,00	●	●	●	●	●	●		300806/...
10	20	65	6,00	●	●	●	●	●	●		301006/...
12	25	70	6,00	●	●	●	●	●	●		301206/...
16	25	70	6,00	●	●	●	●	●	●		301606/...
16	25	70	8,00	●	●	●	●	●	●		301608/...
20	25	70	6,00	●	●	●	●	●	●		302006/...
20	25	70	8,00	●	●	●	●	●	●		302008/...

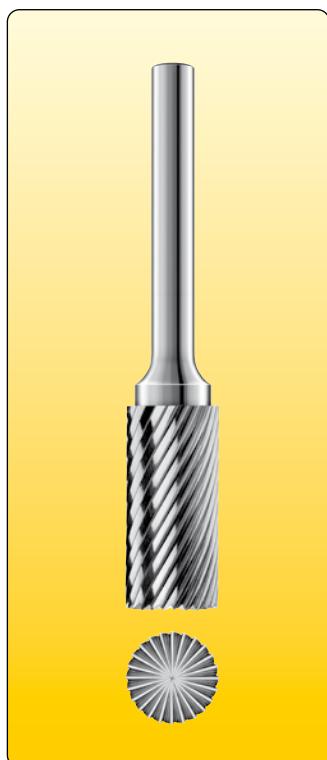
... Indicare sempre la tipologia del tagliente (per esempio: 2015/4)

... Please always indicate cut type (example: 2015/4)

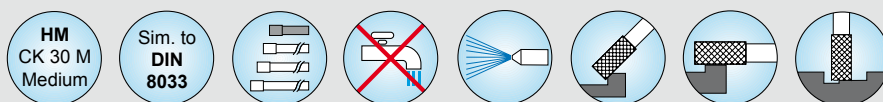
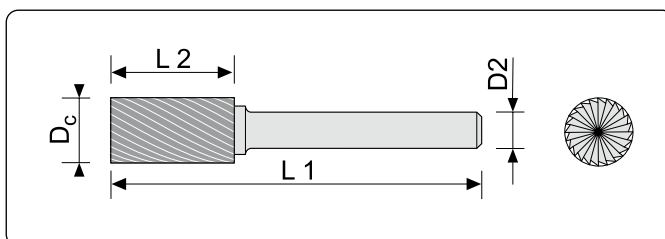


Forma ZYA/ST - cilindrica con tagliente frontale Shape ZYA/ST - Cylindrical with end cut

1.
01



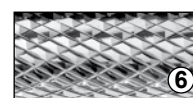
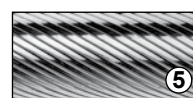
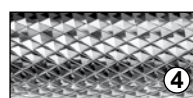
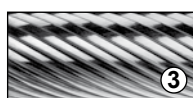
Disponibile su richiesta anche con rivestimento Cer-T
Cer-T coating upon request



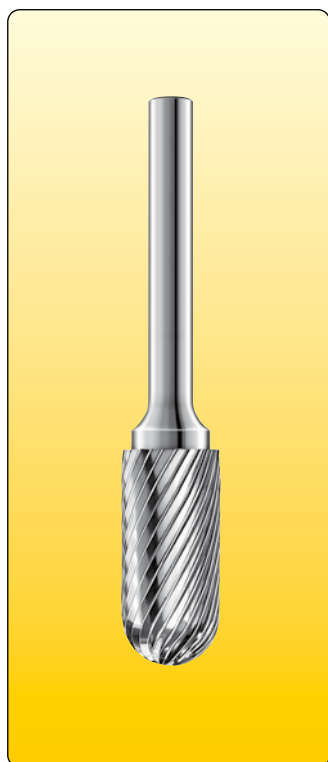
D _c	L2	L1	D2	Tagliente tipo / Cut type						40-ST	30-ST
				1	2	3	4	5	6		
1,5	8	40	3,00	-	●	●	●	●	●	4015/...ST	
2	10	40	3,00	-	●	●	●	●	●	4020/...ST	
2,5	12	40	3,00	-	●	●	●	●	●	4025/...ST	
3	13	40	3,00	-	●	●	●	●	●	4033/...ST	
4	10	45	3,00	-	●	●	●	●	●	4043/...ST	
5	12	47	3,00	-	●	●	●	●	●	4053/...ST	
6	13	48	3,00	-	●	●	●	●	●	4063/...ST	
4	13	50	6,00	●	●	●	●	●	●		300406/...ST
6	16	50	6,00	●	●	●	●	●	●		300606/...ST
8	20	65	6,00	●	●	●	●	●	●		300806/...ST
10	20	65	6,00	●	●	●	●	●	●		301006/...ST
12	25	70	6,00	●	●	●	●	●	●		301206/...ST
16	25	70	6,00	●	●	●	●	●	●		301606/...ST
16	25	70	8,00	●	●	●	●	●	●		301608/...ST
20	25	70	6,00	●	●	●	●	●	●		302006/...ST
20	25	70	8,00	●	●	●	●	●	●		302008/...ST

... Indicare sempre la tipologia del tagliente (per esempio: 2015/4)

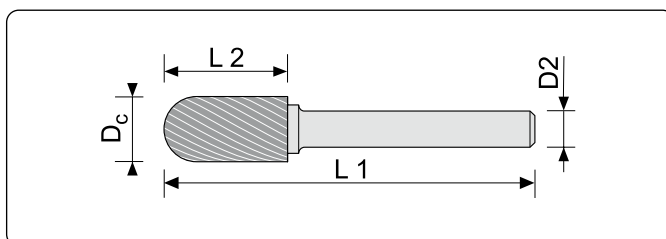
... Please always indicate cut type (example: 2015/4)



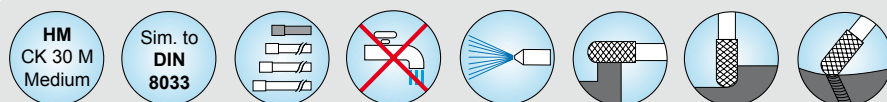
Forma WRC - cilindrica a testa raggiata Shape WRC - Cylindrical radius end



Disponibile su richiesta anche con rivestimento Cer-T
Cer-T coating upon request



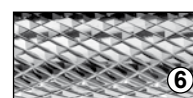
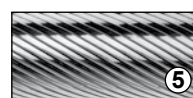
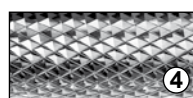
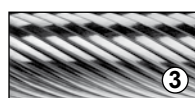
1.
01



D _c	L2	L1	D2	Tagliente tipo / Cut type						41	31
				1	2	3	4	5	6		
1,5	8	40	3,00	-	●	●	●	●	●	4115/...	
2	10	40	3,00	-	●	●	●	●	●	4120/...	
2,5	12	40	3,00	-	●	●	●	●	●	4125/...	
3	13	40	3,00	-	●	●	●	●	●	4133/...	
4	10	45	3,00	-	●	●	●	●	●	4143/...	
5	12	47	3,00	-	●	●	●	●	●	4153/...	
6	13	48	3,00	-	●	●	●	●	●	4163/...	
4	13	50	6,00	●	●	●	●	●	●		310406/...
6	16	50	6,00	●	●	●	●	●	●		310606/...
8	20	65	6,00	●	●	●	●	●	●		310806/...
10	20	65	6,00	●	●	●	●	●	●		311006/...
12	25	70	6,00	●	●	●	●	●	●		311206/...
16	25	70	6,00	●	●	●	●	●	●		311606/...
16	25	70	8,00	●	●	●	●	●	●		311608/...
20	25	70	6,00	●	●	●	●	●	●		312006/...
20	25	70	8,00	●	●	●	●	●	●		312008/...

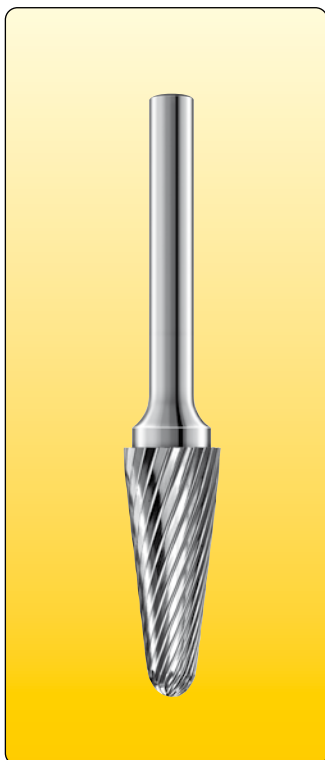
... Indicare sempre la tipologia del tagliente (per esempio: 2015/4)

... Please always indicate cut type (example: 2015/4)

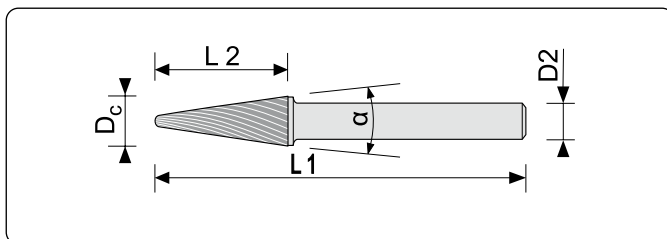


Forma KEL - conica a testa raggiata Shape KEL - Taper radius end

1.
01



Disponibile su richiesta anche con rivestimento Cer-T
Cer-T coating upon request



HM
CK 30 M
Medium

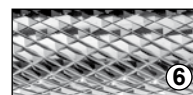
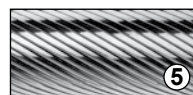
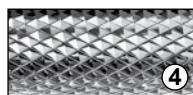
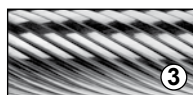
Sim. to
DIN
8033



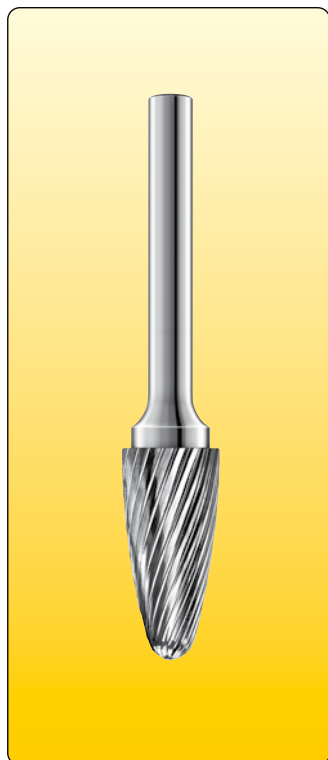
D _c	L2	L1	D2	R	α	Tagliente tipo / Cut type						42	32
						1	2	3	4	5	6		
3	14	40	3,00	1	6°	-	●	●	●	●	●	4233/...	
4	14	49	3,00	1	10°	-	●	●	●	●	●	4243/...	
5	16	51	3,00	1,5	10°	-	●	●	●	●	●	4253/...	
6	20	55	3,00	1,5	10°	-	●	●	●	●	●	4263/...	
4	14	50	6,00	1	10°	●	●	●	●	●	●		320406/...
6	20	50	6,00	1,5	10°	●	●	●	●	●	●		320606/...
8	20	65	6,00	1,5	14°	●	●	●	●	●	●		320806/...
10	20	65	6,00	2,9	14°	●	●	●	●	●	●		321006/...
12	30	75	6,00	2,6	14°	●	●	●	●	●	●		321206/...
16	30	75	6,00	4,8	14°	●	●	●	●	●	●		321606/...
16	30	75	8,00	4,8	14°	●	●	●	●	●	●		321608/...
20	42	87	6,00	5,9	14°	●	●	●	●	●	●		322006/...
20	42	87	8,00	5,9	14°	●	●	●	●	●	●		322008/...

... Indicare sempre la tipologia del tagliente (per esempio: 2015/4)

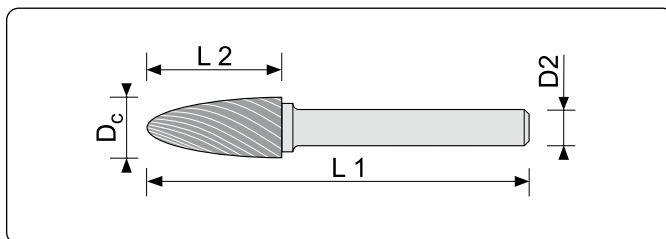
... Please always indicate cut type (example: 2015/4)



Forma RBF - ogiva a testa raggiata Shape RBF - Tree with radius end



Disponibile su richiesta anche con rivestimento Cer-T
Cer-T coating upon request



1.
01

HM
CK 30 M
Medium

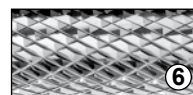
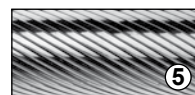
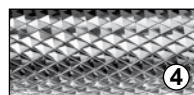
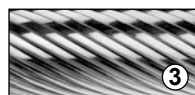
Sim. to
DIN
8033



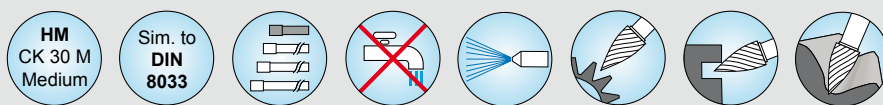
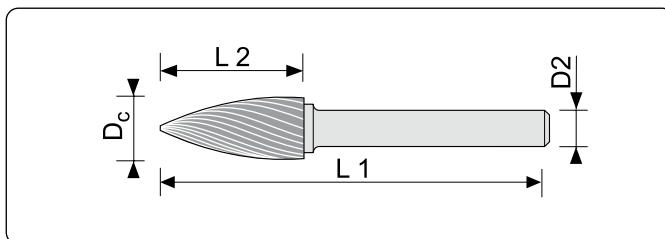
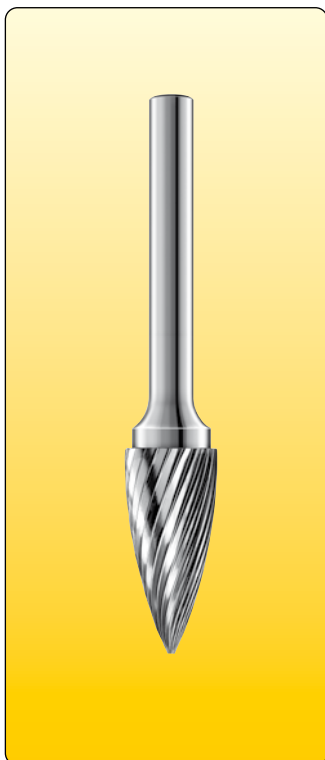
D _c	L2	L1	D2	R~	Tagliente tipo / Cut type						43	33
					1	2	3	4	5	6		
3	13	40	3,00	0,8	-	●	●	●	●	●	4333/...	
4	10	45	3,00	1	-	●	●	●	●	●	4343/...	
5	12	47	3,00	1,2	-	●	●	●	●	●	4353/...	
6	13	48	3,00	1,4	-	●	●	●	●	●	4363/...	
4	14	50	6,00	1	●	●	●	●	●	●		330406/...
6	18	50	6,00	1,5	●	●	●	●	●	●		330606/...
8	20	65	6,00	1,8	●	●	●	●	●	●		330806/...
10	20	65	6,00	2,5	●	●	●	●	●	●		331006/...
12	25	70	6,00	2,5	●	●	●	●	●	●		331206/...
16	30	75	6,00	3,6	●	●	●	●	●	●		331606/...
16	30	75	8,00	3,6	●	●	●	●	●	●		331608/...
20	35	80	6,00	5	●	●	●	●	●	●		332006/...
20	35	80	8,00	5	●	●	●	●	●	●		332008/...

... Indicare sempre la tipologia del tagliente (per esempio: 2015/4)

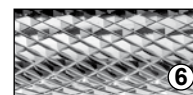
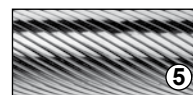
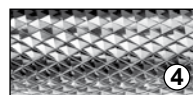
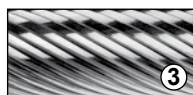
... Please always indicate cut type (example: 2015/4)



Disponibile su richiesta anche con rivestimento Cer-T
Cer-T coating upon request

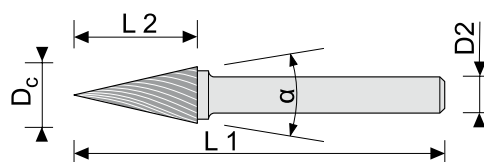
[illegible]

... Please always indicate cut type (example: 2015/4)



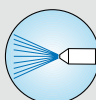
Forma SKM - conica Shape SKM - Conical

Disponibile su richiesta anche con rivestimento Cer-T
Cer-T coating upon request



HM
CK 30 M
Medium

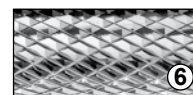
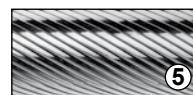
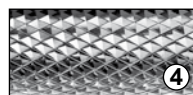
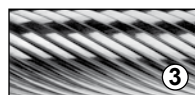
Sim. to
DIN
8033



D _c	L2	L1	D2	Tagliente tipo / Cut type						45	35
				1	2	3	4	5	6		
3	11	40	3,00	-	●	●	●	●	●	4533/...	
4	10	45	3,00	-	●	●	●	●	●	4543/...	
5	12	47	3,00	-	●	●	●	●	●	4553/...	
6	13	48	3,00	-	●	●	●	●	●	4563/...	
4	14	50	6,00	●	●	●	●	●	●		350406/...
6	18	50	6,00	●	●	●	●	●	●		350606/...
8	20	65	6,00	●	●	●	●	●	●		350806/...
10	20	65	6,00	●	●	●	●	●	●		351006/...
12	25	70	6,00	●	●	●	●	●	●		351206/...
16	25	70	6,00	●	●	●	●	●	●		351606/...
16	25	70	8,00	●	●	●	●	●	●		351608/...
20	24	69	6,00	●	●	●	●	●	●		352006/...
20	24	69	8,00	●	●	●	●	●	●		352008/...

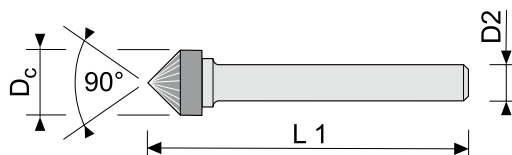
... Indicare sempre la tipologia del tagliente (per esempio: 2015/4)

... Please always indicate cut type (example: 2015/4)

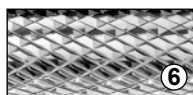


Disponibile su richiesta anche con rivestimento Cer-T
Cer-T coating upon request

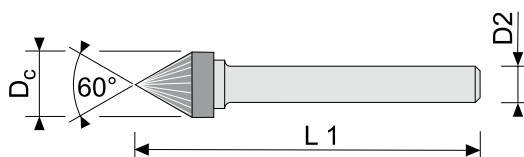
1.01



... Indicare sempre la tipologia del tagliante (per esempio: 2015/4)
... Please always indicate cut type (example: 2015/4)



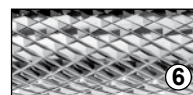
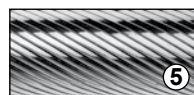
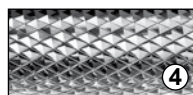
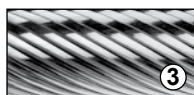
Disponibile su richiesta anche con rivestimento Cer-T
Cer-T coating upon request



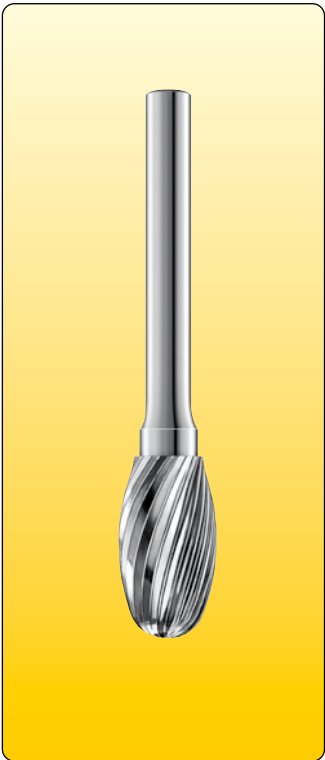
1.01

[illegible]

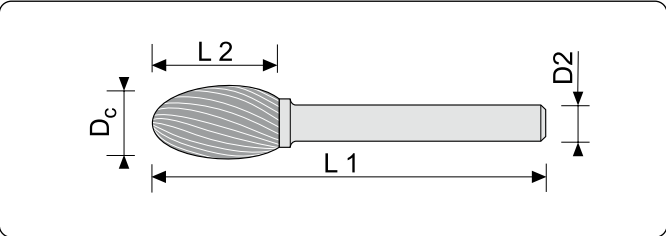
... Please always indicate cut type (example: 2015/4)



Forma TRE - ovale
Shape TRE - Oval



Disponibile su richiesta anche con rivestimento Cer-T
Cer-T coating upon request



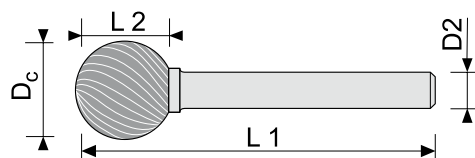
D _c	L2	L1	D2	R	Tagliente tipo / Cut type						47	37
					1	2	3	4	5	6		
3	7	40	3,00	1,2	-	●	●	●	●	●	4733/...	
4	7	42	3,00	1,5	-	●	●	●	●	●	4743/...	
5	8	43	3,00	2	-	●	●	●	●	●	4753/...	
6	10	45	3,00	2,8	-	●	●	●	●	●	4763/...	
4	7	50	6,00	1,5	●	●	●	●	●	●		370406/...
6	10	50	6,00	2,8	●	●	●	●	●	●		370606/...
8	13	58	6,00	3,7	●	●	●	●	●	●		370806/...
10	16	61	6,00	4	●	●	●	●	●	●		371006/...
12	20	65	6,00	5	●	●	●	●	●	●		371206/...
16	25	70	6,00	6,5	●	●	●	●	●	●		371606/...
16	25	70	8,00	6,5	●	●	●	●	●	●		371608/...
20	25	70	6,00	9	●	●	●	●	●	●		372006/...
20	25	70	8,00	9	●	●	●	●	●	●		372008/...

... Indicare sempre la tipologia del tagliente (per esempio: 2015/**4**)
... Please always indicate cut type (example: 2015/**4**)



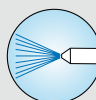
Forma KUD - sferica Shape KUD - Ball

Disponibile su richiesta anche con rivestimento Cer-T
Cer-T coating upon request



HM
CK 30 M
Medium

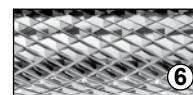
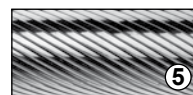
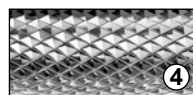
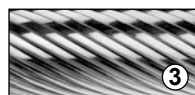
Sim. to
DIN
8033



D _c	L2	L1	D2	Tagliente tipo / Cut type						48	38
				1	2	3	4	5	6		
1,5	1,35	40	3,00	-	●	●	●	●	●	4815/...	
2	1,8	40	3,00	-	●	●	●	●	●	4820/...	
2,5	2,2	40	3,00	-	●	●	●	●	●	4825/...	
3	2,7	40	3,00	-	●	●	●	●	●	4833/...	
4	3,6	38,5	3,00	-	●	●	●	●	●	4843/...	
5	4,5	39,5	3,00	-	●	●	●	●	●	4853/...	
6	5,4	40,4	3,00	-	●	●	●	●	●	4863/...	
4	3,6	50	6,00	●	●	●	●	●	●		380406/...
6	5	50	6,00	●	●	●	●	●	●		380606/...
8	7,2	52,2	6,00	●	●	●	●	●	●		380806/...
10	9	54	6,00	●	●	●	●	●	●		381006/...
12	10,8	55,8	6,00	●	●	●	●	●	●		381206/...
16	14,4	59,4	6,00	●	●	●	●	●	●		381606/...
16	14,4	59,4	8,00	●	●	●	●	●	●		381608/...
20	18	63	6,00	●	●	●	●	●	●		382006/...
20	18	63	8,00	●	●	●	●	●	●		382008/...

... Indicare sempre la tipologia del tagliente (per esempio: 2015/4)

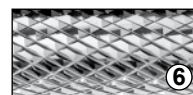
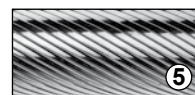
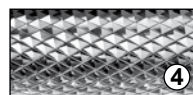
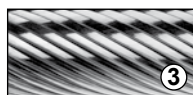
... Please always indicate cut type (example: 2015/4)

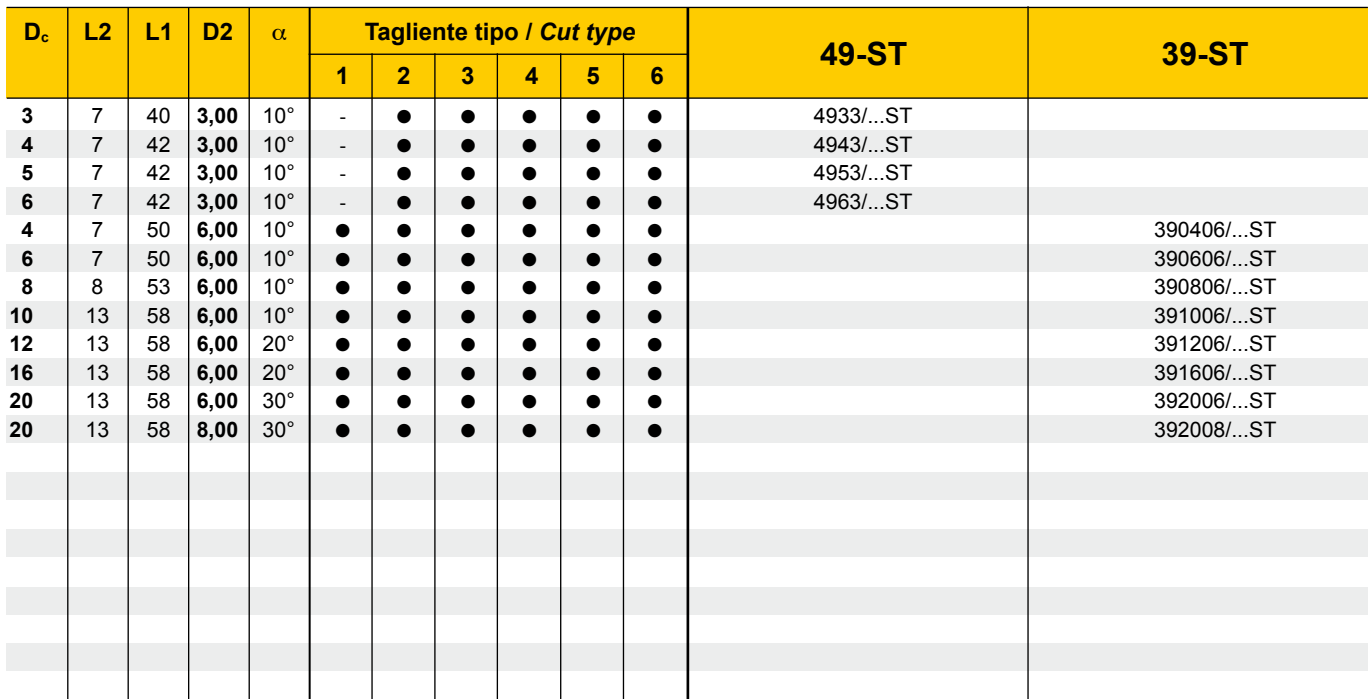
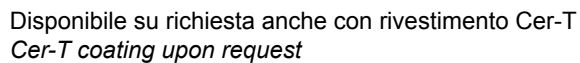


Technical drawing of a tapered shaft. The drawing shows a shaft with a tapered section of length L_1 and a cylindrical section of length L_2 . The diameter of the tapered section is D_c and the angle of taper is α . The diameter of the cylindrical section is D_2 .

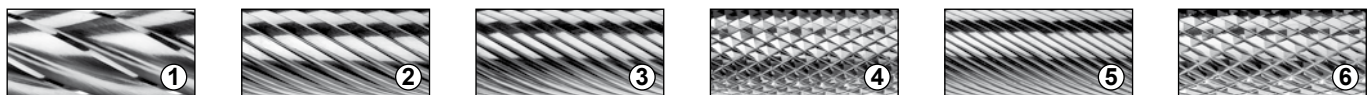
[illegible]

... Please always indicate cut type (example: 2015/4)





... Please always indicate cut type (example: 2015/4)



Kit e accessori Sets & Accessories

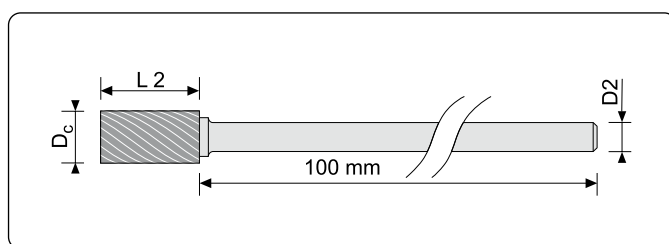
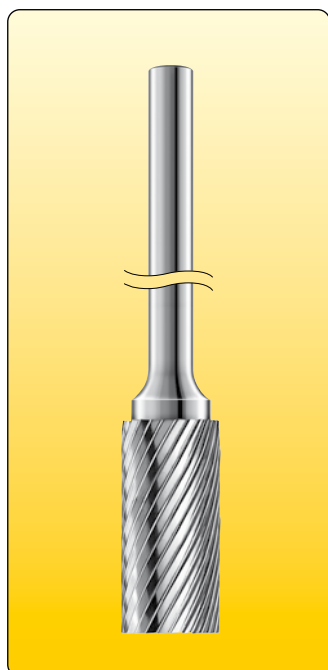
1.
01

Kit / Set	Nr. 10
	Kit n° 10 - composto da: 4033 - 4133 - 4233 - 4333 - 4433 - 4533 - 4633 - 4733 - 4833 - 4933 Disponibile con taglienti tipo 3-4-5-6 <i>Set Nr. 10 - including:</i> 4033 - 4133 - 4233 - 4333 - 4433 - 4533 - 4633 - 4733 - 4833 - 4933 <i>Available in cut type 3-4-5-6</i>
Kit / Set	Nr. 11
	Kit n° 11 - composto da: 4063 - 4163 - 4263 - 4363 - 4463 - 4563 - 4663 - 4763 - 4863 - 4963 Disponibile con taglienti tipo 2-3-4-5-6 <i>Set Nr. 11 - including:</i> 4063 - 4163 - 4263 - 4363 - 4463 - 4563 - 4663 - 4763 - 4863 - 4963 <i>Available in cut type 2-3-4-5-6</i>
Kit / Set	Nr. 12
	Kit n° 12 - composto da: 300606 - 310606 - 320606 - 330606 - 340606 - 350606 - 360606 - 370606 - 380606 - 390606 Disponibile con taglienti tipo 1-2-3-4-5-6 <i>Set Nr. 12 - including:</i> 300606 - 310606 - 320606 - 330606 - 340606 - 350606 - 360606 - 370606 - 380606 - 390606 <i>Available in cut type 1-2-3-4-5-6</i>

SMERIGLIATRICE PNEUMATICA Numero di giri: 24.000 giri/min - Consumo aria: 250 l/min
AIR GRINDING UNIT 24.000 min⁻¹ - Air consumption: 250 l/min

Kit / Set	Nr. 13
	Kit n° 13 - composto da: 301206/1 - 311206/2 - 321206/3 - 331206/4 - 341206/5 - 351206/3SP - 361206/3 - 371206/3 - 381206/6 - 391206/3 SMS 30 DC <i>Set Nr. 13 - including:</i> 301206/1 - 311206/2 - 321206/3 - 331206/4 - 341206/5 - 351206/3SP - 361206/3 - 371206/3 - 381206/6 - 391206/3 SMS 30 DC

Lime rotative - Lunghezza gambo 100 mm Rotary burs shank length 100 mm



HM
CK 30 M
Medium

WN

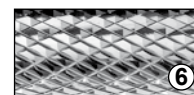
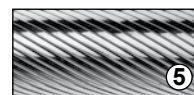
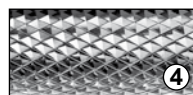
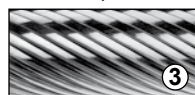


1.
02

D _c	L2	D2	Tagliente tipo / Cut type						Codice articolo Order code	Forma Design
			1	2	3	4	5	6		
6	18	6	-	-	●	●	-	●	300606/...x100	Forma - Shape ZYA Ident. 30
8	20	6	-	-	●	●	-	●	300806/...x100	
10	20	6	-	-	●	●	-	●	301006/...x100	
12	25	6	-	-	●	●	-	●	301206/...x100	
16	25	6	-	-	●	●	-	●	301606/...x100	
16	25	8	-	-	●	●	-	●	301608/...x100	
20	25	6	-	-	●	●	-	●	302006/...x100	
20	25	8	-	-	●	●	-	●	302008/...x100	
6	18	6	-	-	●	●	-	●	300606/...STx100	Forma - Shape ZYA-ST Ident. 30-ST
8	20	6	-	-	●	●	-	●	300806/...STx100	
10	20	6	-	-	●	●	-	●	301006/...STx100	
12	25	6	-	-	●	●	-	●	301206/...STx100	
16	25	6	-	-	●	●	-	●	301606/...STx100	
16	25	8	-	-	●	●	-	●	301608/...STx100	
20	25	6	-	-	●	●	-	●	302006/...STx100	
20	25	8	-	-	●	●	-	●	302008/...STx100	
6	18	6	-	-	●	●	-	●	310606/...x100	Forma - Shape WRC Ident. 31
8	20	6	-	-	●	●	-	●	310806/...x100	
10	20	6	-	-	●	●	-	●	311006/...x100	
12	25	6	-	-	●	●	-	●	311206/...x100	
16	25	6	-	-	●	●	-	●	311606/...x100	
16	25	8	-	-	●	●	-	●	311608/...x100	
20	25	6	-	-	●	●	-	●	312006/...x100	
20	25	8	-	-	●	●	-	●	312008/...x100	
6	20	6	-	-	●	●	-	●	320606/...x100	Forma - Shape KEL-14° Ident. 32
8	20	6	-	-	●	●	-	●	320806/...x100	
10	20	6	-	-	●	●	-	●	321006/...x100	
12	30	6	-	-	●	●	-	●	321206/...x100	
16	30	6	-	-	●	●	-	●	321606/...x100	
16	30	8	-	-	●	●	-	●	321608/...x100	
20	42	6	-	-	●	●	-	●	322006/...x100	
20	42	8	-	-	●	●	-	●	322008/...x100	

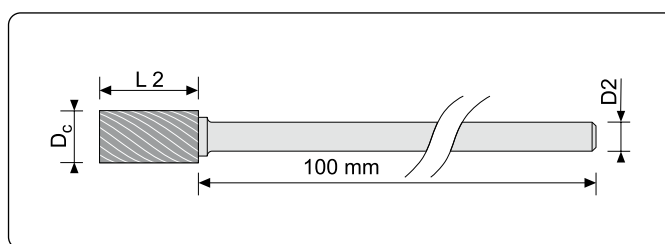
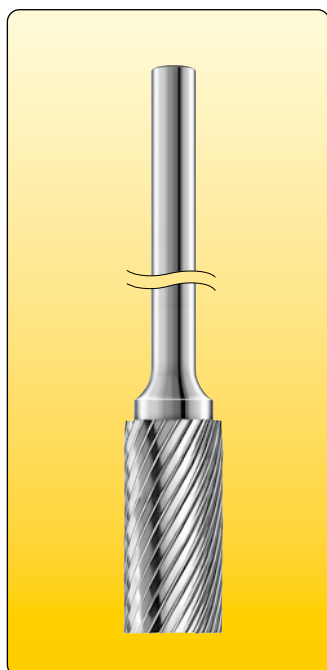
... Indicare sempre la tipologia del tagliente (per esempio: 2015/4)

... Please always indicate cut type (example: 2015/4)



Lime rotative - Lunghezza gambo 100 mm Rotary burs shank length 100 mm

1.
02



HM
CK 30 M
Medium

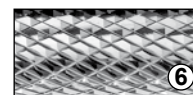
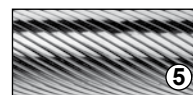
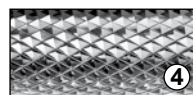
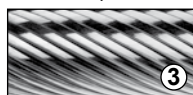
WN



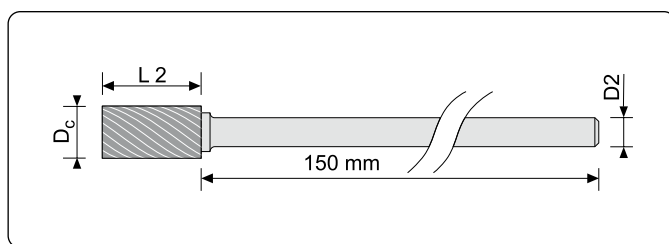
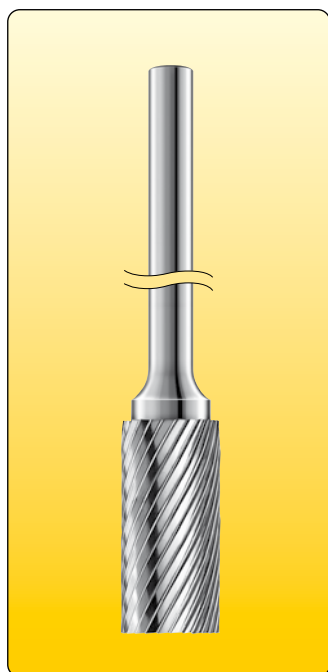
D _c	L2	D2	Tagliente tipo / Cut type						Codice articolo Order code	Forma - Shape Design
			1	2	3	4	5	6		
6	18	6	-	-	●	●	-	●	330606/...x100	Forma - Shape RBF Ident. 33
8	20	6	-	-	●	●	-	●	330806/...x100	
10	20	6	-	-	●	●	-	●	331006/...x100	
12	25	6	-	-	●	●	-	●	331206/...x100	
16	30	6	-	-	●	●	-	●	331606/...x100	
16	30	8	-	-	●	●	-	●	331608/...x100	
20	35	6	-	-	●	●	-	●	332006/...x100	
20	35	8	-	-	●	●	-	●	332008/...x100	
6	18	6	-	-	●	●	-	●	340606/...x100	Forma - Shape SPG Ident. 34
8	20	6	-	-	●	●	-	●	340806/...x100	
10	20	6	-	-	●	●	-	●	341006/...x100	
12	25	6	-	-	●	●	-	●	341206/...x100	
16	30	6	-	-	●	●	-	●	341606/...x100	
16	30	8	-	-	●	●	-	●	341608/...x100	
20	40	6	-	-	●	●	-	●	342006/...x100	
20	40	8	-	-	●	●	-	●	342008/...x100	
6	20	6	-	-	●	●	-	●	370606/...x100	Forma - Shape TRE Ident. 37
8	13	6	-	-	●	●	-	●	370806/...x100	
10	16	6	-	-	●	●	-	●	371006/...x100	
12	20	6	-	-	●	●	-	●	371206/...x100	
16	25	6	-	-	●	●	-	●	371606/...x100	
16	25	8	-	-	●	●	-	●	371608/...x100	
20	25	6	-	-	●	●	-	●	372006/...x100	
20	25	8	-	-	●	●	-	●	372008/...x100	
6	5,4	6	-	-	●	●	-	●	380606/...x100	Forma - Shape KUD Ident. 38
8	7,2	6	-	-	●	●	-	●	380806/...x100	
10	9	6	-	-	●	●	-	●	381006/...x100	
12	10,8	6	-	-	●	●	-	●	381206/...x100	
16	14,4	6	-	-	●	●	-	●	381606/...x100	
16	14,4	8	-	-	●	●	-	●	381608/...x100	
20	18	6	-	-	●	●	-	●	382006/...x100	
20	18	8	-	-	●	●	-	●	382008/...x100	

... Indicare sempre la tipologia del tagliente (per esempio: 2015/4)

... Please always indicate cut type (example: 2015/4)



Lime rotative - Lunghezza gambo 150 mm Rotary burs shank length 150 mm



HM
CK 30 M
Medium

WN

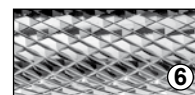
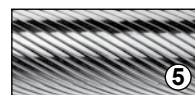
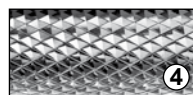
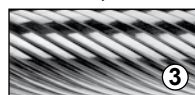


1.
02

D _c	L2	D2	Tagliente tipo / Cut type						Codice articolo Order code	Forma Design
			1	2	3	4	5	6		
6	18	6	-	-	●	●	-	●	300606/...x150	Forma - Shape ZYA Ident. 30
8	20	6	-	-	●	●	-	●	300806/...x150	
10	20	6	-	-	●	●	-	●	301006/...x150	
12	25	6	-	-	●	●	-	●	301206/...x150	
16	25	6	-	-	●	●	-	●	301606/...x150	
16	25	8	-	-	●	●	-	●	301608/...x150	
20	25	6	-	-	●	●	-	●	302006/...x150	
20	25	8	-	-	●	●	-	●	302008/...x150	
6	18	6	-	-	●	●	-	●	300606/...STx150	Forma - Shape ZYA-ST Ident. 30-ST
8	20	6	-	-	●	●	-	●	300806/...STx150	
10	20	6	-	-	●	●	-	●	301006/...STx150	
12	25	6	-	-	●	●	-	●	301206/...STx150	
16	25	6	-	-	●	●	-	●	301606/...STx150	
16	25	8	-	-	●	●	-	●	301608/...STx150	
20	25	6	-	-	●	●	-	●	302006/...STx150	
20	25	8	-	-	●	●	-	●	302008/...STx150	
6	18	6	-	-	●	●	-	●	310606/...x150	Forma - Shape WRC Ident. 31
8	20	6	-	-	●	●	-	●	310806/...x150	
10	20	6	-	-	●	●	-	●	311006/...x150	
12	25	6	-	-	●	●	-	●	311206/...x150	
16	25	6	-	-	●	●	-	●	311606/...x150	
16	25	8	-	-	●	●	-	●	311608/...x150	
20	25	6	-	-	●	●	-	●	312006/...x150	
20	25	8	-	-	●	●	-	●	312008/...x150	
6	20	6	-	-	●	●	-	●	320606/...x150	Forma - Shape KEL-14° Ident. 32
8	20	6	-	-	●	●	-	●	320806/...x150	
10	20	6	-	-	●	●	-	●	321006/...x150	
12	30	6	-	-	●	●	-	●	321206/...x150	
16	30	6	-	-	●	●	-	●	321606/...x150	
16	30	8	-	-	●	●	-	●	321608/...x150	
20	42	6	-	-	●	●	-	●	322006/...x150	
20	42	8	-	-	●	●	-	●	322008/...x150	

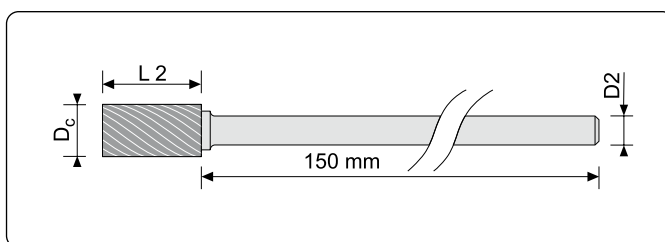
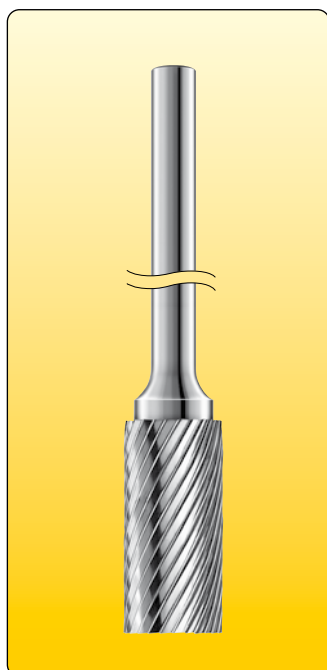
... Indicare sempre la tipologia del tagliente (per esempio: 2015/4)

... Please always indicate cut type (example: 2015/4)



Lime rotative - Lunghezza gambo 150 mm Rotary burs shank length 150 mm

1.
02



HM
CK 30 M
Medium

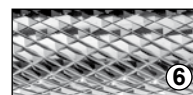
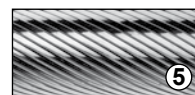
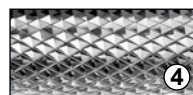
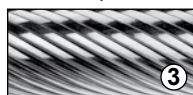
WN



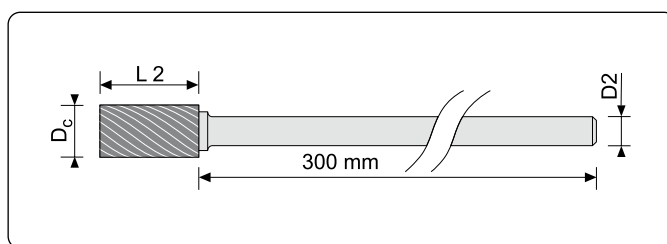
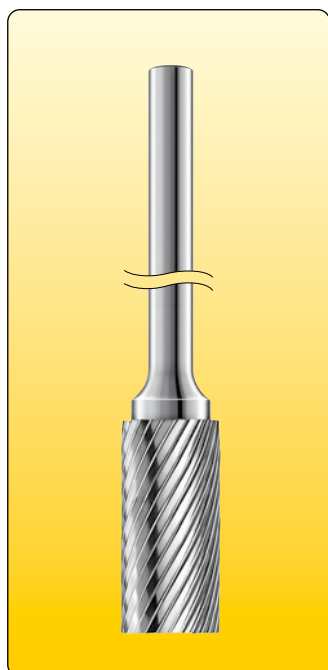
D _c	L2	D2	Tagliente tipo / Cut type						Codice articolo Order code	Forma - Shape Design
			1	2	3	4	5	6		
6	18	6	-	-	●	●	-	●	330606/...x150	Forma - Shape RBF Ident. 33
8	20	6	-	-	●	●	-	●	330806/...x150	
10	20	6	-	-	●	●	-	●	331006/...x150	
12	25	6	-	-	●	●	-	●	331206/...x150	
16	30	6	-	-	●	●	-	●	331606/...x150	
16	30	8	-	-	●	●	-	●	331608/...x150	
20	35	6	-	-	●	●	-	●	332006/...x150	
20	35	8	-	-	●	●	-	●	332008/...x150	
6	18	6	-	-	●	●	-	●	344606/...x150	Forma - Shape SPG Ident. 34
8	20	6	-	-	●	●	-	●	344806/...x150	
10	20	6	-	-	●	●	-	●	341006/...x150	
12	25	6	-	-	●	●	-	●	341206/...x150	
16	30	6	-	-	●	●	-	●	341606/...x150	
16	30	8	-	-	●	●	-	●	341608/...x150	
20	40	6	-	-	●	●	-	●	342006/...x150	
20	40	8	-	-	●	●	-	●	342008/...x150	
6	20	6	-	-	●	●	-	●	370606/...x150	Forma - Shape TRE Ident. 37
8	13	6	-	-	●	●	-	●	370806/...x150	
10	16	6	-	-	●	●	-	●	371006/...x150	
12	20	6	-	-	●	●	-	●	371206/...x150	
16	25	6	-	-	●	●	-	●	371606/...x150	
16	25	8	-	-	●	●	-	●	371608/...x150	
20	25	6	-	-	●	●	-	●	372006/...x150	
20	25	8	-	-	●	●	-	●	372008/...x150	
6	5,4	6	-	-	●	●	-	●	380606/...x150	Forma - Shape KUD Ident. 38
8	7,2	6	-	-	●	●	-	●	380806/...x150	
10	9	6	-	-	●	●	-	●	381006/...x150	
12	10,8	6	-	-	●	●	-	●	381206/...x150	
16	14,4	6	-	-	●	●	-	●	381606/...x150	
16	14,4	8	-	-	●	●	-	●	381608/...x150	
20	18	6	-	-	●	●	-	●	382006/...x150	
20	18	8	-	-	●	●	-	●	382008/...x150	

... Indicare sempre la tipologia del tagliente (per esempio: 2015/4)

... Please always indicate cut type (example: 2015/4)



Lime rotative - Lunghezza gambo 300 mm Rotary burs shank length 300 mm



HM
CK 30 M
Medium

WN



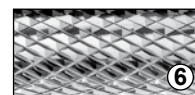
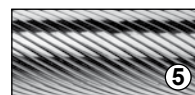
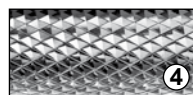
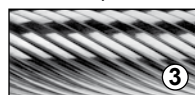
Vc
-30%

1.
02

D _c	L2	D2	Tagliente tipo / Cut type						Codice articolo Order code	Forma Design
			1	2	3	4	5	6		
6	18	6	-	-	●	●	-	●	300606/...x300	Forma - Shape ZYA Ident. 30
8	20	6	-	-	●	●	-	●	300806/...x300	
10	20	6	-	-	●	●	-	●	301006/...x300	
12	25	6	-	-	●	●	-	●	301206/...x300	
16	25	6	-	-	●	●	-	●	301606/...x300	
16	25	8	-	-	●	●	-	●	301608/...x300	
20	25	6	-	-	●	●	-	●	302006/...x300	
20	25	8	-	-	●	●	-	●	302008/...x300	
6	18	6	-	-	●	●	-	●	300606/...STx300	Forma - Shape ZYA-ST Ident. 30-ST
8	20	6	-	-	●	●	-	●	300806/...STx300	
10	20	6	-	-	●	●	-	●	301006/...STx300	
12	25	6	-	-	●	●	-	●	301206/...STx300	
16	25	6	-	-	●	●	-	●	301606/...STx300	
16	25	8	-	-	●	●	-	●	301608/...STx300	
20	25	6	-	-	●	●	-	●	302006/...STx300	
20	25	8	-	-	●	●	-	●	302008/...STx300	
6	18	6	-	-	●	●	-	●	310606/...x300	Forma - Shape WRC Ident. 31
8	20	6	-	-	●	●	-	●	310806/...x300	
10	20	6	-	-	●	●	-	●	311006/...x300	
12	25	6	-	-	●	●	-	●	311206/...x300	
16	25	6	-	-	●	●	-	●	311606/...x300	
16	25	8	-	-	●	●	-	●	311608/...x300	
20	25	6	-	-	●	●	-	●	312006/...x300	
20	25	8	-	-	●	●	-	●	312008/...x300	
6	20	6	-	-	●	●	-	●	320606/...x300	Forma - Shape KEL-14° Ident. 32
8	20	6	-	-	●	●	-	●	320806/...x300	
10	20	6	-	-	●	●	-	●	321006/...x300	
12	30	6	-	-	●	●	-	●	321206/...x300	
16	30	6	-	-	●	●	-	●	321606/...x300	
16	30	8	-	-	●	●	-	●	321608/...x300	
20	42	6	-	-	●	●	-	●	322006/...x300	
20	42	8	-	-	●	●	-	●	322008/...x300	

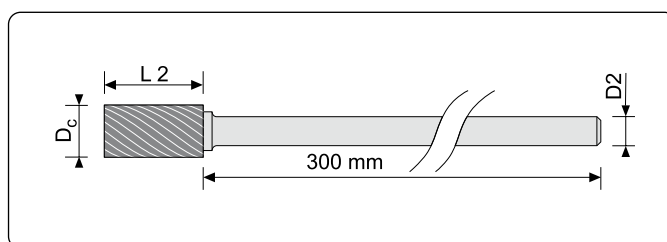
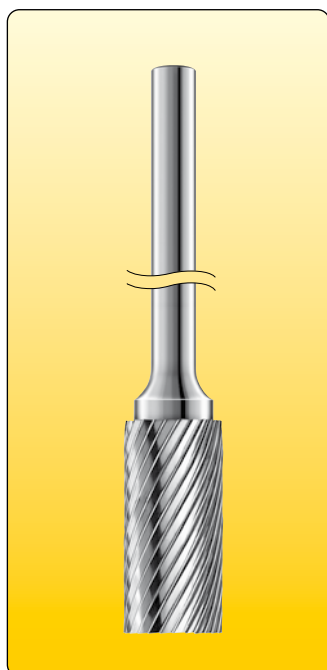
... Indicare sempre la tipologia del tagliente (per esempio: 2015/4)

.. Please always indicate cut type (example: 2015/4)



Lime rotative - Lunghezza gambo 300 mm Rotary burs shank length 300 mm

1.
02



HM
CK 30 M
Medium

WN

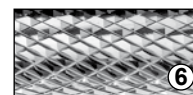
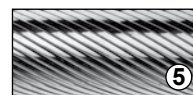
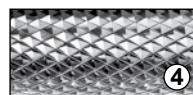
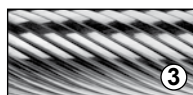


Vc
-30%

D _c	L2	D2	Tagliente tipo / Cut type						Codice articolo Order code	Forma - Shape Design
			1	2	3	4	5	6		
6	18	6	-	-	●	●	-	●	330606/...x300	Forma - Shape RBF Ident. 33
8	20	6	-	-	●	●	-	●	330806/...x300	
10	20	6	-	-	●	●	-	●	331006/...x300	
12	25	6	-	-	●	●	-	●	331206/...x300	
16	30	6	-	-	●	●	-	●	331606/...x300	
16	30	8	-	-	●	●	-	●	331608/...x300	
20	35	6	-	-	●	●	-	●	332006/...x300	
20	35	8	-	-	●	●	-	●	332008/...x300	
6	18	6	-	-	●	●	-	●	340606/...x300	Forma - Shape SPG Ident. 34
8	20	6	-	-	●	●	-	●	340806/...x300	
10	20	6	-	-	●	●	-	●	341006/...x300	
12	25	6	-	-	●	●	-	●	341206/...x300	
16	30	6	-	-	●	●	-	●	341606/...x300	
16	30	8	-	-	●	●	-	●	341608/...x300	
20	40	6	-	-	●	●	-	●	342006/...x300	
20	40	8	-	-	●	●	-	●	342008/...x300	
6	20	6	-	-	●	●	-	●	370606/...x300	Forma - Shape TRE Ident. 37
8	13	6	-	-	●	●	-	●	370806/...x300	
10	16	6	-	-	●	●	-	●	371006/...x300	
12	20	6	-	-	●	●	-	●	371206/...x300	
16	25	6	-	-	●	●	-	●	371606/...x300	
16	25	8	-	-	●	●	-	●	371608/...x300	
20	25	6	-	-	●	●	-	●	372006/...x300	
20	25	8	-	-	●	●	-	●	372008/...x300	
6	5,4	6	-	-	●	●	-	●	380606/...x300	Forma - Shape KUD Ident. 38
8	7,2	6	-	-	●	●	-	●	380806/...x300	
10	9	6	-	-	●	●	-	●	381006/...x300	
12	10,8	6	-	-	●	●	-	●	381206/...x300	
16	14,4	6	-	-	●	●	-	●	381606/...x300	
16	14,4	8	-	-	●	●	-	●	381608/...x300	
20	18	6	-	-	●	●	-	●	382006/...x300	
20	18	8	-	-	●	●	-	●	382008/...x300	

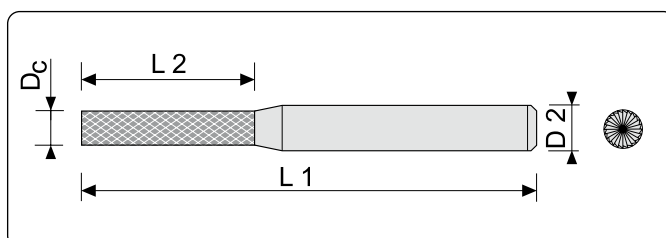
... Indicare sempre la tipologia del tagliente (per esempio: 2015/4)

... Please always indicate cut type (example: 2015/4)

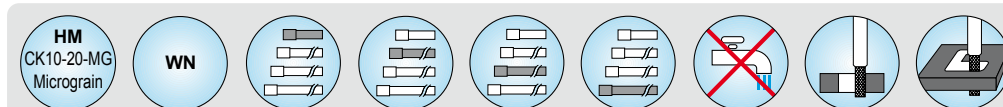


Lime rotative per stampi e matrici con tagliente frontale Mould, tool and die making rotary burs with end cut

Disponibile su richiesta anche con rivestimento Cer-T
Cer-T coating upon request



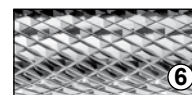
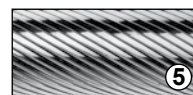
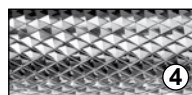
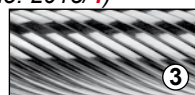
1.
03



D _c	L2	L1	D2	Tagliente tipo / Cut type						Codice articolo tagliente 4 Cut type 4	Codice articolo tagliente 6 Cut type 6
				1	2	3	4	5	6		
1	6	50	3,00	-	-	-	●	-	●	4010/4STx050	4010/6STx050
1	6	65	3,00	-	-	-	●	-	●	4010/4STx065	4010/6STx065
1	6	70	3,00	-	-	-	●	-	●	4010/4STx070	4010/6STx070
1	6	80	3,00	-	-	-	●	-	●	4010/4STx080	4010/6STx080
1	6	90	3,00	-	-	-	●	-	●	4010/4STx090	4010/6STx090
1	6	100	3,00	-	-	-	●	-	●	4010/4STx100	4010/6STx100
1,5	8	50	3,00	-	-	-	●	-	●	4015/4STx050	4015/6STx050
1,5	8	65	3,00	-	-	-	●	-	●	4015/4STx065	4015/6STx065
1,5	8	70	3,00	-	-	-	●	-	●	4015/4STx070	4015/6STx070
1,5	8	80	3,00	-	-	-	●	-	●	4015/4STx080	4015/6STx080
1,5	8	90	3,00	-	-	-	●	-	●	4015/4STx090	4015/6STx090
1,5	8	100	3,00	-	-	-	●	-	●	4015/4STx100	4015/6STx100
2	10	50	3,00	-	-	-	●	-	●	4020/4STx050	4020/6STx050
2	10	65	3,00	-	-	-	●	-	●	4020/4STx065	4020/6STx065
2	10	70	3,00	-	-	-	●	-	●	4020/4STx070	4020/6STx070
2	10	80	3,00	-	-	-	●	-	●	4020/4STx080	4020/6STx080
2	10	90	3,00	-	-	-	●	-	●	4020/4STx090	4020/6STx090
2	10	100	3,00	-	-	-	●	-	●	4020/4STx100	4020/6STx100

... Indicare sempre la tipologia del tagliente (per esempio: 2015/4)

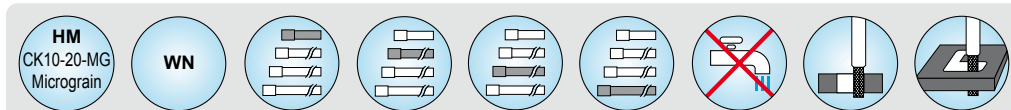
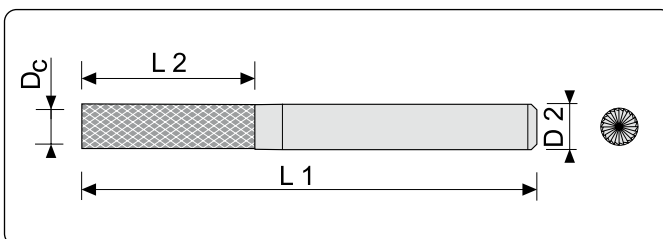
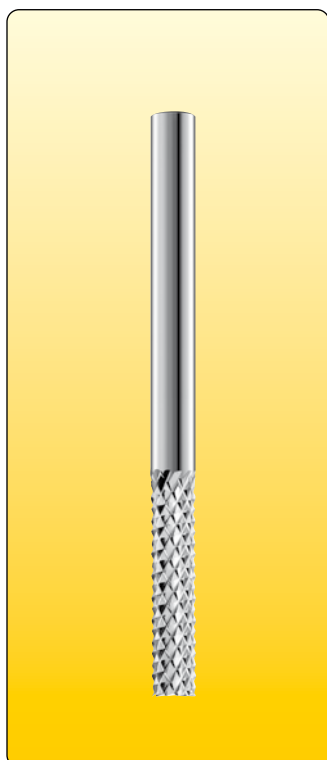
... Please always indicate cut type (example: 2015/4)



Lime rotative per stampi e matrici con tagliente frontale Mould, tool and die making rotary burs with end cut

Disponibile su richiesta anche con rivestimento Cer-T
Cer-T coating upon request

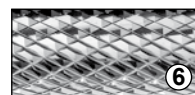
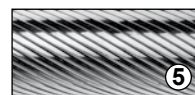
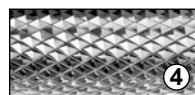
1.
03



D _c	L2	L1	D2	Tagliente tipo / Cut type						Codice articolo tagliente 4 Cut type 4	Codice articolo tagliente 6 Cut type 6
				1	2	3	4	5	6		
2,5	12	50	3,00	-	-	-	●	-	●	4025/4STx050	4025/6STx050
2,5	12	65	3,00	-	-	-	●	-	●	4025/4STx065	4025/6STx065
2,5	12	70	3,00	-	-	-	●	-	●	4025/4STx070	4025/6STx070
2,5	12	80	3,00	-	-	-	●	-	●	4025/4STx080	4025/6STx080
2,5	12	90	3,00	-	-	-	●	-	●	4025/4STx090	4025/6STx090
2,5	12	100	3,00	-	-	-	●	-	●	4025/4STx100	4025/6STx100
3	14	50	3,00	-	-	-	●	-	●	4033/4STx050	4033/6STx050
3	14	65	3,00	-	-	-	●	-	●	4033/4STx065	4033/6STx065
3	14	70	3,00	-	-	-	●	-	●	4033/4STx070	4033/6STx070
3	14	80	3,00	-	-	-	●	-	●	4033/4STx080	4033/6STx080
3	14	90	3,00	-	-	-	●	-	●	4033/4STx090	4033/6STx090
3	14	100	3,00	-	-	-	●	-	●	4033/4STx100	4033/6STx100

... Indicare sempre la tipologia del tagliente (per esempio: 2015/4)

... Please always indicate cut type (example: 2015/4)

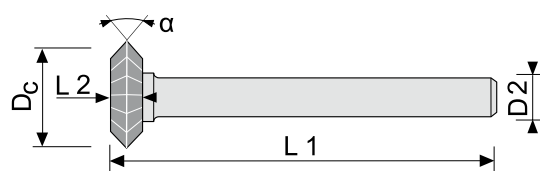


Lime rotative per canalini - 90° Grove cutters at 90°

114

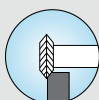


Disponibile su richiesta anche con rivestimento Cer-T
Cer-T coating upon request



HM
CK 30 M
Medium

WN



**1.
04**

D _c	L2	L1	D2	α	114-90°
10	1,5	47	6	90°	114.1015-90°
12	1,5	47	6	90°	114.1215-90°
16	1,5	47	6	90°	114.1615-90°
20	1,5	47	6	90°	114.2015-90°
10	2	47	6	90°	114.1020-90°
12	2	47	6	90°	114.1220-90°
16	2	47	6	90°	114.1620-90°
20	2	47	6	90°	114.2020-90°
10	2,5	47	6	90°	114.1025-90°
12	2,5	47	6	90°	114.1225-90°
16	2,5	47	6	90°	114.1625-90°
20	2,5	47	6	90°	114.2025-90°

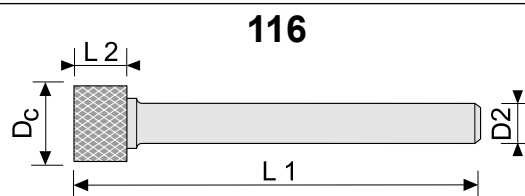
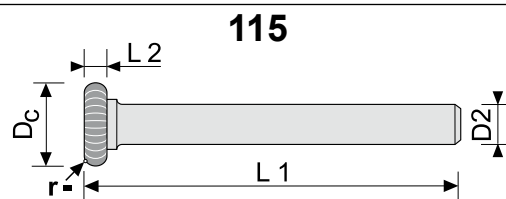
Lime rotative raggate e cilindriche Disc cutters straight or with radius

Disponibile su richiesta anche con rivestimento Cer-T
Cer-T coating upon request

115



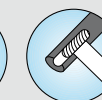
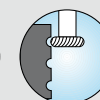
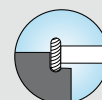
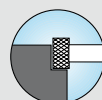
116



**1.
04**

HM
CK 30 M
Medium

WN



D _c	L2	L1	D2	r 115	115	116
10	2	47	6	20	1151006/3x2	1161006/4x2
10	3	48	6	20	1151006/3x3	1161006/4x3
10	4	49	6	20	1151006/3x4	1161006/4x4
10	6	51	6	20	1151006/3x6	1161006/4x6
12	2	47	6	24	1151206/3x2	1161206/4x2
12	3	48	6	24	1151206/3x3	1161206/4x3
12	4	49	6	24	1151206/3x4	1161206/4x4
12	6	51	6	24	1151206/3x6	1161206/4x4
16	2	47	6	30	1151606/3x2	1161606/4x2
16	3	48	6	30	1151606/3x3	1161606/4x3
16	4	49	6	30	1151606/3x4	1161606/4x4
16	6	51	6	30	1151606/3x6	1161606/4x6
16	8	53	6	30	1151606/3x8	1161606/4x8
20	2	47	6	35	1152006/3x2	1162006/4x2
20	4	49	6	35	1152006/3x4	1162006/4x4
20	6	51	6	35	1152006/3x6	1162006/4x6
20	8	53	6	35	1152006/3x8	1162006/4x8
20	10	55	6	35	1152006/3x10	1162006/4x10

1.
04

Frese in metallo duro integrale
End mills

Indice

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02

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Frese di copiatura a testa raggiata - Z=2 elica a 40° - simile a DIN 6527-L	Ball nose copy cutters - Z=2 Helix 40° - Similar to DIN 6527-L	102RC-40° 102RC-40°G	95
Linea "ULTRA Ra" con gole lappate	"ULTRA Ra" Speed Line with fine lapped chip flutes		
Frese di copiatura a testa raggiata - Z=2 elica a 40° - norma interna - extralunga	Ball nose copy cutters - Z=2 Helix 40° - Internal standard extra long	102RCL-40° 102RCL-40°G	96
"Linea "ULTRA Ra" con gole lappate	"ULTRA Ra" Speed Line with fine lapped chip flutes		
Frese di copiatura toriche - Z=2 elica a 40° - simile a DIN 6527-L	Torus copy cutters - Z=2 Helix 40° - Similar to DIN 6527-L	102TC-40° 102TC-40°G	97
Linea "ULTRA Ra" con gole lappate	"ULTRA Ra" Speed Line with fine lapped chip flutes		
Frese di copiatura toriche - Z=2 elica a 40° - norma interna - extralunga	Torus copy cutters - Z=2 Helix 40° - Internal standard extra long	102TCL-40° 102TCL-40°G	98
Linea "ULTRA Ra" con gole lappate	"ULTRA Ra" Speed Line with fine lapped chip flutes		
Frese di copiatura toriche - Z=2 elica a 30° - norma interna	Torus copy cutters - Z=2 Helix 30° - Internal standard	72CT 72CTC	99
Frese di copiatura a testa raggiata - Z=2 elica a 30° - norma interna	Ball nose copy cutters - Z=2 Helix 30° - Internal standard	72CR 72CRC	100
Frese toriche - Z=2 elica a 30° - norma interna - per acciai temprati	Torus cutters - Z=2 Helix 30° - Internal standard - for hardened steels	62THR 62THRB	101
Frese a testa raggiata - Z=2 elica a 30° - norma interna - per acciai temprati	Ball nose cutters - Z=2 Helix 30° - Internal standard - for hardened steels	62RHR 62RHRB	102
Frese toriche - Z=4 elica a 30° - norma interna - per acciai temprati	Torus cutters - Z=4 Helix 30° - Internal standard - for hardened steels	64THR 64THRB	103
Frese a testa raggiata - Z=4 elica a 30° - norma interna - per acciai temprati	Ball nose cutters - Z=4 Helix 30° - Internal standard - for hardened steels	64RHR 64RHRB	104
Frese multitaglienti - elica a 45° - norma interna - per acciai temprati	Multiflutes cutters - Helix 45° - Internal standard - for hardened steels	66HR 66HRB	105
Frese toriche multitaglienti - elica a 45° - norma interna - per acciai temprati	Torus multiflutes cutters - Helix 45° - Internal standard - for hardened steels	66THR 66THRB	106

Utensili gruppo 2.3: Frese per grafite	Tools Group 2.3: Milling cutters for graphite	N° id.. Code	Pagina Page
Introduzione	Introduction		109 ÷ 110
Dati di taglio: f (mm/giro) - Taglienti alternati - con rivestimento Cer-D	Cutting data: f (mm) - Cross cut - with Cer-D coating	GF GM	111
Frese cilindriche e a testa emisferica - con dentature alterne speciali (F/M) - con tagliente fine e rompitruciolo (66GF-D)	End mills and ball nose cutters - with special cross cut (F/M) - with fine cut and chip breaker (66GF-D)		

Frese toriche per grafite - Z=2 elica a 30° - norma interna	<i>Torus cutters for graphite - Z=2 Helix 30° - Internal standard</i>	72GT 72GTD	112
Frese a testa raggiata per grafite - Z=2 elica a 30° - norma interna	<i>Ball nose cutters for graphite - Z=2 Helix 30° - Internal standard</i>	72GR 72GRD	113
Frese a testa raggiata per grafite - Z=3 elica a 30° - divisione irregolare - norma interna	<i>Radius cutters for graphite - Z=3 Helix 30° univen indexing - Internal Standard</i>	73GRI 73GRID	114
Frese toriche per grafite - Z=3 elica a 30° - divisione irregolare - norma interna	<i>Torus cutters for graphite - Z=3 Helix 30° univen indexing - Internal Standard</i>	73GTI 73GTID	115
Frese di scanalatura per grafite - taglio incrociato - norma interna	<i>Slot milling cutters for graphite - special cross cut - Internal Standard</i>	108GFD 108GMD	116
Frese a forare per grafite - taglio incrociato - norma interna	<i>Drill milling cutters for graphite - special cross cut - Internal Standard</i>	109GFD 109GMD	117
Frese a testa raggiata per grafite - taglio incrociato - norma interna	<i>Ball nose cutters for graphite - cross cut - Internal Standard</i>	106RGFD 106RGMD	118
Frese a candela per grafite - tagliente fine con rompitrucciolo - norma interna	<i>End mills for graphite - fine cut with chip breaker - Internal Standard</i>	66GF 66GFD	119
Frese a testa raggiata per grafite - tagliente fine con rompitrucciolo - norma interna	<i>Ball nose end mills for graphite - fine cut with chip breaker - Internal Standard</i>	66RGF 66RGFD	120

Utensili gruppo 2.4: Frese per materiali compositi	Tools Group 2.4: End mills for composite materials	N° id. Code	Pagina Page
Introduzione	<i>Introduction</i>		122 ÷ 126
Frese a elica destra e sinistra - Z=2+2 “ Butterfly” - norma interna	<i>Right and left helix - Z=2+2 “Butterfly” - Internal standard</i>	102PH 102PHE	128
Frese a forare “Dummy” con rompitrucciolo alternato - norma interna	<i>Drill milling cutters “Dummy” with counter- wise point cut - Internal standard</i>	119P 119PE	129
Frese per materiali compositi a elica dritta - con rompitrucciolo - norma interna	<i>End mills for composite materials - straight flute - with chip breaker - Internal standard</i>	65SU 65SUE	130
Frese per materiali compositi - elica destra a 10° - con rompitrucciolo - norma interna	<i>End mills for composite materials - 10° right helix - large counterwise chip breaker - Internal standard</i>	66SU 66SUE	131
Frese per fibra di carbonio - con tagliente frontale Z=2 - norma interna	<i>End mills for Carbonfibre - with two frontal teeth Z=2 - Internal standard</i>	68SU 68SUD	132
Frese per materiali compositi - taglio incrocia- to - senza tagliente frontale - norma interna	<i>End mills for composite materials - cross cut - without end cut - Internal standard</i>	106F - 106M 106G	133
Frese per materiali compositi - taglio incro- ciato - con tagliente frontale - norma interna	<i>End mills for composite materials - cross cut - with end cut - Internal standard</i>	107F - 107M 107G	134
Frese per materiali compositi - taglio incro- ciato con 2 taglienti frontali - norma interna	<i>Drill slot milling cutters - cross cut - Internal standard</i>	108F - 108M 108G	135
Frese a forare per materiali compositi - taglio incrociato - norma interna	<i>Drill milling cutters - cross cut - Internal standard</i>	109F - 109M 109G	136
Frese a testa raggiata per materiali compositi - taglio incrociato - norma interna	<i>Ball nose end mills - cross cut - Internal standard</i>	106RF 106RM	137
Frese a candela Z=2 elica a 14° - simili a DIN 6527-L	<i>End mills Z=2 Helix 14° - Similar to DIN 6527-L</i>	102S 102SE	138
Linea “ULTRA Ra” con gole lappate	<i>“ULTRA Ra” Speed Line with fine lapped chip flutes</i>		
Frese per nido d’ape - con rompitrucciolo - norma interna	<i>End mills for honeycomb - large counterwise chip breaker - Internal standard</i>	77SU 77SUE	139

Utensili gruppo 2.5: Frese tipo "W"	Tools Group 2.5: "W" design end mills	N° id. Code	Pagina Page
Introduzione	Introduction		142 ÷ 147
Frese Z=1 a elica diritta - norma interna Linea "ULTRA Ra" con gole lappate	End mills - Z=1 straight flute - Internal standard "ULTRA Ra" Speed Line with fine lapped chip flutes	110TD 110TDG	148
Frese a testa raggiata- Z=1 a elica diritta - norma interna Linea "ULTRA Ra" con gole lappate	Ball nose cutter - Z=1 straight flute - Internal standard "ULTRA Ra" Speed Line with fine lapped chip flutes	110TDR 110TDRG	149
Frese Z=1 -elica destra e taglio destro per alluminio Linea "ULTRA Ra" con gole lappate	Single Flute routers Right hand Spiral - Right hand cut for Aluminium "ULTRA Ra" Speed Line with fine lapped chip flutes	110A 110AG	150
Frese Z=1 - elica sinistra e taglio destro per alluminio Linea "ULTRA Ra" con gole lappate	Single Flute routers Left hand Spiral - Right hand cut for Aluminium "ULTRA Ra" Speed Line with fine lapped chip flutes	111A 111AG	151
Frese Z=1 - elica destra e taglio destro Linea "ULTRA Ra" con gole lappate	Single Flute routers Right hand Spiral - Right hand cut "ULTRA Ra" Speed Line with fine lapped chip flutes	110 110G	152
Frese Z=1 - elica sinistra e taglio destro Linea "ULTRA Ra" con gole lappate	Single Flute routers Left hand Spiral - Right hand cut "ULTRA Ra" Speed Line with fine lapped chip flutes	111 111G	154
Frese Z=1 a testa raggiata - elica destra e taglio destro Linea "ULTRA Ra" con gole lappate	Radius Single Flute routers Right hand Spiral - Right hand cut "ULTRA Ra" Speed Line with fine lapped chip flutes	110R 110RG	156
Frese Z=2 a taglienti diritti - norma interna Linea "ULTRA Ra" con gole lappate	End mills - Z=2 straight flute - Internal standard "ULTRA Ra" Speed Line with fine lapped chip flutes	100 100G	157
Frese Z=2 - elica 30° - norma interna Linea "ULTRA Ra" con gole lappate - doppio angolo di spoglia - nocciolo conico	End mills - Z=2 Helix 30° - Internal standard "ULTRA Ra" Speed Line with fine lapped chip flutes-with double rake angle - conical core	102A 102AG	158
Frese Z=2 - elica 30° - norma interna Linea "ULTRA Ra" con gole lappate	End mills - Z=2 Helix 30° - Internal standard "ULTRA Ra" Speed Line with fine lapped chip flutes	102 102G	159
Frese Z=2 - elica sinistra, taglio destro - norma interna Linea "ULTRA Ra" con gole lappate	End mills - Z=2 Left hand spiral - Right hand cut - Internal standard "ULTRA Ra" Speed Line with fine lapped chip flutes	104 104G	160
Frese Z=2 - elica a 45° - norma interna Linea "ULTRA Ra" con gole lappate	End mills - Z=2 Helix 45° - Internal standard "ULTRA Ra" Speed Line with fine lapped chip flutes	102-45° 102-45°G	161
Frese Z=3 a taglienti diritti - norma interna Linea "ULTRA Ra" con gole lappate	End mills - Z=3 straight flute - Internal standard "ULTRA Ra" Speed Line with fine lapped chip flutes	101 101G	162
Frese Z=5 - elica a 45° - simili a DIN 6527-L - per superfinitura Plexiglass "PIRAÑA" divisione irregolare taglienti - gole lappate	End mills - Helix 45° - Similar to DIN 6527-L - for super-finishing of Plexiglass "PIRAÑA"uneven division of cutting edges - fine lapped chip flutes	103S 103SE	163
Frese Z=3 - elica a 30° - elica sinistra, taglio destro - norma interna Linea "ULTRA Ra" con gole lappate	End mills - Z=3 Helix 30° - Left hand spiral - Right hand cut - Internal standard "ULTRA Ra" Speed Line with fine lapped chip flutes	105 105G	164
Frese Z=3 - elica 30° - simili a DIN 6527-L "PIRAÑA" divisione irregolare taglienti - gole lappate	End mills - Z=3 Helix 30° - Similar to DIN 6527-L "PIRAÑA"uneven division of cutting edges - fine lapped chip flutes	103I 103IG	165

Frese toriche - Z=3 - elica a 30° - simile a DIN 6527-L "PIRAÑA" divisione irregolare taglienti - gole lappate	<i>Torus cutters - Z=3 Helix 30° - Similar to DIN 6527-L</i> <i>"PIRAÑA"uneven division of cutting edges - fine lapped chip flutes</i>	103TI 103TIG	166
Frese Z=3 - elica a 45° - simile a DIN 6527-L "PIRAÑA" divisione irregolare taglienti - gole lappate	<i>End mills - Z=3 Helix 45° - Similar to DIN 6527-L</i> <i>"PIRAÑA"uneven division of cutting edges - fine lapped chip flutes</i>	103I-45° 103I-45°G	167
Frese raggiate - Z=3 - elica a 30° - simile a DIN 6527-L "PIRAÑA" divisione irregolare taglienti - gole lappate	<i>Ball nose cutters - Z=3 Helix 30°</i> <i>- Similar to DIN 6527-L</i> <i>"PIRAÑA"uneven division of cutting edges - fine lapped chip flutes</i>	103RI 103RIG	168
Frese Z=1 con elica destra e rompitrucciolo - norma interna Linea "ULTRA Ra" con gole lappate	<i>Z=1 with right helix and chip breaker</i> <i>- Internal standard</i> <i>"ULTRA Ra" Speed Line with fine lapped chip flutes</i>	110SP 110SPG	169

Utensili gruppo 2.6: Frese per sgrossatura	Tools Group 2.6: Roughing end mills	N° id. Code	Pagina Page
Introduzione	<i>Introduction</i>		172 ÷ 174
Frese per sgrossatura ad alte prestazioni - elica a 45° - simile a DIN 6527-L	<i>High performance roughing end mills</i> <i>Helix 45°</i> <i>- Similar to DIN 6527-L</i>	64SS 64SSC 64SSW 64SSWC	175
Frese per sgrossatura - Z=3 - elica a 30° - simile a DIN 6527-L	<i>Roughing end mills</i> <i>- Z=3 Helix 30°</i> <i>- Similar to DIN 6527-L</i>	63SP 63SPC 63SPW 63SPWC	176
Frese per sgrossatura - Z=3 - elica a 45° - simile a DIN 6527-L	<i>Roughing end mills</i> <i>- Z=3 Helix 45°</i> <i>- Similar to DIN 6527-L</i>	63SP-45° 63SP-45°C 63SPW-45° 63SPW-45°C	177
Frese per sgrossatura - Z=4 elica 30° - DIN 6527-L	<i>Roughing end mills</i> <i>- Z=4 Helix 30°</i> <i>- DIN 6527-L</i>	64SP 64SPC 64SPW 64SPWC	178

Utensili gruppo 2.7: Frese a 2 taglienti	Tools Group 2.7: 2 flutes end mills	N° id. Code	Pagina Page
Introduzione	<i>Introduction</i>		180 ÷ 182
Frese Z=2 a taglienti dritti - norma interna	<i>End mills Z=2 straight flute</i> <i>- Internal standard</i>	62TD 62TDA	183
Frese a testa raggata - Z=2 a taglienti dritti - norma interna	<i>Radius end mills - Z=2 straight flute</i> <i>- Internal standard</i>	62TDR 62TDRA	184
Frese Z=2 - elica a 30° - simili a DIN 6527-L	<i>End mills - Z=2 Helix 30°</i> <i>- Similar to DIN 6527-L</i>	62 62A 62W 62WA	185

Frese Z=2 - elica a 45° - DIN 6527-L	End Mills - Z=2 Helix 45° - DIN 6527-L	62-45° 62-45°A 62W-45° 62W-45°A	186
Frese Z=2 - elica a 30° - norma interna - lunga	End Mills - Z=2 Helix 30° - Internal standard long	62L 62LA	187
Frese Z=2 - elica a 30° - norma interna - extralunga	End mills - Z=2 Helix 30° - Internal standard extra long	62XL 62XLA	188
Frese a testa raggiata - Z=2 - elica a 30° - simili a DIN 6527-L	Ball nose end mills - Z=2 Helix 30° - Similar to DIN 6527-L	62R 62RA 62RW 62RWA	189
Frese a testa raggiata - Z=2 - elica a 45° - DIN 6527 L	Ball nose end mills - Z=2 Helix 45° - DIN 6527-L	62R-45° 62R-45°A 62RW-45° 62RW-45°A	190
Frese a testa raggiata - Z=2 elica a 30° - norma interna - lunga	Ball nose end mills - Z=2 Helix 30° - Internal standard long	62RL 62RLA	191
Frese a testa raggiata - Z=2 elica a 30° - norma interna - extralunga	Ball nose end mills - Z=2 Helix 30° - Internal standard extra long	62RXL 62RXLA	192
Utensili gruppo 2.8: Frese a 3 taglienti	Tools Group 2.8: 3 flutes end mills	N° id. Code	Pagina Page
Frese Z=3 "PIRAÑA"-SQ con divisione irregolare ed eliche differenziate - DIN 6527-L	End Mills - Z=3 "PIRAÑA"-SQ uneven division of cutting edges and helix angle - DIN 6527-L	63ISQ 63ISQC	194
Frese toriche - Z=3 "PIRAÑA"-SQ con divisione irregolare ed eliche differenziate - DIN 6527-L	End Mills - Z=3 "PIRAÑA"-SQ uneven division of cutting edges and helix angle - DIN 6527-L	63TISQ 63TISQC	195
Frese Z=3 - elica a 30° - norma interna	End mills - Z=3 Helix 30° - Internal standard	63 63A 63W 63WA	196
Frese Z=3 - elica a 45° - DIN 6527-L	End mills - Z=3 Helix 45° - DIN 6527-L	63-45° 63-45°A 63W-45° 63W-45°A	197
Frese Z=3 - elica a 30° - norma interna - lunga	End mills - Z=3 Helix 30° - Internal standard long	63L 63LA	198
Frese Z=3 - elica a 30° - norma interna - extralunga	End mills - Z=3 Helix 30° - Internal standard extra long	63XL 63XLA	199
Frese a testa raggiata - Z=3 - elica a 30° - norma interna	Ball nose end mills - Z=3 Helix 30° - Internal standard	63R 63RA 63RW 63RWA	200
Frese a testa raggiata - Z=3 - elica a 30° - norma interna - lunga	Ball nose end mills - Z=3 Helix 30° - Internal standard long	63RL 63RLA	201
Frese a testa raggiata - Z=3 - elica a 30° - norma interna - extralunga	Ball nose end mills - Z=3 Helix 30° - Internal standard extra long	63RXL 63RXLA	202

Frese coniche - Z=3 - elica ad angolo costante - norma interna	<i>Taper end mills - Z=3 - constant spiral angle - Internal standard</i>	63K 63KA	203
Frese coniche - Z=3 - elica ad angolo costante - norma interna	<i>Taper ball nose end mills - Z=3 - constant spiral angle - Internal standard</i>	63KR 63KRA	204

Utensili gruppo 2.9: Frese a 4 taglienti	Tools Group 2.9: 4 flutes end mills	N° id. Code	Pagina Page
Frese Z=4 - elica a 30° - norma interna	<i>End mills - Z=4 Helix 30° - Internal standard</i>	64 64A 64W 64WA	207
Frese Z=4 - elica a 30° - norma interna - lunga	<i>End mills - Z=4 Helix 30° - Internal standard long</i>	64L 64LA	208
Frese Z=4 elica a 30° - norma interna - extralunga	<i>End mills - Z=4 Helix 30° - Internal standard extra long</i>	64XL 64XLA	209
Frese a testa raggiata - Z=4 - elica a 30° - norma interna	<i>Ball nose cutters - Z=4 Helix 30° - Internal standard</i>	64R 64RA 64RW 64RWA	210
Frese a testa raggiata - Z=4 - elica a 30° - norma interna - lunga	<i>Ball nose cutters - Z=4 Helix 30° - Internal standard long</i>	64RL 64RLA	212
Frese a testa raggiata - Z=4 - elica a 30° - norma interna - extralunga	<i>Ball nose cutters - Z=4 Helix 30° - Internal standard extra long</i>	64RXL 64RXLA	213

Utensili gruppo 2.10: Frese multitaglienti per finitura	Tools Group 2.10: Multi-flute finishing end mills	N° id. Code	Pagina Page
Frese Z=6 - elica a 25° - norma interna	<i>End mills - Z=6 Helix 25° - "H" design - Internal standard</i>	66 66A	216
Frese di finitura multitaglienti - con Z dispari - norma interna	Multi-flute finishing end mills - uneven number of flutes - Internal standard	66Z 66ZA	217
Frese a taglio fine - con rompitrucciolo - norma interna	End mills - Fine cut with chipbreaker - Internal standard	66M 66MA	218
Frese a testa raggiata - taglio fine - con rompitrucciolo - norma interna	Ball nose end mills - Fine cut with chipbreaker - Internal standard	66MR 66MRA	219

Utensili gruppo 2.11: Bulini	Tools Group 2.11: Engraving tools	N° id. Code	Pagina Page
Cilindretti grezzi	Round blanks	90	222
Bulini sgrossati su un lato	Engraving tool preshaped on one side	91	223
Bulini -a 90° - 60°	Engraving tool 90° - 60° shaped on one side	94-90° 94-60°	224
Barrette quadre grezze	Square blanks	200	225
Barrette rettangolari grezze	Rectangular blanks	200	226

Per essere all'altezza dell'evoluzione costante della tecnologia, Cerin ha portato sul mercato una gamma completa ed avanzata di frese in metallo duro integrale. In aggiunta alle già note serie standard, sono state introdotte nuove frese conformi alle norme DIN più recenti, oltre ad una gamma differenziata che va dalle frese lunghe ed extra-lunghe alle frese per sgrossatura e alle frese coniche. Una serie di frese con un tagliente particolare denominato «PIRAÑA» ha ottenuto notevole riscontro e apprezzamento sul mercato, grazie al taglio privo di vibrazioni e per l'altissima qualità della finitura superficiale.

Cerin have always been sensitive to market trends and now offer a wide and technologically advanced range of solid carbide end mills. In addition to the well-known traditional products, Cerin supplies cutters which comply with the most recent DIN norms as well as a diversified range of long and extra-long, roughing and conical cutters. A special cutter, called «PIRAÑA», is very successful and appreciated thanks to its vibrationless machining and the excellent finish of the workpiece.

FRESATURA CONCORDE

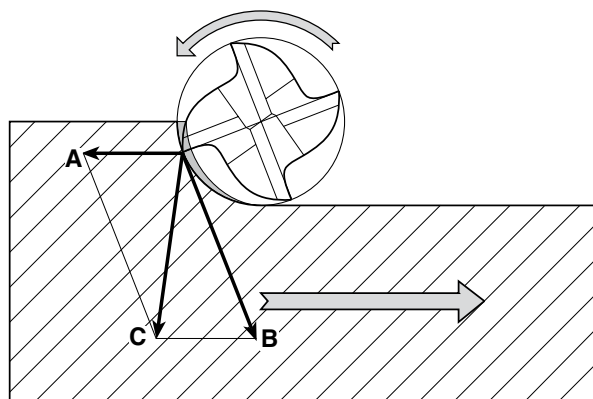
Il senso di rotazione della fresa e l'avanzamento del pezzo vanno nella stessa direzione.

Quando la fresa attacca il materiale, il truciolo asportato è del massimo spessore, mentre quando ne esce lo spessore del truciolo è minimo.

DOWN MILLING

Cutter rotation and work feed have the same direction.

The cutter machines the material at the maximum chip thickness and leaves it at the minimum.



Caratteristiche principali del tipo di taglio:

- riduzione delle vibrazioni
- elevata qualità superficiale
- maggiore durata del filo del tagliente
- possibilità di impiegare velocità di taglio maggiori

Main features:

- less vibrations
- good surface quality
- longer life of cutting edges
- higher cutting speed.

FRESATURA DISCORDE

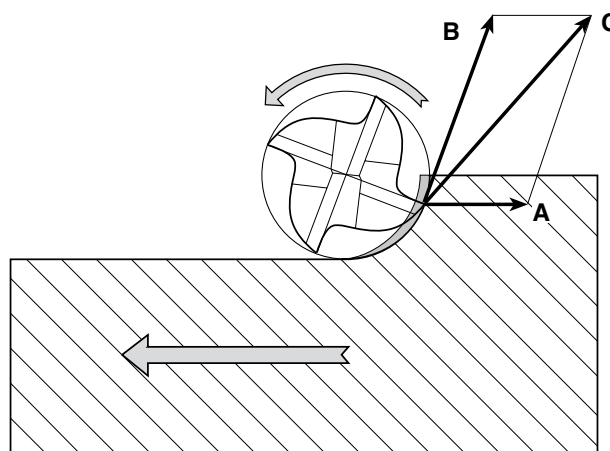
Il senso di rotazione della fresa e l'avanzamento del pezzo vanno in direzione opposta.

Quando la fresa attacca il materiale, il truciolo asportato è del minimo spessore, mentre quando ne esce lo spessore del truciolo è massimo.

UP MILLING

Cutter rotation and work feed have opposite directions.

The material is cut at the minimum thickness and left at the maximum.



Caratteristiche principali del tipo di taglio:

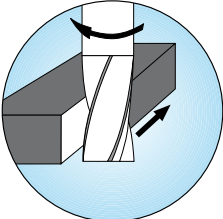
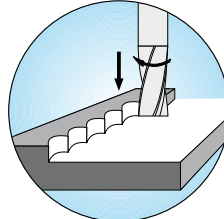
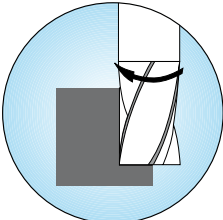
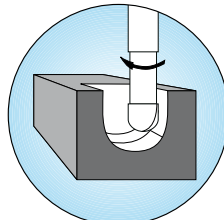
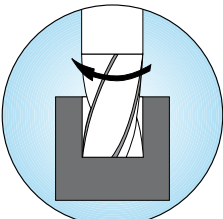
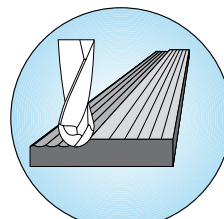
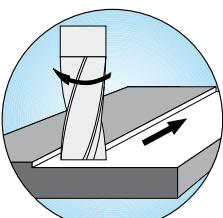
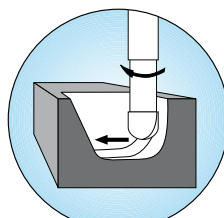
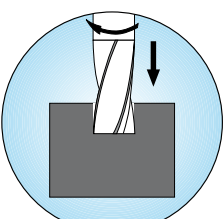
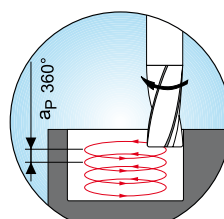
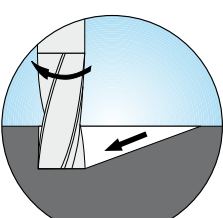
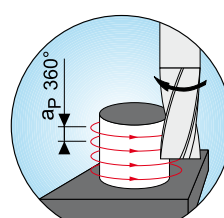
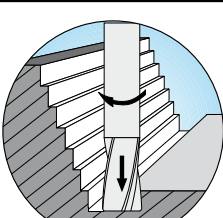
- maggiori vibrazioni dovute all'aumento dello sforzo di taglio
- minore durata della fresa a causa della maggiore usura dei taglienti nel primo tratto di lavoro
- la componente verticale dello sforzo di taglio tende a sollevare il pezzo dalla tavola di fissaggio.

Main features:

- more vibrations due to increased shear stress
- shorter life of cutter due to higher wear of cutting edges in the first working length
- the vertical shearing stress component tends to detach the work from the table.

Applicazioni di fresatura Applications for milling cutters

Esempi di applicazione / Application examples

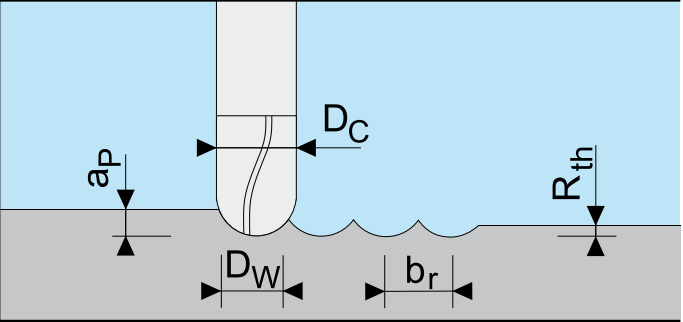
 Contornatura Profondità di taglio assiale a_p Larghezza di taglio radiale a_e Contour milling Axial depth of cut a_p Radial depth of cut a_e	 Fresatura a tuffo Impiegando foratura in asse Z per eseguire cave profonde Plunge milling by using drilling in Z-axis to open up a deep slot
 Spallamento retto Profondità di taglio assiale a_p Larghezza di taglio radiale a_e Side milling Axial depth of cut a_p Radial depth of cut a_e	 Fresatura a copiare truciolo di piccola sezione con frese di grande raggio Copy milling small chip sections with large radius cutters
 Fresatura di cave dal pieno Larghezza di taglio $D_c \times 1$ Profondità di taglio $a_p = D_c \times 1$ Slot milling working width $D_c \times 1$ Axial depth of cut $a_p = D_c \times 1$	 Fresatura a copiare truciolo di piccola sezione con frese di grande raggio Copy milling small chip sections with large radius cutters
 Fresatura frontale / spianatura Profondità di taglio a_p Larghezza di taglio fino a $D_c \times 1$ Face milling Axial depth of cut a_p working width up to $D_c \times 1$	 Fresatura di copiatura a tuffo Copiatura con procedimento 3D Push-pull plunging Copying movements in 3D machining
 Fresatura con foratura Lavorazione solo in asse Z Drilling feed only in Z-axis	 Fresatura a interpolazione circolare interna Foratura con avanzamento circolare in asse Z Internal helical interpolation ramping drilling operation with circular movement in Z-axis
 Fresatura a tuffo trasversale La penetrazione angolare dell'asse Z è più economica della foratura Ramping angular ramping in Z-axis is more economical than drilling	 Fresatura a interpolazione circolare esterna Lavorazione esterna con avanzamento circolare in asse Z External helical interpolation ramping circumference operation with circular movement in Z-axis
 Fresatura pendolare (sgrossatura) Foratura con asse Z e poi lavorazione lineare Z - leveling Drilling in Z-axis then linear x-y movement	

Breve descrizione dei termini tecnici
Brief description of technical terms

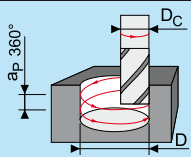
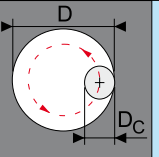
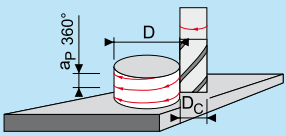
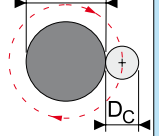
02

Formule di calcolo Formulae of calculation

02

Frese cilindriche, di copiatura e toriche End mills - Torus cutters - Ball nose cutters		Fresatura in pendolare a copiare Trace milling	
Numero di giri Revolution per minute	$n = \frac{V_c \times 1000}{D_c \times 3,14}$		
Velocità di taglio Cutting speed	$V_c = \frac{D_c \times 3,14 \times n}{1000}$		
Avanzamento/dente Feed per tooth	$f_z = \frac{V_f}{Z_n \times n}$	R_{th} Rautiefe / Surface roughness b_r Zeilensprung / Line offset D_w Arbeitsdurchmesser / Working diameter	
Avanzamento/giro Feed for revolution	$f = f_z \times Z_n$	Rautiefe Roughness	$R_{th} = \frac{D_c}{2} \sqrt{\frac{D_c^2 - b_r^2}{4}}$
Velocità di avanzamento Feed per minute	$V_f = f_z \times Z_n \times n$	Zeilensprung Line offset	$b_r = 2 \sqrt{R_{th} (D_c - R_{th})}$
Spessore medio truciolo Average chip thickness	$h_m = f_z \times \sqrt{\frac{a_e}{D_c}}$	Arbeitsdurchmesser Working diameter	$D_w = 2 \sqrt{a_p (D_c - a_p)}$

Formule di calcolo Formulae of calculation

Fresatura circolare - Fresatura con foratura - Avanzamento basato sul movimento dell'asse della fresa VfM (mm/min) Circular milling - Drill milling - Feed based on movement of the cutter axis V_{fm} (mm/min.)			
		Lavorazione interna Internal profile	$V_{fm} = \frac{V_f \times (D - D_c)}{D}$
		Lavorazione esterna External profile	$V_{fm} = \frac{V_f \times (D + D_c)}{D}$

PROBLEMA PROBLEM		RIMEDIO REMEDY	AUMENTARE INCREASE
Scheggiatura del tagliente Cutting edge spalling	Avanzamento per dente Tooth feed	Velocità di taglio - Tenacità del metallo duro - Fase sul tagliente - Stabilità della macchina Cutting speed - Carbide toughness - Cutting edge phase - Machine stability	
Usura del tagliente Cutting edge wear	Velocità di taglio Cutting speed	Avanzamento per dente - Resistenza all'usura del metallo duro - Fase sul tagliente Carbide wear resistance Cutting edge phase	
Craterizzazione Cratering	Velocità di taglio Avanzamento per dente Cutting speed Tooth feed	Resistenza all'usura del metallo duro Pressione del refrigerante Carbide wear resistance Coolant pressure	
Incollamento sul tagliente Deposit on cutting edge	Profondità di taglio Cutting depth	Velocità di taglio Avanzamento per dente Pressione del refrigerante Cutting speed Tooth feed Coolant pressure	
Cattiva qualità superficiale del pezzo Bad workpiece surface	Avanzamento per dente Fase sul tagliente Profondità di taglio Tooth feed Cutting edge phase Cutting depth	Velocità di taglio - Stabilità della macchina - Angolo dell'elica - Concentricità della fresa - Numero dei taglienti Cutting speed - Machine stability - Helix angle - Mill concentricity - Number of flute	
Vibrazioni Vibrations	Profondità di taglio Velocità di taglio Cutting depth Cutting speed	Stabilità della macchina Stabilità del pezzo Viscosità del refrigerante Machine stability Workpiece stability Coolant density	
Scheggiatura del pezzo Spalling workpiece	Avanzamento per dente Fase sul tagliente Profondità di taglio Tooth feed Cutting edge phase Cutting depth		
Sovraccarico della macchina Overload machine	Velocità di taglio Avanzamento per dente Profondità di taglio Cutting speed Tooth feed Cutting depth		
			DIMINUIRE DECREASE

Velocità di taglio V_c (m/min) - Numero di giri n (min⁻¹)
Cutting speeds V_c (m/min) - Revolution per minute n (min⁻¹)

Formule di calcolo: Velocità di taglio V_c (m/min) - Numero di giri n (min⁻¹)
Calculation formula: Cutting speed V_c (m/min) - Revolution per minute n (min⁻¹)

$$V_c \text{ (m/min)} = \frac{D_c \text{ (mm)} \times 3,14 \times n \text{ (min}^{-1}\text{)}}{1000}$$

$$n \text{ (min}^{-1}\text{)} = \frac{V_c \text{ (m/min)} \times 1000}{D_c \text{ (mm)} \times 3,14}$$

02

V_c (m/min)	D_c (mm)								
	1,00	1,5	2,00	2,50	3,00	4,00	5,00	6,00	8,00
Numero giri n (min ⁻¹) / Revolution per minute n (min ⁻¹)									
20	6369	4245	3185	2548	2123	1592	1274	1062	796
25	7962	5307	3981	3185	2654	1990	1592	1327	995
30	9554	6368	4777	3822	3185	2389	1911	1592	1194
40	12739	8491	6369	5096	4246	3185	2548	2123	1592
50	15924	10613	7962	6369	5308	3981	3185	2654	1990
60	19108	12736	9554	7643	6369	4777	3822	3185	2389
80	25478	16982	12739	10191	8493	6369	5096	4246	3185
100	31847	21227	15924	12739	10616	7962	6369	5308	3981
125	39809	26534	19904	15924	13270	9952	7962	6635	4976
150	47771	31840	23885	19108	15924	11943	9554	7962	5971
175	55732	37147	27866	22293	18577	13933	11146	9289	6967
200	63694	42454	31847	25478	21231	15924	12739	10616	7962
250	79618	53067	39809	31847	26539	19904	15924	13270	9952
300	95541	63681	47771	38217	31847	23885	19108	15924	11943
400	127389	84908	63694	50955	42463	31847	25478	21231	15924
450	143312	95521	71656	57325	47771	35828	28662	23885	17914
500	159236	106135	79618	63694	53079	39809	31847	26539	19904
600		127361	95541	76433	63694	47771	38217	31847	23885
800			127389	101911	84926	63694	50955	42463	31847
1000				127389	106157	79618	63694	53079	39809

V_c (m/min)	D_c (mm)								
	10,00	12,00	14,00	15,00	16,00	18,00	20,00	25,00	32,00
Numero giri n (min ⁻¹) / Revolution per minute n (min ⁻¹)									
20	637	531	455	425	398	354	318	255	199
25	796	663	569	531	498	442	398	318	249
30	955	796	682	637	597	531	478	382	299
40	1274	1062	910	849	796	708	637	510	398
50	1592	1327	1137	1062	995	885	796	637	498
60	1911	1592	1365	1274	1194	1062	955	764	597
80	2548	2123	1820	1699	1592	1415	1274	1019	796
100	3185	2654	2275	2123	1990	1769	1592	1274	995
125	3981	3317	2843	2654	2488	2212	1990	1592	1244
150	4777	3981	3412	3185	2986	2654	2389	1911	1493
175	5573	4644	3981	3715	3483	3096	2787	2229	1742
200	6369	5308	4550	4246	3981	3539	3185	2548	1990
250	7962	6635	5687	5308	4976	4423	3981	3185	2488
300	9554	7962	6824	6369	5971	5308	4777	3822	2986
400	12739	10616	9099	8493	7962	7077	6369	5096	3981
450	14331	11943	10237	9554	8957	7962	7166	5732	4479
500	15924	13270	11374	10616	9952	8846	7962	6369	4976
600	19108	15924	13649	12739	11943	10616	9554	7643	5971
800	25478	21231	18198	16985	15924	14154	12739	10191	7962
1000	31847	26539	22748	21231	19904	17693	15924	12739	9952

Velocità di taglio (valori approssimativi) per frese Cerin

Approximative values of cutting speed for milling machines

Gruppo Materiale	Denominazione Materiale	Resistenza N/mm ² V _c (m/min)	Metallo duro	Rivestito
Material Group	Material Description	Strength N/mm ²	Carbide	Coating
Alluminio - Leghe d'alluminio - Rame - Leghe di rame - Magnesio Aluminium - Aluminium alloys - Copper - Copper alloys - Magnesium				Cer-Al
A 1.1	G-AlMg3	130 - 190	220	500
A 1.2	Al 99.5 / F13	100 - 250	300	600
A 1.3	GDAlSi17Cu4	180 - 250		200
A 1.4	GD-AlSi12	220 - 300		280
A 1.5	GD-AlSi9Cu3	240 - 320		280
A 1.6	AlCuMg1 / F39	300-500	300	600
A1.7	Composti a matrice metallica (MMC) - Lega in metallo leggero - rinforzo in fibra		220	300
A 2.1	E-Cu	220 - 350	200	250
A 2.2	GCuSn5ZnPb / Rg5	150 - 350	220	300
A 2.3	GCuSn7ZnPb / Rg7	150 - 350	220	300
A 2.4	CuZn40 / Ms60	340 - 500	220	250
A 2.5	CuZn39Pb2 / Ms58	350-500	350	500
A 2.6	CuZn37 / Ms63	300 - 550	200	250
A 2.7	CuAl10Ni	500 - 800	150	250
A 3.1	Ampco 16	630		65
A 3.2	Ampco 20	600		25
A 4.1	MgAl6	300 - 500	200	280
A 4.2	GMgAl9Zn1	300 - 500	180	260
Plastiche - Plastiche rinforzate con fibre - Materiali non ferrosi Plastics - Reinforced plastic fibres - Nonferrous materials				Cer-P
B 1.1	Duroplastiche / Thermosets	80 - 110	200	400
B 1.2	Termoplastiche / Thermoplastics	≤ 80	250	500
B 1.3	Policarbonato / Polycarbonate		150	300
B 1.4	CFK-GFK-AFK	800 - 1500	120	180
B 1.5	Plexiglas / Plexiglass	≤ 255	150	300
B 2.1	Legno duro / Hard wood	≤ 255	200	300
B 2.2	Gomma dura / Hard rubber		60	100
B 2.3	Metalli NF / Nonferrous metals	≤ 255	200	300
B 2.4	Cartone pressato / Pressed carton	≤ 255	200	250
Acciai in generale - Leghe d'acciaio - Acciai temprati General steels - Steel alloys - Hardened steels				Cer-T
C 1.1	Q-St-37-3	< 400	200	250
C 1.2	R-Fe80	< 400	200	250
C 1.3	9SMnPb28	500 - 700	150	200
C 1.4	St37-2	320 - 470	150	200
C 1.5	16MnCr5	500 - 700	100	150
C 1.6	Ck45	600 - 800	100	150
C 1.7	Gs25CrMo4	650 - 950	100	180
C 1.8	St70-2	700 - 900	120	180
C 2.1	100Cr6	700 - 900	100	150
C 2.2	X155CrVMo12-1	900 - 1100	80	120
C 2.3	X30WCrV5-3	1100	80	120
C 2.4	42CrMo4V	1200 - 1400	80	120
C 3.1	X38CrMoV5-3	900 - 1100	80	120
C 3.2	55NiCrMoV6	47 - 52 HRC		100
C 3.3	45WCrV7	56 - 60 HRC		100
C 3.4	X155CrVMo12-1	60 - 63 HRC		80
C 3.5	X210CrW12	63 - 66 HRC		80
C 4.1	FeroTiC	800 - 900		40
C 4.2	Hardox500	1300 - 1400		30

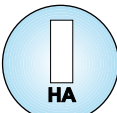
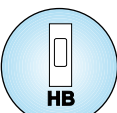
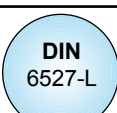
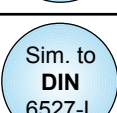
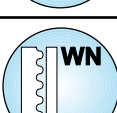
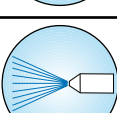
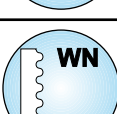
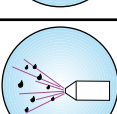
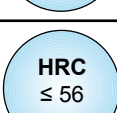
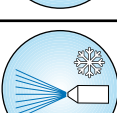
Velocità di taglio (valori approssimativi) per frese Cerin

Approximative values of cutting speed for milling machines

02

Gruppo Materiale	Denominazione Materiale	Resistenza N/mm ²	Metallo duro V _c (m/min)	Rivestito
Material Group	Material Description	Strength N/mm ²	Carbide	Coating
Acciai resistenti alla corrosione e agli acidi - Acciai resistenti al calore <i>Corrosion and acid resistant steels - Heat resistant steels</i>				
D 1.1	X10NiCrAlTi32-20 (INCOLOY800)	610 - 850		90
D 1.2	X12CrNiTi18-9	500 - 700		90
D 1.3	X6CrNiMoTi17-12-2	500 - 730		90
D 1.4	X45SiCr4	900 - 1100		70
D 1.5	X5NiCrTi26-15	1200		50
Leghe di nichel/cobalto - Titanio - Leghe di titanio <i>Nickel/Cobalt alloys - Titanium - Titanium alloys</i>				
E 1.1	Ti3 (Ti99.4)	700	100	120
E 1.2	TiAl6V4	700 - 900	80	100
E 1.3	TiAlMo4Sn2	900 - 1250		80
E 2.1	NiCu30Fe (MONEL400I)	420 - 610		70
E 2.2	NiCr19NbMo (INCONEL718)	850-1200		60
E 2.3	Haynes 25 (L605)	1550 - 2000		40
Ghisa <i>Cast irons</i>				
F 1.1	GG 20	120-220 HB	140	160
F 1.2	GG 30	220 - 270 HB	120	150
F 1.4	Hartguß / Hard cast iron	< 400 HB		80
F 1.2	GTW40	360 - 420	120	160
F 1.3	GTS65	560 - 650	100	150
F 2.1	GGG 40	400	120	150
F 2.2	GGG 70	700 - 1050	100	150
F 2.3	GGV (80% Perlite)	220 HB	80	100
F 2.4	GGV (100% Perlite)	230 HB	70	100
Grafite - Leghe tungsteno/rame <i>Graphite - Tungsten/cooper alloys</i>				
G 1.1	C-800	60		450
G 2.1	W-Cu 80/20	230-250 HV		400

DESCRIZIONE DEI PITTOGRAMMI (SIMBOLI) ICONS (SYMBOLS) DESCRIPTION

Qualità metallo duro <i>Carbide grade</i>		Fresatura di materiali da 44 a 67 HRC <i>Hard milling from 44 to 67 HRC</i>	
Qualità metallo duro <i>Carbide grade</i>		Gambo secondo norma DIN 6535 HA <i>Shank according to DIN 6535HA</i>	
Qualità metallo duro <i>Carbide grade</i>		Gambo secondo norma DIN 6535 HB <i>Shank according to DIN 6535 HB</i>	
Qualità metallo duro <i>Carbide grade</i>		Gambo secondo norma DIN 6535 HA/HB <i>Shank according to DIN 6535 HA/HB</i>	
Esecuzione utensile secondo norma interna <i>Cutting edge design acc. to internal standard</i>		Fresatura ad alte prestazioni <i>High Performance Cutting</i>	
Norma interna (WN) corta <i>Internal standard short</i>		Fresatura ad alta velocità <i>High speed cutting</i>	
Norma interna (WN) lunga <i>Internal standard long</i>		Dimensioni secondo norma DIN 6527-L <i>Dimensions acc. to DIN 6527-L</i>	
Norma interna (WN) extra lunga <i>Internal standard extra long</i>		Dimensioni secondo norma DIN 6527-K <i>Dimensions acc. to DIN 6527-K</i>	
Werksnorm (WN) extra lang Norma interna (WN) extra lunga <i>Internal standard extra long</i>		Dimensioni secondo norma DIN 6528 <i>Dimensions acc. to DIN 6528</i>	
Utensile con taglienti opposti - norma interna <i>Internal standard - Counterwise special cut</i>		Dimensioni simili a norma DIN 6527-L <i>Dimensions similar to DIN 6527-L</i>	
Rompitruciolo <i>Chip breaker</i>		Lavorazione con aria compressa <i>With compressed air</i>	
Rompitruciolo <i>Chip breaker</i>		Lavorazione con nebulizzazione <i>With cold air coolant system</i>	
Fresatura di materiali fino a 56 HRC <i>Hard milling up to 56 HRC</i>		MQL - Lavorazione con lubrificazione minimale <i>MQL - Minimum quantity lubrication</i>	

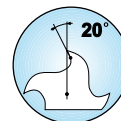
DESCRIZIONE DEI PITTOGRAMMI (SIMBOLI) ICONS (SYMBOLS) DESCRIPTION

02

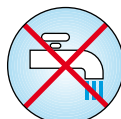
Lavorazione con emulsione d'olio
With oil emulsion



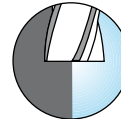
Angolo di spoglia
Rake angle



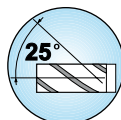
Lavorazione a secco
Dry machining



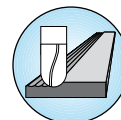
Esempio di lavorazione
Application example



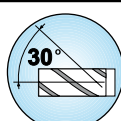
Angolo dell'elica
Helix angle



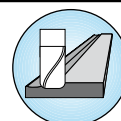
Esempio di lavorazione
Application example



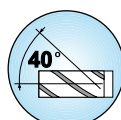
Angolo dell'elica
Helix angle



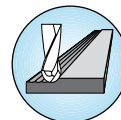
Esempio di lavorazione
Application example



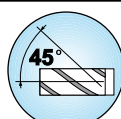
Angolo dell'elica
Helix angle



Esempio di lavorazione
Application example



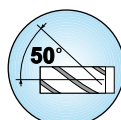
Spiralwinkel
Helix angle



Esempio di lavorazione
Application example



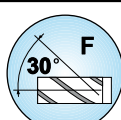
Angolo dell'elica
Helix angle



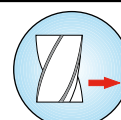
Esempio di lavorazione
Application example



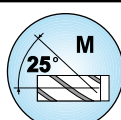
Angolo dell'elica
Helix angle



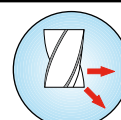
Senso di avanzamento
Feed direction



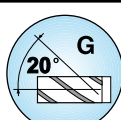
Angolo dell'elica
Helix angle



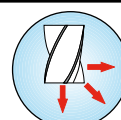
Senso di avanzamento
Feed direction



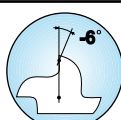
Angolo dell'elica
Helix angle



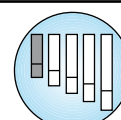
Senso di avanzamento
Feed direction



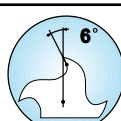
Angolo di spoglia
Rake angle



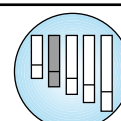
Lunghezza utensile
Tool length



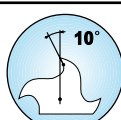
Angolo di spoglia
Rake angle



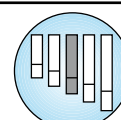
Lunghezza utensile
Tool length



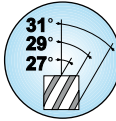
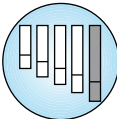
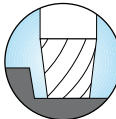
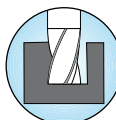
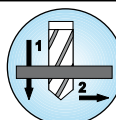
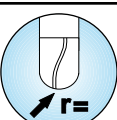
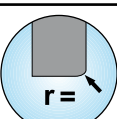
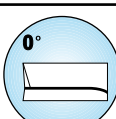
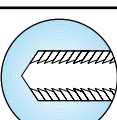
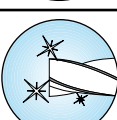
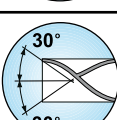
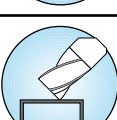
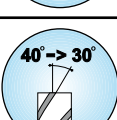
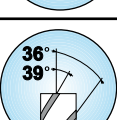
Angolo di spoglia
Rake angle



Lunghezza utensile
Tool length



DESCRIZIONE DEI PITTOGRAMMI (SIMBOLI) ICONS (SYMBOLS) DESCRIPTION

Lunghezza utensile <i>Tool length</i>		Differenti angoli dell'elica <i>Different helix angle</i>	
Lunghezza utensile <i>Tool length</i>		Esempio di lavorazione <i>Application example</i>	
Lunghezza utensile <i>Tool length</i>		Esempio di lavorazione <i>Application example</i>	
Lunghezza utensile <i>Tool length</i>		Esempio di lavorazione <i>Application example</i>	
Lunghezza utensile <i>Tool length</i>		Esempio di lavorazione <i>Application example</i>	
Frese di copiatura <i>Ball nose cutters</i>		Esempio di lavorazione <i>Application example</i>	
Raggio al vertice <i>Corner radius</i>		A elica dritta <i>Straight flute</i>	
Tagliente in opposizione <i>Counterrotating cutting edges</i>			
taglienti con lappatura scarico elica <i>with fine lapped chip flutes</i>			
Taglio sinistro/destro <i>Right/left cutting edges</i>			
Esempio di lavorazione <i>Application example</i>			
Angolo dell'elica variabile <i>Variable helix angle</i>			
2 differenti angoli dell'elica <i>2 different helix angles</i>			

02



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Frese di copiatura e frese per materiali duri
Copying milling cutters and milling cutters for hard materials

FRESATURA AD ALTA VELOCITÀ

La fresatura ad alta velocità significa riduzione dei tempi di lavorazione e dei costi di lavorazione, con impiego di alte velocità di taglio e di profondità relativamente ridotte in senso sia radiale che assiale.
Le frese HSC presentano una geometria particolarmente appropriata e sono prodotte in metallo duro a grana extra fine.

HIGH SPEED CUTTING

High speed cutting means to reduce times and costs of production, by using extremely high speed cutting and depth of cut, both radial and axial, relatively reduced.
“HSC end mills” show a particularly appropriate geometry and are built with special hard metals, extra-fine grained.

CONSIGLI PER LA LAVORAZIONE HSC / USEFUL SUGGESTIONS FOR THE HSC METHOD

Consigliamo per quanto possibile il taglio in tirata.
Il truciolo di sezione maggiore corrisponde alla velocità di taglio ottimale.

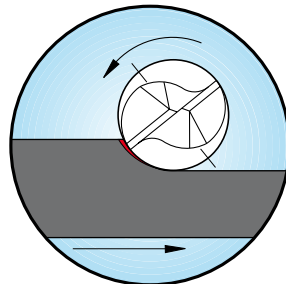
*We recommend that pull cutting be used as much as possible.
The greater section of swarf corresponds to the optimum cutting speed.*



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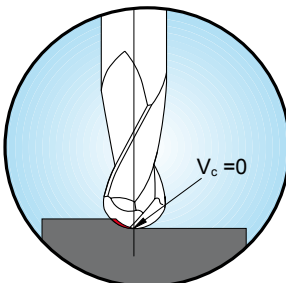
La fresatura concorde è qualitativamente migliore di quella discorde: si ottiene una rugosità superficiale migliore, con minore rumore e maggiore durata utile degli utensili.

*Concordant milling gives a better quality result than discordant milling:
better surface roughness, less noise, and longer tool life.*



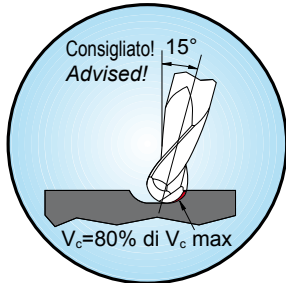
Se possibile, la fresa dovrebbe essere leggermente inclinata nel senso dell'avanzamento per evitare la lavorazione nel punto centrale dell'utensile, dove la velocità di taglio è pari a 0.

If possible, the tools should be slightly tilted in the feed direction to avoid any working in the central part of the tool where the cutting speed is equal to 0.



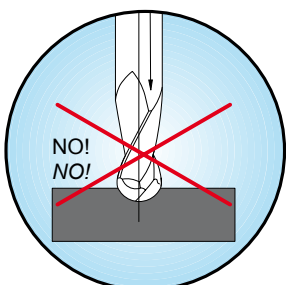
L'inclinazione ideale è di 15° nel senso dell'avanzamento e consente alla fresa di lavorare con una velocità di taglio pari all'80% della massima velocità possibile rispetto al diametro nominale della fresa.

The ideal tilt is at 15° in the feed direction and allows the mill to work to a cutting speed equal to 80% of the maximum theoretical one in reference to the nominal diameter of the cutter itself.



Non eseguire movimenti a tuffo perpendicolari al pezzo. Raccomandiamo movimenti a spirale o a rampa.

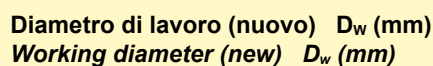
Do not carry out vertical movements of immersion in the piece; we recommend spiral or ramp movements.



D_w (mm) - Working diameters for copy cutters and Z leveling cutters

Calculation formula: Cutting speed V_c (m/min) - Revolution per minute n (min^{-1}) - Working width (eff. working diameter) D_w (mm)

$$D_w \text{ (mm)} = 2 \times \sqrt{a_p (D_c - a_p)}$$



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Velocità di taglio V_c (m/min) - Numero di giri al minuto n (min⁻¹)

Cutting speed V_c (m/min) - Revolution per minute n (min⁻¹)

Formule di calcolo: Velocità di taglio V_c (m/min) - Numero di giri n (min⁻¹)
Calculation formula: Cutting speed V_c (m/min) - Revolution per minute n (min⁻¹)

$$V_c \text{ (m/min)} = \frac{D_w \text{ (mm)} \times 3,14 \times n \text{ (min}^{-1}\text{)}}{1000}$$

$$n \text{ (min}^{-1}\text{)} = \frac{V_c \text{ (m/min)} \times 1000}{D_w \text{ (mm)} \times 3,14}$$

Numero di giri al minuto per diametro di lavoro D_w (mm)

Revolution per minute for working diameters D_w (mm)

D_w (mm)	V_c (m/min)									
	40	50	60	80	100	125	150	180	200	220
	Numero giri al minuto n (min ⁻¹) / Revolution per minute n (min ⁻¹)									
0,3	42463	53079	6369	84926	106157	132696	159236			
0,4	31847	39809	4777	63694	79618	99522	119427	143312	159236	175159
0,5	25478	31847	3822	50955	63694	79618	95541	114650	127389	140127
0,6	21231	26539	3185	42463	53079	66348	79618	95541	106157	116773
0,7	18198	22748	2730	36397	45496	56870	68244	81893	90992	100091
0,8	15924	19904	2389	31847	39809	49761	59713	71656	79618	87580
0,9	14154	17693	2123	28309	35386	44232	53079	63694	70771	77849
1	12739	15924	1911	25478	31847	39809	47771	57325	63694	70064
1,1	11581	14476	1737	23162	28952	36190	43428	52113	57904	63694
1,2	10616	13270	1592	21231	26539	33174	39809	47771	53079	58386
1,3	9799	12249	1470	19598	24498	30622	36747	44096	48996	53895
1,4	9099	11374	1365	18198	22748	28435	34122	40946	45496	50045
1,5	8493	10616	1274	16985	21231	26539	31847	38217	42463	46709
1,6	7962	9952	1194	15924	19904	24881	29857	35828	39809	43790
1,8	7077	8846	1062	14154	17693	22116	26539	31847	35386	38924
2	6369	7962	955	12739	15924	19904	23885	28662	31847	35032
2,2	5790	7238	869	11581	14476	18095	21714	26057	28952	31847
2,4	5308	6635	796	10616	13270	16587	19904	23885	26539	29193
2,6	4900	6124	735	9799	12249	15311	18373	22048	24498	26948
2,8	4550	5687	682	9099	11374	14217	17061	20473	22748	25023
3,2	3981	4976	597	7962	9952	12440	14928	17914	19904	21895
3,4	3747	4683	562	7493	9367	11709	14050	16860	18734	20607
3,6	3539	4423	531	7077	8846	11058	13270	15924	17693	19462
3,8	3352	4190	503	6705	8381	10476	12571	15085	16762	18438
4	3185	3981	478	6369	7962	9952	11943	14331	15924	17516
4,3	2963	3703	444	5925	7406	9258	11109	13331	14813	16294
4,6	2769	3462	415	5539	6923	8654	10385	12462	13847	15231
5	2548	3185	382	5096	6369	7962	9554	11465	12739	14013
5,5	2316	2895	347	4632	5790	7238	8686	10423	11581	12739
6	2123	2654	318	4246	5308	6635	7962	9554	10616	11677
6,5	1960	2450	294	3920	4900	6124	7349	8819	9799	10779
7	1820	2275	273	3640	4550	5687	6824	8189	9099	10009
7,5	1699	2123	255	3397	4246	5308	6369	7643	8493	9342
8	1592	1990	239	3185	3981	4976	5971	7166	7962	8758
8,5	1499	1873	225	2997	3747	4683	5620	6744	7493	8243
9	1415	1769	212	2831	3539	4423	5308	6369	7077	7785
9,5	1341	1676	201	2682	3352	4190	5028	6034	6705	7375
10	1274	1592	191	2548	3185	3981	4777	5732	6369	7006
10,5	1213	1517	182	2426	3033	3791	4550	5460	6066	6673
11	1158	1448	174	2316	2895	3619	4343	5211	5790	6369
11,5	1108	1385	166	2215	2769	3462	4154	4985	5539	6092
12	1062	1327	159	2123	2654	3317	3981	4777	5308	5839
13	980	1225	147	1960	2450	3062	3675	4410	4900	5390
14	910	1137	136	1820	2275	2843	3412	4095	4550	5005
15	849	1062	127	1699	2123	2654	3185	3822	4246	4671
16	796	995	119	1592	1990	2488	2986	3583	3981	4379

Velocità di taglio V_c (m/min) - Numero di giri al minuto n (min⁻¹)
Cutting speed V_c (m/min) - Revolution per minute n (min⁻¹)

Formule di calcolo: Velocità di taglio V_c (m/min) - Numero di giri n (min⁻¹)
Calculation formula: Cutting speed V_c (m/min) - Revolution per minute n (min⁻¹)

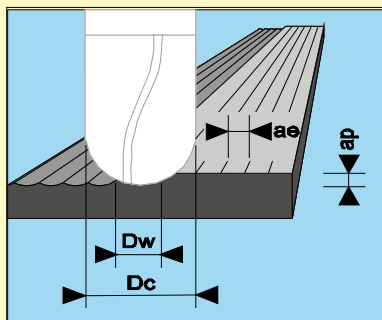
$$V_c \text{ (m/min)} = \frac{D_w \text{ (mm)} \times 3,14 \times n \text{ (min}^{-1}\text{)}}{1000}$$

$$n \text{ (min}^{-1}\text{)} = \frac{V_c \text{ (m/min)} \times 1000}{D_w \text{ (mm)} \times 3,14}$$

Numero di giri al minuto per diametro di lavoro D_w (mm)
Revolution per minute for working diameters D_w (mm)

D _w (mm)	V _c (m/min)										
	250	300	350	400	450	500	550	600	650	700	750
	Numero giri al minuto n (min ⁻¹) / Revolution per minute n (min ⁻¹)										
0,3											
0,4											
0,5	159236										
0,6	132696	159236									
0,7	113740	136488	159236								
0,8	99522	119427	139331	159236							
0,9	88464	106157	123850	141543	159236						
1	79618	95541	111465	127389	143312	159236					
1,1	72380	86856	101332	115808	130284	144760	159236				
1,2	66348	79618	92887	106157	119427	132696	145966	159236			
1,3	61244	73493	85742	97991	110240	122489	134738	146987	159236		
1,4	56870	68244	79618	90992	102366	113740	125114	136488	147862	159236	
1,5	53079	63694	74310	84926	95541	106157	116773	127389	138004	148620	159236
1,6	49761	59713	69666	79618	89570	99522	109475	119427	129379	139331	149283
1,8	44232	53079	61925	70771	79618	88464	97311	106157	115004	123850	132696
2	39809	47771	55732	63694	71656	79618	87580	95541	103503	111465	119427
2,2	36190	43428	50666	57904	65142	72380	79618	86856	94094	101332	108570
2,4	33174	39809	46444	53079	59713	66348	72983	79618	86253	92887	99522
2,6	30622	36747	42871	48996	55120	61244	67369	73493	79618	85742	91867
2,8	28435	34122	39809	45496	51183	56870	62557	68244	73931	79618	85305
3,2	24881	29857	34833	39809	44785	49761	54737	59713	64689	69666	74642
3,4	23417	28100	32784	37467	42151	46834	51517	56201	60884	65568	70251
3,6	22116	26539	30962	35386	39809	44232	48655	53079	57502	61925	66348
3,8	20952	25142	29333	33523	37714	41904	46095	50285	54475	58666	62856
4	19904	23885	27866	31847	35828	39809	43790	47771	51752	55732	59713
4,3	18516	22219	25922	29625	33328	37032	40735	44438	48141	51844	55547
4,6	17308	20770	24232	27693	31155	34616	38078	41540	45001	48463	51925
5	15924	19108	22293	25478	28662	31847	35032	38217	41401	44586	47771
5,5	14476	17371	20266	23162	26057	28952	31847	34742	37638	40533	43428
6	13270	15924	18577	21231	23885	26539	29193	31847	34501	37155	39809
6,5	12249	14699	17148	19598	22048	24498	26948	29397	31847	34297	36747
7	11374	13649	15924	18198	20473	22748	25023	27298	29572	31847	34122
7,5	10616	12739	14862	16985	19108	21231	23355	25478	27601	29724	31847
8	9952	11943	13933	15924	17914	19904	21895	23885	25876	27866	29857
8,5	9367	11240	13114	14987	16860	18734	20607	22480	24354	26227	28100
9	8846	10616	12385	14154	15924	17693	19462	21231	23001	24770	26539
9,5	8381	10057	11733	13409	15085	16762	18438	20114	21790	23466	25142
10	7962	9554	11146	12739	14331	15924	17516	19108	20701	22293	23885
10,5	7583	9099	10616	12132	13649	15165	16682	18198	19715	21231	22748
11	7238	8686	10133	11581	13028	14476	15924	17371	18819	20266	21714
11,5	6923	8308	9693	11077	12462	13847	15231	16616	18001	19385	20770
12	6635	7962	9289	10616	11943	13270	14597	15924	17251	18577	19904
13	6124	7349	8574	9799	11024	12249	13474	14699	15924	17148	18373
14	5687	6824	7962	9099	10237	11374	12511	13649	14786	15924	17061
15	5308	6369	7431	8493	9554	10616	11677	12739	13800	14862	15924
16	4976	5971	6967	7962	8957	9952	10947	11943	12938	13933	14928

Frese a copiare - Dati di taglio - Avanzamento per dente f_z (mm) - Profondità di taglio a_p (mm) - Larghezza di taglio a_e (mm)
 Copy milling cutters - Cutting data - Feed per tooth f_z (mm) - Axial depth of cut a_p (mm) - Radial depth of cut a_e (mm)



Copiatura a_e (mm) e a_p (mm)
 Copying a_e (mm) and a_p (mm)

Avanzamento per dente f_z (mm) / Feed per tooth f_z (mm)
 Avanzamento al giro f (mm) / Feed per revolution f (mm)
 Avanzamento V_f (mm/min) / Feed rate V_f (mm/min)

$f_z = D_c$ (mm) x Valore tabella / D_c (mm) / Value table
 $f = Z_n \times f_z$
 $V_f = n \times Z_n \times f_z$

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Gruppe A - Alluminio - Leghe d'alluminio - Rame - Leghe di rame - Magnesio
 Group A - Aluminium - Aluminium alloys - Copper - Copper alloys - Magnesium

		Frese a testa raggiata / Ball nose cutters						Frese toriche / Torus cutters					
		Sgrossatura Roughing			Finitura Finishing			Sgrossatura Roughing			Finitura Finishing		
		$a_p = D_c \times 0,1$ $a_e = D_c \times 0,2$			$a_p = D_c \times 0,02$			$a_p = D_c \times 0,1$ $a_e = D_c \times 0,2$			$a_p = D_c \times 0,02$		
		■ D_c (mm)			D_c (mm)			D_c (mm)			D_c (mm)		
	$f_z =$	1,5-2,5	3,0-5,0	6,0-20	1,5-2,5	3,0-5,0	6,0-20	1,5-2,5	3,0-5,0	6,0-20	1,5-2,5	3,0-5,0	6,0-20
A 1.1	$D_c \times$	0,009	0,014	0,018	0,009	0,014	0,018	0,009	0,014	0,016	0,009	0,014	0,018
A 1.2	$D_c \times$	0,010	0,015	0,019	0,010	0,015	0,019	0,010	0,015	0,017	0,010	0,015	0,019
A 1.3	$D_c \times$	0,008	0,012	0,015	0,008	0,012	0,015	0,008	0,012	0,014	0,008	0,012	0,015
A 1.4	$D_c \times$	0,007	0,010	0,013	0,007	0,010	0,013	0,007	0,010	0,012	0,007	0,010	0,013
A 1.5	$D_c \times$	0,008	0,013	0,016	0,008	0,013	0,016	0,008	0,013	0,014	0,008	0,013	0,016
A 1.6	$D_c \times$	0,010	0,015	0,019	0,010	0,015	0,019	0,010	0,015	0,017	0,010	0,015	0,019
A 1.7	$D_c \times$	0,004	0,006	0,008	0,004	0,006	0,008	0,004	0,006	0,007	0,004	0,006	0,008
A 2.1	$D_c \times$	0,006	0,010	0,012	0,006	0,010	0,012	0,006	0,010	0,011	0,006	0,010	0,012
A 2.2	$D_c \times$	0,006	0,010	0,012	0,006	0,010	0,012	0,006	0,010	0,011	0,006	0,010	0,012
A 2.3	$D_c \times$	0,006	0,010	0,012	0,006	0,010	0,012	0,006	0,010	0,011	0,006	0,010	0,012
A 2.4	$D_c \times$	0,006	0,009	0,011	0,006	0,009	0,011	0,006	0,009	0,010	0,006	0,009	0,011
A 2.5	$D_c \times$	0,006	0,009	0,011	0,006	0,009	0,011	0,006	0,009	0,010	0,006	0,009	0,011
A 2.6	$D_c \times$	0,006	0,009	0,011	0,006	0,009	0,011	0,006	0,009	0,010	0,006	0,009	0,011
A 2.7	$D_c \times$	0,006	0,010	0,012	0,006	0,010	0,012	0,006	0,010	0,011	0,006	0,010	0,012
A 3.1	$D_c \times$	0,005	0,008	0,010	0,005	0,008	0,010	0,005	0,008	0,009	0,005	0,008	0,010
A 3.2	$D_c \times$	0,004	0,006	0,007	0,004	0,006	0,007	0,004	0,006	0,006	0,004	0,006	0,007
A 4.1	$D_c \times$	0,009	0,014	0,018	0,009	0,014	0,018	0,009	0,014	0,016	0,009	0,014	0,018
A 4.2	$D_c \times$	0,010	0,015	0,019	0,010	0,015	0,019	0,010	0,015	0,017	0,010	0,015	0,019

■ Questi valori approssimativi devono essere sempre adattati alla macchina, all'utensile e al pezzo.
 ■ These approx. values always should be adapted to machine, workpiece and tool.

Frese a copiare - Dati di taglio - Avanzamento per dente f_z (mm) - Profondità di taglio a_p (mm) - Larghezza di taglio a_e (mm)
 Copy milling cutters - Cutting data - Feed per tooth f_z (mm) - Axial depth of cut a_p (mm) - Radial depth of cut a_e (mm)

Gruppo B - Plastiche - Plastiche rinforzate con fibre - Materiali non ferrosi Group B - Plastics - Reinforced plastic fibres - Nonferrous materials													
		Frese a testa raggiata / Ball nose cutters						Frese toriche / Torus cutters					
		Sgrossatura Roughing			Finitura Finishing			Sgrossatura Roughing			Finitura Finishing		
		$a_p = D_c \times 0,1$ $a_e = D_c \times 0,2$			$a_p = D_c \times 0,02$			$a_p = D_c \times 0,1$ $a_e = D_c \times 0,2$			$a_p = D_c \times 0,02$		
		■ D_c (mm)			■ D_c (mm)			■ D_c (mm)			■ D_c (mm)		
	$f_z =$	1,0-2,5	3,0-5,0	6,0-20	1,0-2,5	3,0-5,0	6,0-20	1,0-2,5	3,0-5,0	6,0-20	1,0-2,5	3,0-5,0	6,0-20
B 1.1	$D_c \times$	0,010	0,018	0,020	0,008	0,012	0,016	0,010	0,016	0,018	0,010	0,008	0,014
B 1.2	$D_c \times$	0,009	0,016	0,018	0,007	0,011	0,014	0,009	0,014	0,016	0,009	0,007	0,013
B 1.3	$D_c \times$	0,010	0,018	0,020	0,008	0,012	0,016	0,010	0,016	0,018	0,010	0,008	0,014
B 1.4	$D_c \times$	0,005	0,009	0,010	0,004	0,006	0,008	0,005	0,008	0,009	0,005	0,004	0,007
B 1.5	$D_c \times$	0,010	0,018	0,020	0,008	0,012	0,016	0,010	0,016	0,018	0,010	0,008	0,014
B 2.1	$D_c \times$	0,006	0,011	0,012	0,005	0,007	0,010	0,006	0,010	0,011	0,006	0,005	0,008
B 2.2	$D_c \times$	0,005	0,009	0,010	0,004	0,006	0,008	0,005	0,008	0,009	0,005	0,004	0,007
B 2.3	$D_c \times$	0,008	0,014	0,016	0,006	0,010	0,013	0,008	0,013	0,014	0,008	0,006	0,011
B 2.4	$D_c \times$	0,007	0,012	0,013	0,005	0,008	0,010	0,007	0,010	0,012	0,007	0,005	0,009
Gruppo C - Acciai in generale - Leghe d'acciaio - Acciai temprati Group C - General steels - Steel alloys - Hardened steels													
C 1.1	$D_c \times$	0,006	0,011	0,012	0,005	0,007	0,010	0,006	0,010	0,011	0,006	0,005	0,008
C 1.2	$D_c \times$	0,006	0,011	0,012	0,005	0,007	0,010	0,006	0,010	0,011	0,006	0,005	0,008
C 1.3	$D_c \times$	0,006	0,011	0,012	0,005	0,007	0,010	0,006	0,010	0,011	0,006	0,005	0,008
C 1.4	$D_c \times$	0,006	0,011	0,012	0,005	0,007	0,010	0,006	0,010	0,011	0,006	0,005	0,008
C 1.5	$D_c \times$	0,005	0,009	0,010	0,004	0,006	0,008	0,005	0,008	0,009	0,005	0,004	0,007
C 1.6	$D_c \times$	0,005	0,009	0,010	0,004	0,006	0,008	0,005	0,008	0,009	0,005	0,004	0,007
C 1.7	$D_c \times$	0,006	0,010	0,011	0,004	0,007	0,009	0,006	0,009	0,010	0,006	0,004	0,008
C 1.8	$D_c \times$	0,006	0,010	0,011	0,004	0,007	0,009	0,006	0,009	0,010	0,006	0,004	0,008
C 2.1	$D_c \times$	0,005	0,009	0,010	0,004	0,006	0,008	0,005	0,008	0,009	0,005	0,004	0,007
C 2.2	$D_c \times$	0,004	0,007	0,008	0,003	0,005	0,006	0,004	0,006	0,007	0,004	0,003	0,006
C 2.3	$D_c \times$	0,004	0,007	0,008	0,003	0,005	0,006	0,004	0,006	0,007	0,004	0,003	0,006
C 2.4	$D_c \times$	0,004	0,007	0,008	0,003	0,005	0,006	0,004	0,006	0,007	0,004	0,003	0,006
C 3.1	$D_c \times$	0,004	0,007	0,008	0,003	0,005	0,006	0,004	0,006	0,007	0,004	0,003	0,006
C 4.1	$D_c \times$	0,004	0,006	0,007	0,003	0,004	0,006	0,004	0,006	0,006	0,004	0,003	0,005
C 4.2	$D_c \times$	0,004	0,006	0,007	0,003	0,004	0,006	0,004	0,006	0,006	0,004	0,003	0,005

2.
02

Acciai tempratie Hardened steels											
		≤ 52 HRC				≤ 57 HRC		≤ 63 HRC		≤ 66 HRC	
		Frese a testa raggiata Ball nose cutters				Frese toriche Torus cutters				Frese multitaglienti Multiflute cutters	
		a _p = D _c x 0,02				a _p = D _c x 0,02				a _p = D _c x 1,5 a _e = D _c x 0,02	
		D _c (mm)				D _c (mm)				D _c (mm)	
		f _z =	1,0-2,0	3,0-5,0	6,0-10	12-20	1,0-2,0	3,0-5,0	6,0-10	12-20	3,0 - 25,0
C 3.2	D _c x	0,004	0,004	0,006	0,005	0,004	0,003	0,004	0,004	0,00175	
C 3.3	D _c x	0,006	0,007	0,009	0,008	0,006	0,004	0,006	0,007	0,00275	
C 3.4	D _c x	0,005	0,006	0,008	0,007	0,005	0,004	0,005	0,006	0,0025	
C 3.5	D _c x	0,005	0,005	0,007	0,006	0,005	0,004	0,005	0,005	0,0025	

- Questi valori approssimativi devono essere sempre adattati alla macchina, all'utensile e al pezzo
 ■ These approx. values always should be adapted to machine, workpiece and tool.

Frese a copiare - Dati di taglio - Avanzamento per dente f_z (mm) - Profondità di taglio a_p (mm) - Larghezza di taglio a_e (mm)
 Copy milling cutters - Cutting data - Feed per tooth f_z (mm) - Axial depth of cut a_p (mm) - Radial depth of cut a_e (mm)

Gruppo D - Acciai resistenti alla corrosione, agli acidi e al calore Group D - Corrosion and acid resistant steels - Heat resistant steels													
		Frese a testa raggiata / Ball nose cutters						Frese toriche / Torus cutters					
		Sgrossatura Roughing			Finitura Finishing			Sgrossatura Roughing			Finitura Finishing		
		$a_p = D_c \times 0,1$ $a_e = D_c \times 0,2$			$a_p = D_c \times 0,02$			$a_p = D_c \times 0,1$ $a_e = D_c \times 0,2$			$a_p = D_c \times 0,02$		
		■ D_c (mm)			■ D_c (mm)			■ D_c (mm)			■ D_c (mm)		
	$f_z =$	1,5-2,5	3,0-5,0	6,0-20	1,5-2,5	3,0-5,0	6,0-20	1,5-2,5	3,0-5,0	6,0-20	1,5-2,5	3,0-5,0	6,0-20
D 1.1	$D_c \times$	0,005	0,009	0,100	0,004	0,006	0,008	0,005	0,008	0,009	0,005	0,004	0,007
D 1.2	$D_c \times$	0,005	0,009	0,100	0,004	0,006	0,008	0,005	0,008	0,009	0,005	0,004	0,007
D 1.3	$D_c \times$	0,005	0,009	0,100	0,004	0,006	0,008	0,005	0,008	0,009	0,005	0,004	0,007
D 1.4	$D_c \times$	0,005	0,008	0,090	0,004	0,005	0,007	0,005	0,007	0,008	0,005	0,004	0,006
D 1.5	$D_c \times$	0,004	0,006	0,070	0,003	0,004	0,006	0,004	0,006	0,006	0,004	0,003	0,005
Gruppo E - Leghe di nichel/cobalto - Titanio - leghe di titanio Group E - Nickel-/ Cobalt alloys - Titanium - Titanium alloys													
E 1.1	$D_c \times$	0,005	0,009	0,010	0,004	0,006	0,008	0,005	0,008	0,009	0,005	0,004	0,007
E 1.2	$D_c \times$	0,005	0,009	0,010	0,004	0,006	0,008	0,005	0,008	0,009	0,005	0,004	0,007
E 1.3	$D_c \times$	0,005	0,008	0,009	0,004	0,005	0,007	0,005	0,007	0,008	0,005	0,004	0,006
E 2.1	$D_c \times$	0,006	0,010	0,011	0,004	0,007	0,009	0,006	0,009	0,010	0,006	0,004	0,008
E 2.2	$D_c \times$	0,005	0,009	0,010	0,004	0,006	0,008	0,005	0,008	0,009	0,005	0,004	0,007
E 2.3	$D_c \times$	0,004	0,006	0,007	0,003	0,004	0,006	0,004	0,006	0,006	0,004	0,003	0,005
Gruppo F - Ghise Group F - Cast irons													
F 1.1	$D_c \times$	0,006	0,010	0,011	0,004	0,007	0,009	0,006	0,009	0,010	0,006	0,004	0,008
F 1.2	$D_c \times$	0,006	0,010	0,011	0,004	0,007	0,009	0,006	0,009	0,010	0,006	0,004	0,008
F 1.3	$D_c \times$	0,004	0,007	0,008	0,003	0,005	0,006	0,004	0,006	0,007	0,004	0,003	0,006
F 1.4	$D_c \times$	0,006	0,010	0,011	0,004	0,007	0,009	0,006	0,009	0,010	0,006	0,004	0,008
F 1.5	$D_c \times$	0,006	0,010	0,011	0,004	0,007	0,009	0,006	0,009	0,010	0,006	0,004	0,008
F 2.1	$D_c \times$	0,006	0,010	0,011	0,004	0,007	0,009	0,006	0,009	0,010	0,006	0,004	0,008
F 2.2	$D_c \times$	0,006	0,010	0,011	0,004	0,007	0,009	0,006	0,009	0,010	0,006	0,004	0,008
F 2.3	$D_c \times$	0,005	0,009	0,010	0,004	0,006	0,008	0,005	0,008	0,009	0,005	0,004	0,007
F 2.4	$D_c \times$	0,005	0,009	0,010	0,004	0,006	0,008	0,005	0,008	0,009	0,005	0,004	0,007
Gruppo G - Grafite - Leghe tungsteno/rame Group G - Graphite - Tungsten / Copper alloys													
G 1.1	$D_c \times$	0,006	0,010	0,011	0,004	0,007	0,009	0,006	0,009	0,010	0,006	0,004	0,008
G 2.1	$D_c \times$	0,006	0,010	0,011	0,004	0,007	0,009	0,006	0,009	0,010	0,006	0,004	0,008

■ Questi valori approssimativi devono essere sempre adattati alla macchina, all'utensile e al pezzo.

■ These approx. values always should be adapted to machine, workpiece and tool.

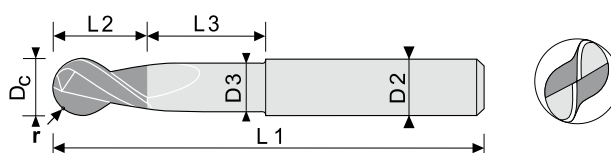
Linea "ULTRA Ra" con gole lappate

"ULTRA Ra" Speed Line with fine lapped chip flutes

A1.1-1.6 A2.1-2.6 A3.1-3.2 A4.1-4.2

(GFK - CFK - AFK) - B1.1-1.6 B2.1-2.4

E1.1-2.1



2.02

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Linea "ULTRA Ra" con gole lappate

"ULTRA Ra" Speed Line with fine lapped chip flutes

102RCL-40°G



A: Leghe leggere / *Light alloys*

A1.1-1.6 A2.1-2.6 A3.1-3.2 A4.1-4.2

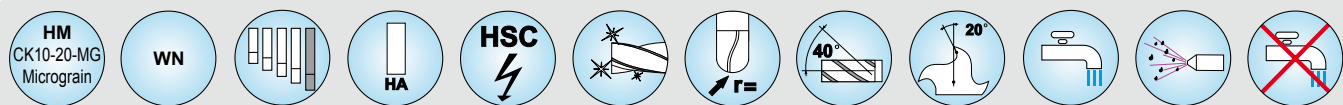
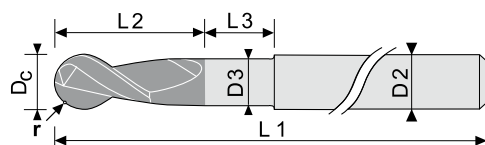
B: Plastiche - Plastiche rinforzate con fibre

B: *Plastics - Reinforced plastic fibres*

(GFK - CFK - AFK) - B1.1-1.6 B2.1-2.4

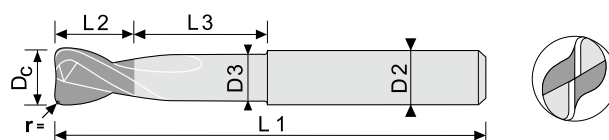
E: Titanio / *Titanium*

E1.1-2.1

96

"ULTRA Ra" Speed Line with fine lapped chip flutes

E1.1-2.1



2.02



97

Linea "ULTRA Ra" con gole lappate

"ULTRA Ra" Speed Line with fine lapped chip flutes

102TCL-40°G



A: Leghe leggere / *Light alloys*

A1.1-1.6 A2.1-2.6 A3.1-3.2 A4.1-4.2

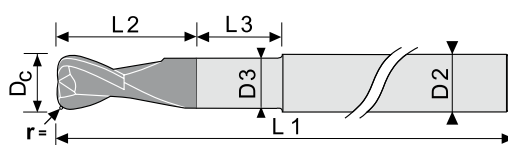
B: Plastiche - Plastiche rinforzate con fibre

B: *Plastics - Reinforced plastic fibres*

(GFK - CFK - AFK) - B1.1-1.6 B2.1-2.4

E: Titanio / *Titanium*

E1.1-2.1

98

Frese di copiatura toriche - Z=2 elica 30° - norma interna Torus copy cutters - Z=2 Helix 30° - Internal standard

72CT



72CTC



Settori d'impiego / Range of application

A: Leghe leggere / Light alloys

A1.7 A2.7 A3.1-3.2

C: Acciaio / Steels

C1.1-1.8 C2.1-2.4 C3.1-3.2 C4.1-4.2

D: Acciaio inossidabile / Stainless steel

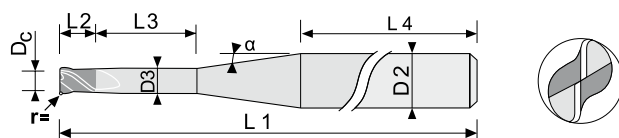
D1.1-1.5

E: Titanio / Titanium

E1.2-1.3 E2.1-2.3

F: Ghise / Cast irons

F1.1-1.5 F2.1-2.4



**2.
02**

HM
CK20-30-MG
Micrograin

WN



HA

HRC
≤ 56



r =



Dc	L2	L1	D2	L3	D3	L4	r	α	72CT	72CTC
h10										Rivestite / Coated
1	2	50	4	2	0,9	30	0,1	5,53°	72CT.010040250	72CT.010040250C
1	2	57	6	2	0,9	30	0,1	6,33°	72CT.010060257	72CT.010060257C
1,5	2,5	50	4	2,5	1,4	30	0,1	4,95°	72CT.015042550	72CT.015042550C
1,5	2,5	57	6	2,5	1,4	30	0,1	5,98°	72CT.015062557	72CT.015062557C
2	3	50	4	3	1,9	30	0,2	4,29°	72CT.020040350	72CT.020040350C
2	3	57	6	3	1,9	30	0,2	5,58°	72CT.020060357	72CT.020060357C
2,5	3,5	50	4	3,5	2,4	30	0,3	3,52°	72CT.025043550	72CT.025043550C
2,5	3,5	57	6	3,5	2,4	30	0,3	5,14°	72CT.025063557	72CT.025063557C
3	3,5	50	4	3,5	2,8	30	0,5	2,42°	72CT.030043550	72CT.030043550C
3	4	80	6	4	2,8	40	0,5	2,86°	72CT.030060480	72CT.030060480C
4	5	57	6	6	3,8	30	0,6	3,93°	72CT.040060557	72CT.040060557C
4	6	80	6	6	3,8	40	0,5	2,25°	72CT.040060680	72CT.040060680C
5	7	57	6	7	4,8	30	0,5	2,64°	72CT.050060757	72CT.050060757C
5	7	80	6	7	4,8	40	0,5	1,32°	72CT.050060780	72CT.050060780C
6	9	100	8	9	5,8	40	1	1,50°	72CT.0600809100	72CT.0600809100C
6	10	120	10	9	5,8	50	1	2,31°	72CT.0601010120	72CT.0601010120C
8	12	120	10	12	7,8	50	1	1,37°	72CT.0801012120	72CT.0801012120C
8	12	150	12	12	7,8	60	1	1,82°	72CT.0801212150	72CT.0801212150C
10	14	150	12	14	9,8	60	1	1,02°	72CT.1001214150	72CT.1001214150C
10	14	150	14	14	9,8	60	1,5	1,94°	72CT.1001414150	72CT.1001414150C
12	16	150	14	16	11,8	60	1,5	1,09°	72CT.1201416150	72CT.1201416150C
12	16	150	16	16	11,8	60	1,5	2,07°	72CT.1201616150	72CT.1201616150C
16	20	150	20	20	15,8	60	2	2,41°	72CT.1602020150	72CT.1602020150C

Frese di copiatura a testa raggiata - Z=2 elica 30° - norma interna Ball nose copy cutters - Z=2 Helix 30° - Internal standard

72CR

72CRC

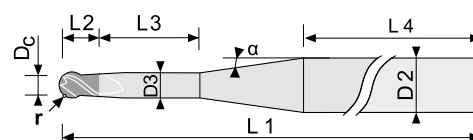

Settori d'impiego / Range of application

A: Leghe leggere / Light alloys
A1.7 A2.7 A3.1-3.2

C: Acciai / Steels
C1.1-1.8 C2.1-2.4 C3.1-3.2 C4.1-4.2

D: Acciaio inossidabile / Stainless steel
D1.1-1.5

E: Titanio / Titanium
E1.2-1.3 E2.1-2.3

F: Ghisa / Cast irons
F1.1-1.5 F2.1-2.4

HM
CK20-30-MG
Micrograin

WN

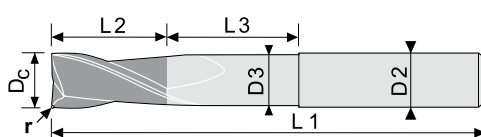

HRC
≤ 56


D _c h10	L2	L1	D2	L3	D3	L4	r	α	72CR	72CRC
										Rivestite / Coated
1	2	50	4	2	0,9	30	0,5	5,53°	72CR.010040250	72CR.010040250C
1	2	57	6	2	0,9	30	0,5	6,33°	72CR.010060257	72CR.010060257C
1,5	2,5	50	4	2,5	1,4	30	0,75	4,95°	72CR.015042550	72CR.015042550C
1,5	2,5	57	6	2,5	1,4	30	0,75	5,98°	72CR.015062557	72CR.015062557C
2	3	50	4	3	1,9	30	1	4,29°	72CR.020040350	72CR.020040350C
2	3	57	6	3	1,9	30	1	5,58°	72CR.020060357	72CR.020060357C
2,5	3,5	50	4	3,5	2,4	30	1,25	3,52°	72CR.025043550	72CR.025043550C
2,5	3,5	57	6	3,5	2,4	30	1,25	5,14°	72CR.025063557	72CR.025063557C
3	3,5	50	4	3,5	2,8	30	1,5	2,42°	72CR.030043550	72CR.030043550C
3	4	80	6	4	2,8	40	1,5	2,86°	72CR.030060480	72CR.030060480C
4	5	57	6	6	3,8	30	0,5	3,93°	72CR.040060557	72CR.040060557C
4	6	80	6	6	3,8	40	2	2,25°	72CR.040060680	72CR.040060680C
5	7	57	6	7	4,8	30	0,5	2,64°	72CR.050060757	72CR.050060757C
5	7	80	6	7	4,8	40	2,5	1,32°	72CR.050060780	72CR.050060780C
6	9	100	8	9	5,8	40	3	1,50°	72CR.0600809100	72CR.0600809100C
6	10	120	10	9	5,8	50	3	2,31°	72CR.0601010120	72CR.0601010120C
8	12	120	10	12	7,8	50	4	1,37°	72CR.0801012120	72CR.0801012120C
8	12	150	12	12	7,8	60	4	1,82°	72CR.0801212150	72CR.0801212150C
10	14	150	12	14	9,8	60	5	1,02°	72CR.1001214150	72CR.1001214150C
10	14	150	14	14	9,8	60	5	1,94°	72CR.1001414150	72CR.1001414150C
12	16	150	14	16	11,8	60	6	1,09°	72CR.1201416150	72CR.1201416150C
12	16	150	16	16	11,8	60	6	2,07°	72CR.1201616150	72CR.1201616150C
16	20	150	20	20	15,6	60	8	2,41°	72CR.1602020150	72CR.1602020150C

Torus cutters - Z=2 Helix 30° - Internal standard - for hardened steels



C:Acciai / Steels
C3.2-3.5



2.02

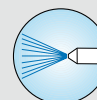
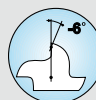
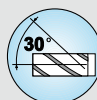
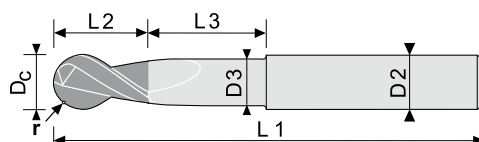


101

2.02



C:Acciai / Steels
C3.2-3.5

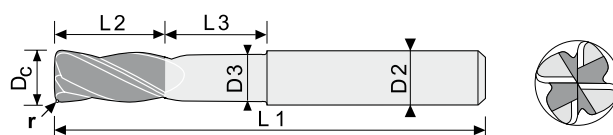


■ **previste per rivestimento in proprio - non utilizzabili senza adeguato rivestimento.**
■ ***provided for own coating. Not suitable without adapted coating.***

Torus cutters - Z=4 Helix 30° - Internal standard - for hardened steels



C:Acciai / Steels
C3.2-3.5



2.02

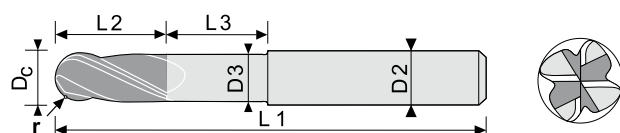


■ **previste per rivestimento in proprio - non utilizzabili senza adeguato rivestimento.**
 ■ ***provided for own coating. Not suitable without adapted coating.***

2.02



C:Acciai / Steels
C3.2-3.5



■ previste per rivestimento in proprio - non utilizzabili senza adeguato rivestimento.
■ *provided for own coating. Not suitable without adapted coating.*

Frese multitaglienti - elica 45° - norma interna - per acciai temprati Multiflutes cutters - Helix 45° - Internal standard - for hardened steels

66HR

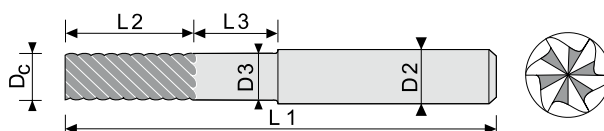


66HRB



Settori d'impiego / Range of application

C:Acciai / Steels
C3.2-3.5



2.
02



D _c h10	L2	L1	D2 h6	D3	L3	Z	66HR	66HRB
							■	Rivestite / Coated
4	11	57	6	3,9	8	6	66HR.040061157	66HR.040061157B
5	13	57	6	4,9	8	6	66HR.050061357	66HR.050061357B
6	15	57	6	5,9	12	6	66HR.060061557	66HR.060061557B
6	18	80	6	5,9	18	6	66HR.060061880	66HR.060061880B
8	20	63	8	7,8	12	6	66HR.080082063	66HR.080082063B
8	23	100	8	7,8	23	6	66HR.0800823100	66HR.0800823100B
10	23	72	10	9,8	12	8	66HR.100102372	66HR.100102372B
10	25	100	10	9,8	25	8	66HR.1001025100	66HR.1001025100B
12	28	83	12	11,8	15	8	66HR.120122883	66HR.120122883B
12	30	100	12	11,8	30	8	66HR.1201230100	66HR.1201230100B
14	28	83	14	13,8	15	8	66HR.140142883	66HR.140142883B
14	30	120	14	13,8	30	8	66HR.1401430120	66HR.1401430120B
16	32	92	16	15,8	18	10	66HR.160163292	66HR.160163292B
16	40	150	16	15,8	40	10	66HR.1601640150	66HR.1601640150B
18	35	92	18	17,7	18	10	66HR.180183592	66HR.180183592B
18	45	150	18	17,7	45	10	66HR.1801845150	66HR.1801845150B
20	40	104	20	19,7	20	12	66HR.2002040104	66HR.2002040104B
20	50	150	20	19,7	50	12	66HR.2002050150	66HR.2002050150B

■ previste per rivestimento in proprio - non utilizzabili senza adeguato rivestimento.
■ provided for own coating. Not suitable without adapted coating.

Frese toriche multitaglienti - elica 45° - norma interna - per acciai temprati Torus multiflutes cutters - Helix 45° - Internal standard - for hardened steels

2.
02

66THR

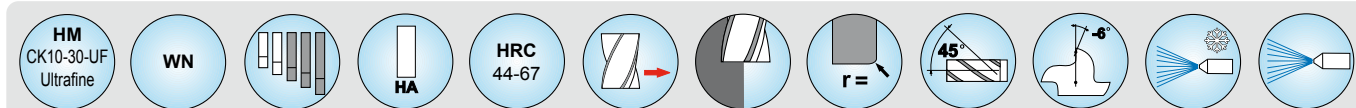
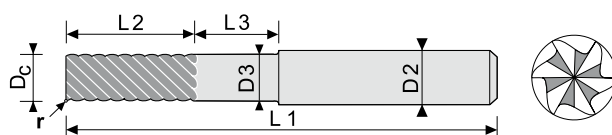


66THRB



Settori d'impiego / Range of application

C:Acciai / Steels
C3.2-3.5



D _c h10	L2	L1	D2 h6	D3	L3	Z	r	66THR	66THRB
								■	Rivestite / Coated
4	11	57	6	3,9	8	6	0,5	66THR.040061157	66THR.040061157B
5	13	57	6	4,9	8	6	0,5	66THR.050061357	66THR.050061357B
6	15	57	6	5,9	12	6	0,5	66THR.060061557	66THR.060061557B
6	18	80	6	5,9	18	6	0,5	66THR.060061880	66THR.060061880B
8	20	63	8	7,8	12	6	0,5	66THR.080082063	66THR.080082063B
8	23	100	8	7,8	23	6	0,5	66THR.0800823100	66THR.0800823100B
10	23	72	10	9,8	12	8	1	66THR.100102372	66THR.100102372B
10	25	100	10	9,8	25	8	1	66THR.1001025100	66THR.1001025100B
12	28	83	12	11,8	15	8	1	66THR.120122883	66THR.120122883B
12	30	100	12	11,8	30	8	1	66THR.1201230100	66THR.1201230100B
14	28	83	14	13,8	15	8	1	66THR.140142883	66THR.140142883B
14	30	120	14	13,8	30	8	1	66THR.1401430120	66THR.1401430120B
16	32	92	16	15,8	18	10	1	66THR.160163292	66THR.160163292B
16	40	150	16	15,8	40	10	1	66THR.1601640150	66THR.1601640150B
18	35	92	18	17,7	18	10	1,5	66THR.180183592	66THR.180183592B
18	45	150	18	17,7	45	10	1,5	66THR.1801845150	66THR.1801845150B
20	40	104	20	19,7	20	12	1,5	66THR.2002040104	66THR.2002040104B
20	50	150	20	19,7	50	12	1,5	66THR.2002050150	66THR.2002050150B

■ previste per rivestimento in proprio - non utilizzabili senza adeguato rivestimento
■ provided for own coating. Not suitable without adapted coating.



2.
03

Frese per grafite
Milling cutters for graphite

2.
03

Velocità di taglio V_c (m/min) - per lavorazione grafite Cutting speed V_c (m/min) - for graphite machining

Per la lavorazione della grafite, i più idonei sono gli utensili con rivestimento diamantato For graphite machining diamond coated tools are best suited		
Grana grafite μm Graphite grain size (μm)		Velocità di taglio V_c m/min Cutting speed V_c (m/min)
1 - 5	mit Cer-D (Diamant) Beschichtung with Cer-D (Diamond) coating	150 - 250
5 - 10		250 - 350
10 - 15		400 - 450
15 - 20		400 - 600
20 - 25		700 - 800
25 - 30		800 - 1000

Nella produzione di elettrodi per stampi, generalmente si impiega grafite a grana media
For the production of electrodes in mould making mainly graphites of medium grains are used

Velocità di taglio V_c (m/min) / Cutting speed V_c (m/min)				
Gruppo G: grafite Group G: Graphite				
	Denominazione materiale Material description	Resistenza HV 10 Strength HV 10	VHM CK05-10 MG Carbide CK05-10 MG	Cer-D V_c (m/min)
G 1.1	C-800	230 - 250	■	500 - 600

- Destinato solo al rivestimento in proprio
- Only assigned for own coating

V_c (m/min)	D_c (mm)									
	2,00	3,00	4,00	5,00	6,00	8,00	10,00	12,00	14,00	16,00
	Δ Numero di giri al minuto n (min ⁻¹) / Revolution n (min ⁻¹)									
150	23885	15924	11943	9554	7962	5971	4777	3981	3412	2986
200	31847	21231	15924	12739	10616	7962	6369	5308	4550	3981
250	39809	26539	19904	15924	13270	9952	7962	6635	5687	4976
300	47771	31847	23885	19108	15924	11943	9554	7962	6824	5971
350	55732	37155	27866	22293	18577	13933	11146	9289	7962	6967
400	63694	42463	31847	25478	21231	15924	12739	10616	9099	7962
450	71656	47771	35828	28662	23885	17914	14331	11943	10237	8957
500	79618	53079	39809	31847	26539	19904	15924	13270	11374	9952
550	87580	58386	43790	35032	29193	21895	17516	14597	12511	10947
600	95541	63694	47771	38217	31847	23885	19108	15924	13649	11943
650	103503	69002	51752	41401	34501	25876	20701	17251	14786	12938
700	111465	74310	55732	44586	37155	27866	22293	18577	15924	13933
750	119427	79618	59713	47771	39809	29857	23885	19904	17061	14928
800	127389	84926	63694	50955	42463	31847	25478	21231	18198	15924
900	143312	95541	71656	57325	47771	35828	28662	23885	20473	17914
1000	159236	106157	79618	63694	53079	39809	31847	26539	22748	19904

Δ o numero massimo di giri della macchina utensile
 Δ a maximum revolution speed of machine tool

Cutting data: f_z (mm) - Milling cutters for graphite machining with Cer-D (Diamond) coating

Ball nose - (Kugel) and Torus cutters

DIN 6527-L - Internal Standard short = f_z (mm) according to table

Internal standard - extralong = f_z (mm) according to table x 0,7

2.03

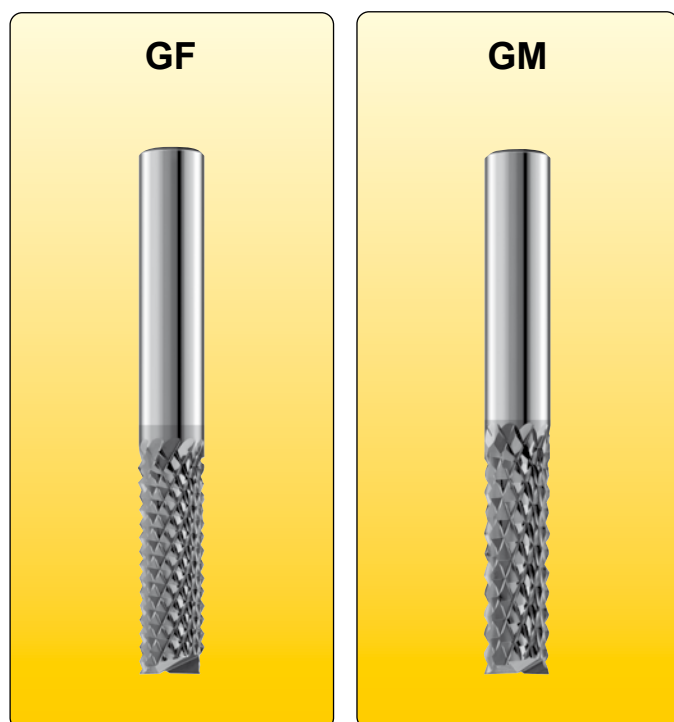
[illegible]

Dati di taglio: f (mm) - Taglio incrociato - con rivestimento Cer-D

Frese a candela e a testa raggiata - con taglienti incrociati speciali (F/M) - con tagliente stretto e rompitruciolo (66GF-D)

Cutting data: f (mm) - Cross cut - with Cer-D coating

End mills and ball nose cutters - with special cross cut (F/M) - with fine cut and chip breaker (66GF-D)



2.
03

Gruppo G: grafite C - 800 Gruppe G: Graphit C - 800						
	Sgrossatura Roughing		Finitura Finishing		Tipo tagliente Cut type	Tipo tagliente Cut type
	Tipo tagliente Cut type		Tipo tagliente Cut type			
	GF	GM	GF	GM	GF	GF
	Fresatura di spallamenti Side-Contour milling		Fresatura di cave piene Slot milling		Fresatura di spallamenti Side-Contour milling	Fresatura a copiare Copy milling
	$a_p = 0,5 \times D_c$ $a_e = 0,5 \times D_c$		$a_p = 0,5 \times D_c$		$a_p = 0,5 \times D_c$ $a_e = 0,3 \times D_c$	$a_p = 0,02 \times D_c$ $a_e = 0,03 \times D_c$
D _c (mm)	con rivestimento Cer-D (diamante) / with Cer-D (Diamond) coating					
	f (mm)	f (mm)	f (mm)	f (mm)	f (mm)	f (mm)
2,00	0,12	0,12	0,10	0,10	0,10	0,10
2,50	0,12	0,12	0,10	0,10	0,10	0,10
3,00	0,16	0,16	0,14	0,12	0,14	0,12
3,50	0,16	0,16	0,14	0,12	0,16	0,14
4,00	0,22	0,18	0,20	0,16	0,20	0,15
5,00	0,25	0,22	0,22	0,18	0,22	0,16
6,00	0,30	0,26	0,26	0,22	0,26	0,18
7,00	0,30	0,26	0,26	0,22	0,28	0,20
8,00	0,35	0,35	0,30	0,26	0,30	0,24
9,00	0,35	0,35	0,30	0,26	0,32	0,30
10,00	0,50	0,40	0,36	0,30	0,36	0,32
11,00	0,50	0,40	0,36	0,30	0,38	0,34
12,00	0,60	0,50	0,40	0,35	0,40	0,36
14,00	0,65	0,55	0,45	0,42	0,45	0,40
16,00	0,70	0,60	0,50	0,50	0,50	0,45
18,00	0,80	0,70	0,55	0,55	0,55	0,50
20,00	1,00	0,85	0,60	0,60	0,60	0,56

Frese toriche per grafite - Z=2 elica 30° - norma interna **Torus cutters for graphite - Z=2 Helix 30° - Internal standard**

2.
03

72GT

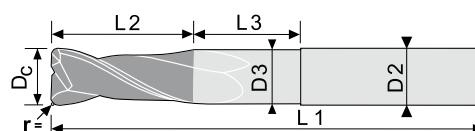


72GTD



Settori d'impiego / Range of application

G: Grafite / Graphite
G1.1



D _c h10	L2	L1	D2 h6	D3	L3	r	72GT	72GTD
							■	Rivestite / Coated
2	6	50	3	1,9	6	0,5	72GT.020030650	72GT.020030650D
2	10	100	3	1,9	10	0,5	72GT.0200310100	72GT.0200310100D
3	8	60	3	2,9	8	0,5	72GT.030030860	72GT.030030860D
3	12	100	3	2,9	12	0,5	72GT.0300312100	72GT.0300312100D
4	10	60	4	3,8	10	0,5	72GT.040041060	72GT.040041060D
4	15	100	4	3,8	15	0,5	72GT.0400415100	72GT.0400415100D
5	12	60	5	4,8	12	0,5	72GT.050051260	72GT.050051260D
5	15	100	5	4,8	15	0,5	72GT.0500515100	72GT.0500515100D
6	20	75	6	5,8	20	0,5	72GT.060062075	72GT.060062075D
6	25	100	6	5,8	25	0,5	72GT.0600625100	72GT.0600625100D
6	30	150	6	5,8	30	0,5	72GT.0600630150	72GT.0600630150D
8	20	75	8	7,8	20	1	72GT.080082075	72GT.080082075D
8	25	100	8	7,8	25	1	72GT.0800825100	72GT.0800825100D
8	30	150	8	7,8	30	1	72GT.0800830150	72GT.0800830150D
10	25	100	10	9,8	25	1	72GT.1001025100	72GT.1001025100D
10	30	150	10	9,8	30	1	72GT.1001030150	72GT.1001030150D
12	25	100	12	11,8	25	1	72GT.1201225100	72GT.1201225100D
12	40	150	12	11,8	40	1	72GT.1201240150	72GT.1201240150D
16	25	100	16	15,8	25	1,5	72GT.1601625100	72GT.1601625100D
16	40	150	16	15,8	40	1,5	72GT.1601640150	72GT.1601640150D

■ Previste per rivestimento in proprio e non utilizzabili senza adeguato rivestimento.
 ■ Provided for own coating only and not applicable without adapted coating.

Frese a testa raggiata per grafite - Z=2 elica 30° - norma interna Ball nose cutters for graphite - Z=2 Helix 30° - Internal standard

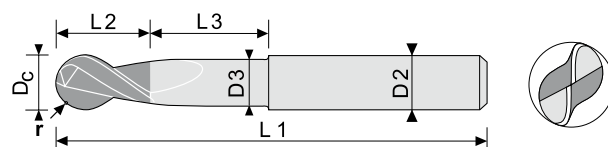
Settori d'impiego / Range of application

G: Grafite / Graphite
G1.1

72GR



72GRD



**2.
03**

HM
CK20-30-MG
Micrograin

WN

HA

$r =$



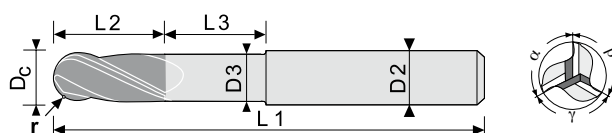
D _c h10	L2	L1	D2 h6	D3	L3	r	72GR	72GRD
							■	Rivestite / Coated
2	6	50	3	1,9	6	1	72GR.020030650	72GR.020030650D
2	10	100	3	1,9	10	1	72GR.0200310100	72GR.0200310100D
3	8	60	3	2,9	8	1,5	72GR.030030860	72GR.030030860D
3	12	100	3	2,9	12	1,5	72GR.0300312100	72GR.0300312100D
4	10	60	4	3,8	10	2	72GR.040041060	72GR.040041060D
4	15	100	4	3,8	15	2	72GR.0400415100	72GR.0400415100D
5	12	60	5	4,8	12	2,5	72GR.050051260	72GR.050051260D
5	15	100	5	4,8	15	2,5	72GR.0500515100	72GR.0500515100D
6	20	75	6	5,8	20	3	72GR.060062075	72GR.060062075D
6	25	100	6	5,8	25	3	72GR.0600625100	72GR.0600625100D
6	30	150	6	5,8	30	3	72GR.0600630150	72GR.0600630150D
8	20	75	8	7,8	20	4	72GR.080082075	72GR.080082075D
8	25	100	8	7,8	25	4	72GR.0800825100	72GR.0800825100D
8	30	150	8	7,8	30	4	72GR.0800830150	72GR.0800830150D
10	25	100	10	9,8	25	5	72GR.1001025100	72GR.1001025100D
10	30	150	10	9,8	30	5	72GR.1001030150	72GR.1001030150D
12	25	100	12	11,8	25	6	72GR.1201225100	72GR.1201225100D
12	40	150	12	11,8	40	6	72GR.1201240150	72GR.1201240150D
16	25	100	16	15,8	25	8	72GR.1601625100	72GR.1601625100D
16	40	150	16	15,8	40	8	72GR.1601640150	72GR.1601640150D

■ Previste per rivestimento in proprio e non utilizzabili senza adeguato rivestimento.
■ Provided for own coating only and not applicable without adapted coating.

2.03



G: Grafite / *Graphite*
G1.1



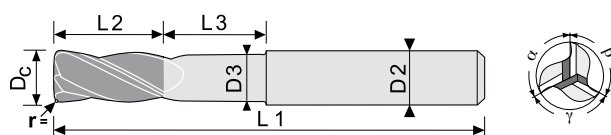
■ Previste per rivestimento in proprio e non utilizzabili senza adeguato rivestimento.
■ *Provided for own coating only and not applicable without adapted coating.*

Frese toriche per grafite - Z=3 elica 30° - divisione irregolare - norma interna
Torus cutters for graphite - Z=3 Helix 30° univen indexing - Internal Standard

73GTID



G: Grafite / *Graphite*
G1.1



2.03

[illegible]

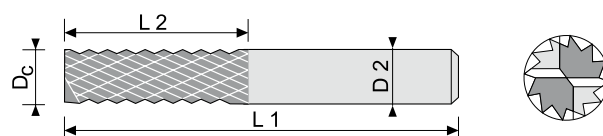
- Previste per rivestimento in proprio e non utilizzabili senza adeguato rivestimento.
■ *Provided for own coating only and not applicable without adapted coating.*

Frese per scanalature grafite - taglio incrociato - Norma interna Slot milling cutters for graphite - special cross cut - Internal Standard

108GFD

108GMD


Settori d'impiego / Range of application

G: Grafite / Graphite
G1.1

HM
CK20-30-MG
Micrograin

WN

HA



D _c h10	L2	L1	D2 h6	108GFD	108GMD
				Rivestite / Coated	Rivestite / Coated
2	7	40	2	108GF.020020740D	108GM.020020740D
2	7	50	6	108GF.020060750D	108GM.020060750D
3	10	40	3	108GF.030031040D	108GM.030031040D
3	12	50	6	108GF.030061250D	108GM.030061250D
4	15	40	4	108GF.040041540D	108GM.040041540D
4	20	50	6	108GF.040062050D	108GM.040062050D
5	16	50	5	108GF.050051650D	108GM.050051650D
5	25	75	6	108GF.050062575D	108GM.050062575D
6	18	50	6	108GF.060061850D	108GM.060061850D
6	35	75	6	108GF.060063575D	108GM.060063575D
8	25	63	8	108GF.080082563D	108GM.080082563D
8	40	100	8	108GF.0800840100D	108GM.0800840100D
10	30	72	10	108GF.100103072D	108GM.100103072D
12	32	83	12	108GF.120123283D	108GM.120123283D
16	36	92	16	108GF.160163692D	108GM.160163692D
20	45	104	20	108GF.2002045104D	108GM.2002045104D
Tipo di dentatura Cut type				F fine F fine 	M medio M medium 

■ versione senza rivestimento a richiesta
■ uncoated version upon request

Frese a forare per grafite - Taglio incrociato - Norma interna Drill milling cutters for graphite - special cross cut - Internal Standard

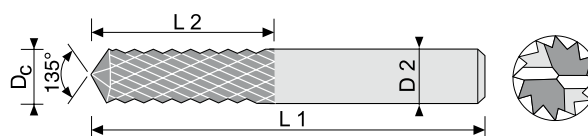
Settori d'impiego / Range of application

G: Grafite / Graphite
G1.1

109GFD



109GMD



2.
03



D _c h10	L2	L1	D2 h6	α	109GFD	109GMD
					■	Rivestite / Coated
2	7	40	2	135	109GF.020020740D	109GM.020020740D
2	7	50	6	135	109GF.020060750D	109GM.020060750D
3	10	40	3	135	109GF.030031040D	109GM.030031040D
3	12	50	6	135	109GF.030061250D	109GM.030061250D
4	15	40	4	135	109GF.040041540D	109GM.040041540D
4	20	50	6	135	109GF.040062050D	109GM.040062050D
5	16	50	5	135	109GF.050051650D	109GM.050051650D
5	25	75	6	135	109GF.050062575D	109GM.050062575D
6	18	50	6	135	109GF.060061850D	109GM.060061850D
6	35	75	6	135	109GF.060063575D	109GM.060063575D
8	25	63	8	135	109GF.080082563D	109GM.080082563D
8	40	100	8	135	109GF.0800840100D	109GM.0800840100D
10	30	72	10	135	109GF.100103072D	109GM.100103072D
12	32	83	12	135	109GF.120123283D	109GM.120123283D
16	36	92	16	135	109GF.160163692D	109GM.160163692D
20	45	104	20	135	109GF.2002045104D	109GM.2002045104D
Tipo di dentatura Cut type					F fine F fine 	M medio M medium 

■ versione senza rivestimento a richiesta
■ uncoated version upon request

Frese a testa raggiata per grafite - Taglio incrociato - Norma interna

Ball nose cutters for graphite - cross cut - Internal Standard

2.
03

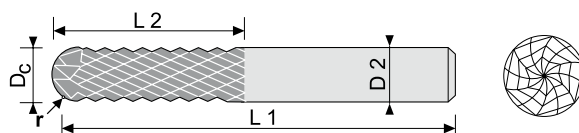
106RGFD



106RGMD



Settori d'impiego / Range of application

G: Grafite / Graphite
G1.1


D _c h10	L2	L1	D2 h6	r	106RGFD	106RGMD
					■	Rivestite / Coated
3	10	40	3	1,5	106RGF.030031040D	106RGM.030031040D
3	12	50	6	1,5	106RGF.030061250D	106RGM.030061250D
4	15	40	4	2	106RGF.040041540D	106RGM.040041540D
4	20	50	6	2	106RGF.040062050D	106RGM.040062050D
5	16	50	5	2,5	106RGF.050051650D	106RGM.050051650D
5	25	75	6	2,5	106RGF.050062575D	106RGM.050062575D
6	18	50	6	3	106RGF.060061850D	106RGM.060061850D
6	35	75	6	3	106RGF.060063575D	106RGM.060063575D
8	25	63	8	4	106RGF.080082563D	106RGM.080082563D
8	40	100	8	4	106RGF.0800840100D	106RGM.0800840100D
10	30	72	10	5	106RGF.100103072D	106RGM.100103072D
12	32	83	12	6	106RGF.120123283D	106RGM.120123283D
16	36	92	16	8	106RGF.160163692D	106RGM.160163692D
20	45	104	20	10	106RGF.2002045104D	106RGM.2002045104D

Tipo di dentatura
Cut type

F fine
F fine

M medio
M medium

■ uersione senza rivestimento a richiesta
■ uncoated version upon request

Frese a candela per grafite - Tagliente fine con rompitruciolo - Norma interna End mills for graphite - fine cut with chip breaker - Internal Standard

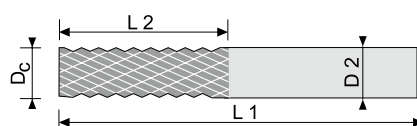
Settori d'impiego / Range of application

G: Grafite / Graphite
G1.1

66GF



66GFD



**2.
03**

HM
CK20-30-MG
Micrograin

WN



D _c h10	L2	L1	D2 h6	66GF	66GFD
				■	Rivestite / Coated
3	10	40	3	66GF.030031040	66GF.030031040D
3,5	10	40	3,5	66GF.035351040	66GF.035351040D
4	11	40	4	66GF.040041140	66GF.040041140D
4,5	11	50	4,5	66GF.045451150	66GF.045451150D
5	13	50	5	66GF.050051350	66GF.050051350D
6	16	50	6	66GF.060061650	66GF.060061650D
7	16	60	7	66GF.070071660	66GF.070071660D
8	19	63	8	66GF.080081963	66GF.080081963D
9	19	63	9	66GF.090091963	66GF.090091963D
10	22	72	10	66GF.100102272	66GF.100102272D
11	22	72	11	66GF.110112272	66GF.110112272D
12	26	83	12	66GF.120122683	66GF.120122683D
14	26	83	14	66GF.140142683	66GF.140142683D
16	32	92	16	66GF.160163292	66GF.160163292D
18	32	92	18	66GF.180183292	66GF.180183292D
20	38	104	20	66GF.2002038104	66GF.2002038104D

■ Previste per rivestimento in proprio e non utilizzabili senza adeguato rivestimento
■ Provided for own coating only and not applicable without adapted coating.

Frese a testa raggiata per grafite - Tagliente fine con rompitruciolo - Norma interna

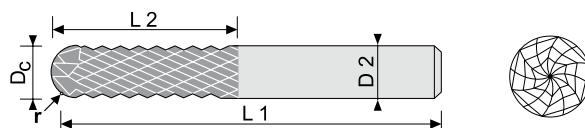
Ball nose end mills for graphite - fine cut with chip breaker - Internal Standard

2.
03

66RGF

66RGFD


Settori d'impiego / Range of application

G: Grafite / Graphite
G1.1

HM
CK20-30-MG
Micrograin

WN

HA

D _c h10	L2	L1	D2 h6	r	66RGF	66RGFD
					■	Rivestite / Coated
3	10	40	3	1,5	66RGF.030031040	66RGF.030031040D
3,5	10	40	3,5	1,75	66RGF.035351040	66RGF.035351040D
4	11	40	4	2	66RGF.040041140	66RGF.040041140D
4,5	11	50	4,5	2,25	66RGF.045451150	66RGF.045451150D
5	13	50	5	2,5	66RGF.050051350	66RGF.050051350D
6	16	50	6	3	66RGF.060061650	66RGF.060061650D
7	16	60	7	3,5	66RGF.070071660	66RGF.070071660D
8	19	63	8	4	66RGF.080081963	66RGF.080081963D
9	19	63	9	4,5	66RGF.090091963	66RGF.090091963D
10	22	72	10	5	66RGF.100102272	66RGF.100102272D
11	22	72	11	5,5	66RGF.110112272	66RGF.110112272D
12	26	83	12	6	66RGF.120122683	66RGF.120122683D
14	26	83	14	7	66RGF.140142683	66RGF.140142683D
16	32	92	16	8	66RGF.160163292	66RGF.160163292D
18	32	92	18	9	66RGF.180183292	66RGF.180183292D
20	38	104	20	10	66RGF.2002038104	66RGF.2002038104D

■ Previste per rivestimento in proprio e non utilizzabili senza adeguato rivestimento
■ Provided for own coating only and not applicable without adapted coating.



2.
04

Frese per materiali compositi
End mills for composite materials

Sommario dei materiali compositi di uso più comune

Summary of common composite materials in use

Termoindurenti - truciolo corto <i>Thermosets - short chipping</i>	
Materiale - Gruppo B 1.1 <i>Material - Group B 1.1</i>	Resistenza N/mm ² <i>Strength N/mm²</i>
Albanit	110
Bakelit	110
Ferrozell	110
Harnstoff-Formaldehyd	80
Melamin-Formaldehyd	80
MF	80
Pertinax	110
Phenol-Formaldehyd	80
Resopal	80
UP	80

Termoplastici - truciolo lungo <i>Thermoplastics - long chipping</i>	
Materiale - Gruppo B 1.2 <i>Material - Group B 1.2</i>	Resistenza N/mm ² <i>Strength N/mm²</i>
ABS	35-50
ABC Copolymere	80
Bayolan	70-75
Dogalan	80
Dolin	50-70
Durethan 43	
Fluon	20-40
Hostafon TF	20-40
Hostaform	50-70
Hostalen	20-80
Hostalen PP	20-38
Hostalit	35-60
Hostyren N	40-65
HostyrenS	22-50
Lupolen	20-30/80
Luran	78
Lustran	80
Makralon 80	
Makrolon 5	
Novodur	35-56
Novolen	21-38
PA 6	43/57/80
PA 66	43/57/80
PC	5
PE-HD	20-30
Plexiglas	70-76
PMMA	70-78
Polyamid 43/57/80	
Polyamid 66	43/57/80
Polykarbonate	5
Polyethylen	20-30/80

Termoplastici - truciolo lungo <i>Thermoplastics - long chipping</i>	
Materiale - Gruppo B 1.2 <i>Material - Group B 1.2</i>	Resistenza N/mm ² <i>Strength N/mm²</i>
Continua <i>To be continued</i>	
Polymethylmethacrylat	70-76
Polyoxymethylen	50/70/80
Polypropylen	21-37
Polystrol	80
Polystyrol	2-/50/40-65
Polytetrafluorethylen	20-40
Polyvinylchlorid	32-60
PO M	50/70/80
PP	21-37
PS	40-65
PTFE	20-40
PVC-U	35-60
Resanit	70-76
Risitex	80
Rilsan	40/57/80
S/B	22-50
SAN	78
Solvic	35-60
Styrol Acrylnitril	78
Styrol Buladien	22-50
Teflon	20-40
Trogamid T	48/57/80
Ultraform 50/70/80	
Vestamid 43/57/80	
Vestolen	20-30/80
Vestolen P	21-37
Vestyron	22-50/80
Vostyron	40-50
Vinol	35-60
Vinoflex	35-60

Plastiche rinforzate con fibre <i>Reinforced plastic fibres</i>	
Materiale - Gruppo B 1.4 <i>Material - Group B 1.4</i>	Resistenza N/mm ² <i>Strength N/mm²</i>
AFK - fibra di aramide / <i>Aramid fiber</i>	800-1000
	1000-1500
CFK - fibra di carbonio / <i>Carbon fiber</i>	800-1000
	1000-1500
GFK - fibra di vetro / <i>Fiberglass</i>	800-1000
	1000-1500

Velocità di taglio V_c (m/min) - per lavorazione di plastiche e materiali compositi
Cutting speed V_c (m/min) - for machining of composite materials

Velocità di taglio V_c (m/min) / Cutting speed V_c (m/min)				
Gruppo B: Plastiche - Fibre di plastiche inforzate - Materiali non ferrosi Group B: Plastics - Reinforced plastic fibres - Nonferrous materials				
	Denominazione materiale Material description	Resistenza N/mm ² Strength N/mm ²	VHM Carbide V_c (m/min)	Cer-P V_c (m/min)
B 1.1	Termoindurenti / Thermosets	80 - 110	200 - 300	300 - 600
B 1.2	Termoplastici / Thermoplastics	≤ 80	250 - 400	400 - 650
B 1.3	Polycarbonato / Polycarbonate	≤ 20	200 - 350	300 - 450
B 1.4	AFK - CFK - GFK	800-1500		150 - 300
B 1.5	Plexiglas / Plexiglass	70 - 80	150 - 300	300 - 450
B 2.1	Legno duro / Hard wood	≤ 255	200 - 300	300 - 450
B 2.2	Gomma dura / Hard rubber	≤ 255	50-150	100 - 150
B 2.3	Materiali non ferrosi / Nonferrous materials	≤ 255	200 - 350	250 - 350
B 2.4	Cartone pressato / Pressed carton	≤ 255	200 - 250	200 - 350

* Numero giri n (min⁻¹)

* Revolution per minute n (min^{-1})

[illegible]

* o numero massimo di giri della macchina utensile.

* Or max machine spindle speed.

Dati di taglio: f_z (mm) - per lavorazione di materiali termoindurenti (valori approssimativi)
Cutting data: f_z (mm) - for machining of thermosets (approximative values)

DIN 6527L - norma interna corta = f_z (mm) come da tabella
DIN 6527-L - Internal standard short = f_z (mm) acc. to table

WN Norma standard interna lunga - extralunga = f_z (mm) come da tabella x 0,7
Internal standard long - extra long = f_z (mm) acc. to table x 0,7

2.04

Dati di taglio: f_z (mm) - per la lavorazione di termoplastiche e plastiche rinforzate con fibre
Cutting date: f_z (mm) - for machining of thermoplastics and reinforced plastic fibres

Frese a copiare tipo W - Frese a candela tipo W - Frese a candela tipo W con rompitruciolo
"W" design - Copy milling cutters - "W" design End mills - "W" design End mills with chip breaker

Gruppe B: Plastiche - Termoplastiche - Policarbonato - Materiali non ferrosi - Gomma dura Group B: Plastics - Thermoplastics - Polycarbonate - Nonferrous metals - Hard rubber					
B 1.2 B 1.3 B 2.2 B 2.3	Frese a candela - tipo W - con e senza rompitruciolo "W" design - End mills with and without chip breaker			Frese toriche e di copiatura - tipo W Torus - Ball nose milling cutters - W design	
	Fresatura di spallamenti retti/contornatura Side-Contour milling		Fresatura di cave piene Slot milling	Fresatura a copiare - pendolare Copying mills - Z levelling	
	Sgrossatura Roughing	Finitura Finishing		Sgrossatura Roughing	Finitura Finishing-
	$a_p = 1,5 \times D_c$ $a_e = 0,8 \times D_c$	$a_p = 1,0 \times D_c$ $a_e = 0,10 \times D_c$	$a_p = 1,0 \times D_c$	$a_p = 0,5 \times D_c$ $a_e = 0,5 \times D_c$	$a_p = 0,05 \times D_c$ $a_e = 0,02 \times D_c$
D_c (mm)	f_z (mm)	f_z (mm)	f_z (mm)	f_z (mm)	f_z (mm)
2,00	0,024	0,022	0,017	0,037	0,030
3,00	0,036	0,033	0,026	0,056	0,045
4,00	0,048	0,044	0,034	0,074	0,060
5,00	0,060	0,055	0,043	0,093	0,075
6,00	0,072	0,066	0,051	0,111	0,090
8,00	0,096	0,088	0,068	0,148	0,120
10,00	0,120	0,110	0,085	0,185	0,150
12,00	0,144	0,132	0,102	0,222	0,180
14,00	0,168	0,154	0,119	0,259	0,210
16,00	0,192	0,176	0,136	0,296	0,240
18,00	0,216	0,198	0,153	0,333	0,270
20,00	0,240	0,220	0,170	0,370	0,300

2.
04

Gruppe B: plastiche rinforzate con fibre - Compositi - AFK - CFK - GFK Group B: reinforced plastic fibres - AFK - CFK - GFK					
B 1.4	Frese a candela con rompitruciolo End mills with chip breaker				
	Fresatura di spallamenti retti/contornatura Side-Contour milling		Fresatura di cave piene Slot milling		
	Sgrossatura Roughing	Finitura Finishing			
	$a_p = 1,0 \times D_c$ $a_e = 0,10 \times D_c$	$a_p = 0,75 \times D_c$ $a_e = 0,03 \times D_c$	$a_p = 0,3 \times D_c$		
D_c (mm)	f_z (mm)	f_z (mm)	f_z (mm)		
2,00	0,026	0,024	0,020		
3,00	0,039	0,036	0,030		
4,00	0,052	0,048	0,040		
5,00	0,065	0,060	0,050		
6,00	0,078	0,072	0,060		
8,00	0,104	0,096	0,080		
10,00	0,130	0,120	0,100		
12,00	0,156	0,144	0,120		
14,00	0,182	0,168	0,140		
16,00	0,208	0,192	0,160		
18,00	0,234	0,216	0,180		
20,00	0,260	0,240	0,200		

Dati di taglio: f (mm) - frese a candela - a taglio incrociato per materiali compositi
Cutting data: f (mm) - Cross cut end mills for composite materials

Frese a candela con taglio incrociato - con e senza taglienti
Cross cut end mills - with and without chip flute

Gruppe B: Plastiche - Termoplastiche e Termoindurenti - Policarbonato - Materiali non ferrosi Group B: Plastics - Thermoplastics - Thermosets - Polycarbonate - Nonferrous materials						
■ B 1.1 ■ B 2.1 ■ B 2.4 ■ B 1.2 ■ B 1.3 ■ B 1.5 ■ B 2.2 ■ B 2.3	■ Termoindurenti ■ Thermosets			■ Termoplastiche ■ Thermoplastics		
	Fresatura di spallamenti - Contornatura - Cave piene Side milling - Contouring - Slot milling			Fresatura di spallamenti - Contornatura - Cave piene Side milling - Contouring - Slot milling		
	$a_p = 0,8 \times D_c$ $a_e = 1,0 \times D_c$	$a_p = 0,8 \times D_c$ $a_e = 1,0 \times D_c$	$a_p = 1,0 \times D_c$ $a_e = 1,0 \times D_c$	$a_p = 0,8 \times D_c$ $a_e = 1,0 \times D_c$	$a_p = 0,8 \times D_c$ $a_e = 1,0 \times D_c$	$a_p = 1,0 \times D_c$ $a_e = 1,0 \times D_c$
	Tipo tagliente / Cut type			Tipo tagliente / Cut type		
	fine - F fine - F	media - M medium - M	grossa - G course - G	fine - F fine - F	media - M medium - M	grossa - G course - G
	D_c (mm)	f_z (mm)	f_z (mm)	f_z (mm)	f_z (mm)	f_z (mm)
2,00	0,20	0,14	0,12	0,16	0,13	0,10
3,00	0,30	0,21	0,18	0,24	0,20	0,15
4,00	0,40	0,28	0,24	0,32	0,26	0,20
5,00	0,50	0,35	0,30	0,40	0,33	0,25
6,00	0,60	0,42	0,36	0,48	0,39	0,30
8,00	0,80	0,56	0,48	0,64	0,52	0,40
10,00	1,00	0,70	0,60	0,80	0,65	0,50
12,00	1,20	0,84	0,72	0,96	0,78	0,60
16,00	1,60	1,12	0,96	1,28	1,04	0,80
20,00	2,00	1,40	1,20	1,60	1,30	1,00

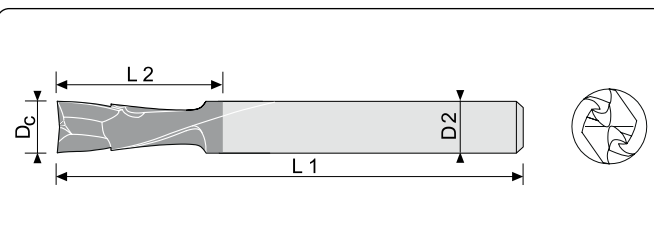
2.
04

Gruppe B: plastiche rinforzate con fibre - Compositi - AFK - CFK - GFK Group B: Reinforced plastic fibres - AFK - CFK - GFK						
B 1.4	Frese a candela a taglio incrociato - con rivestimento CerKo Cross cut end mills - with CerKo coating					
	Fresatura di spallamenti retti - Contornatura - Cave piene Side and contouring milling			Fresatura di cave piene Slot milling		
	$a_p = 1,0 \times D_c$ $a_e = 0,05 \times D_c$	$a_p = 1,0 \times D_c$ $a_e = 0,05 \times D_c$	$a_p = 1,0 \times D_c$ $a_e = 0,05 \times D_c$	$a_p = 0,35 \times D_c$	$a_p = 0,35 \times D_c$	$a_p = 0,35 \times D_c$
	Tipo tagliente / Cut type			Tipo tagliente / Cut type		
	fine - F fine - F	media - M medium - M	grossa - G course - G	fine - F fine - F	media - M medium - M	grossa - G course - G
D_c (mm)	f_z (mm)	f_z (mm)	f_z (mm)	f_z (mm)	f_z (mm)	f_z (mm)
2,00	0,16	0,14	0,12	0,14	0,12	0,10
3,00	0,24	0,21	0,18	0,21	0,18	0,15
4,00	0,32	0,28	0,24	0,28	0,24	0,20
5,00	0,40	0,35	0,30	0,35	0,30	0,25
6,00	0,48	0,42	0,36	0,42	0,36	0,30
8,00	0,64	0,56	0,48	0,56	0,48	0,40
10,00	0,80	0,70	0,60	0,70	0,60	0,50
12,00	0,96	0,84	0,72	0,84	0,72	0,60
16,00	1,28	1,12	0,96	1,12	0,96	0,80
20,00	1,60	1,40	1,20	1,40	1,20	1,00

Frese con elica destra e sinistra - Z=2+2 "Butterfly" - norma interna
Right and left helix - Z=2+2 "Butterfly" - Internal standard



B1.1-1.3 B1.5-1.6 B2.1-2.4 (AFK - CFK - GFK) B1.4

[illegible]

Frese a forare "Dummy" con rompitrucciolo alternato - norma interna Drill milling cutters "Dummy" with counterwise point cut - Internal standard

119P

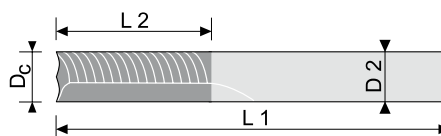


119PE



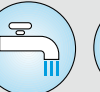
Settori d'impiego / Range of application

B: Plastiche - Plastiche rinforzate con fibre
B: *Plastics - Reinforced plastic fibres*
B: (AFK - CFK - GFK) B1.4 B1.6 B2.2 B2.4



HM
CK10-20-MG
Micrograin

WN



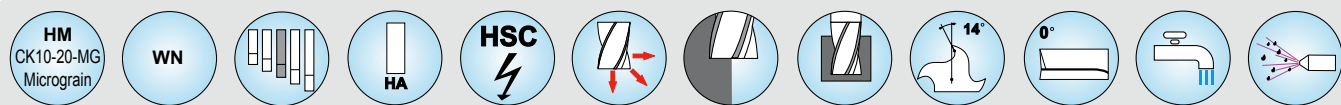
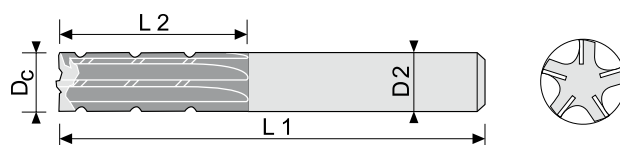
**2.
04**

D _c h10	L2	L1	D2 h6	119P	119PE
					Rivestite / Coated
3	12	50	3	119P.030031250	119P.030031250E
3	18	75	3	119P.030031875	119P.030031875E
4	14	50	4	119P.040041450	119P.040041450E
4	20	75	4	119P.040042075	119P.040042075E
5	16	50	5	119P.050051650	119P.050051650E
5	25	75	5	119P.050052575	119P.050052575E
6	20	60	6	119P.060062060	119P.060062060E
6	35	100	6	119P.0600635100	119P.0600635100E
8	22	63	8	119P.080082263	119P.080082263E
8	40	100	8	119P.0800840100	119P.0800840100E
10	25	72	10	119P.100102572	119P.100102572E
10	50	125	10	119P.1001050125	119P.1001050125E
12	30	83	12	119P.120123083	119P.120123083E
12	60	125	12	119P.1201260125	119P.1201260125E
16	35	92	16	119P.160163592	119P.160163592E
16	75	150	16	119P.1601675150	119P.1601675150E
20	45	104	20	119P.2002045104	119P.2002045104E
20	75	150	20	119P.2002075150	119P.2002075150E

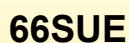
2.04



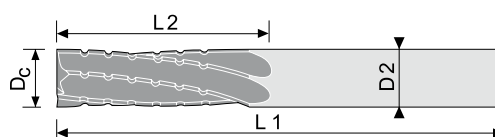
B: Plastiche - Plastiche rinforzate con fibre
B: *Plastics - Reinforced plastic fibres*
(AFK - CFK - GFK) B1.4 B2.1-2.4

130

End mills for composite materials - 10° right helix - large counterwise chip breaker - Internal standard



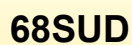
B: Plastiche - Plastiche rinforzate con fibre
B: *Plastics - Reinforced plastic fibres*
(AFK - CFK - GFK) B1.4 B2.1-2.4



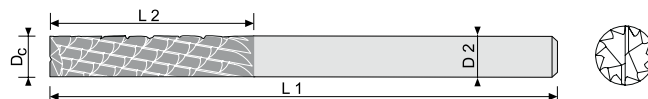
2.04

Per i parametri di lavoro vedere pagina 123
For working-parameters see page 123

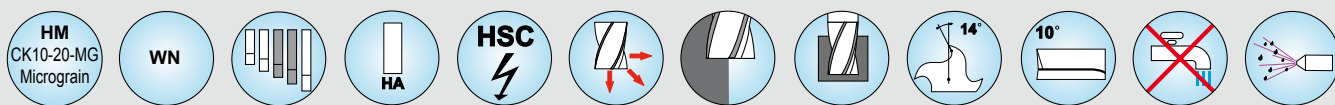
Frese per fibra di carbonio - con dentatura frontale Z=2 - norma interna
End mills for Carbonfibre - with two frontal teeth Z=2 - Internal standard



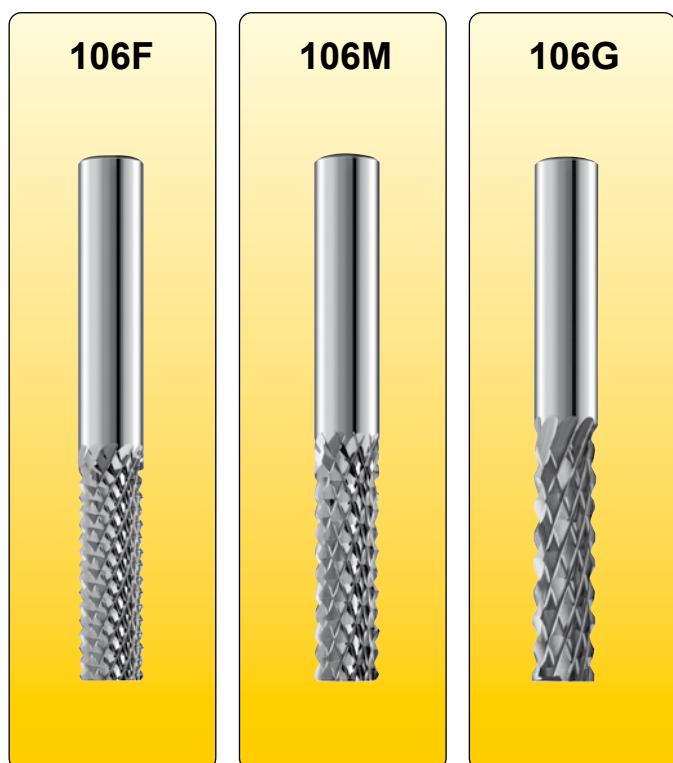
B: plastica rinforzata con fibre
B: *Reinforced plastic fibres*
B1.4 - B2.3



2.04

[illegible]

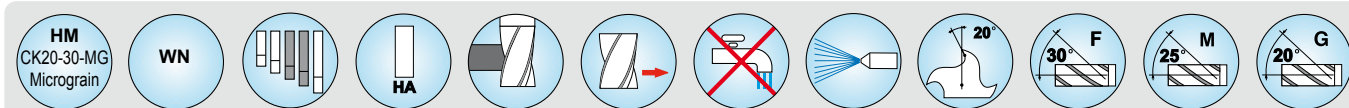
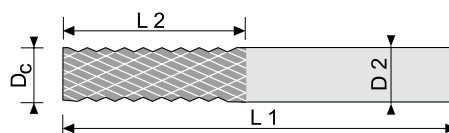
Frese per materiali compositi - taglio incrociato - senza tagliente frontale - norma interna End mills for composite materials - cross cut - without end cut - Internal standard



Settori d'impiego / Range of application

A: Leghe leggere / Light alloys
A1.7

B: plastica rinforzata con fibre
B: Plastics - Reinforced plastic fibres
(AFK - CFK - GFK) - B1.4 B1.1-1.3 B2.1-2.4



2.
04

D _c h10	L2	L1	D2 h6	106F	106M	106G
2	7	40	2	106F.020020740	106M.020020740	106G.020020740
2	7	50	6	106F.020060750	106M.020060750	106G.020060750
3	10	40	3	106F.030031040	106M.030031040	106G.030031040
3	12	50	6	106F.030061250	106M.030061250	106G.030061250
3,5	12	40	3,5	106F.035351240	106M.035351240	106G.035351240
4	15	40	4	106F.040041540	106M.040041540	106G.040041540
4	20	50	6	106F.040062050	106M.040062050	106G.040062050
4,5	15	50	4,5	106F.045451550	106M.045451550	106G.045451550
5	16	50	5	106F.050051650	106M.050051650	106G.050051650
5	25	75	6	106F.050062575	106M.050062575	106G.050062575
6	18	50	6	106F.060061850	106M.060061850	106G.060061850
6	35	75	6	106F.060063575	106M.060063575	106G.060063575
7	22	60	7	106F.070072260	106M.070072260	106G.070072260
8	25	63	8	106F.080082563	106M.080082563	106G.080082563
8	40	100	8	106F.0800840100	106M.0800840100	106G.0800840100
9	25	63	9	106F.090092563	106M.090092563	106G.090092563
10	30	72	10	106F.100103072	106M.100103072	106G.100103072
12	32	83	12	106F.120123283	106M.120123283	106G.120123283
14	32	83	14	106F.140143283	106M.140143283	106G.140143283
16	36	92	16	106F.160163692	106M.160163692	106G.160163692
18	40	92	18	106F.180184092	106M.180184092	106G.180184092
20	45	104	20	106F.2002045104	106M.2002045104	106G.2002045104
Tagliente tipo Cut type				F fine F fine 	M medio M medium 	G grosso G course

Frese per materiali compositi - taglio incrociato - con tagliente frontale - norma interna End mills for composite materials - cross cut - with end cut - Internal standard

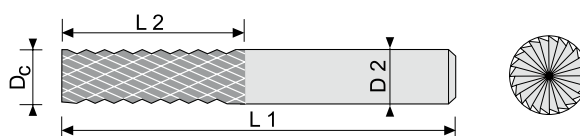
107F

107M

107G

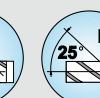
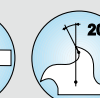
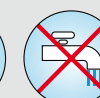

Settori d'impiego / Range of application

A: Leghe leggere / Light alloys
A1.7

B: Plastiche - Plastiche rinforzate con fibre
B: *Plastics - Reinforced plastic fibres*
(AFK - CFK - GFK) - B1.4 B1.1-1.3 B2.1-2.4

2.
04

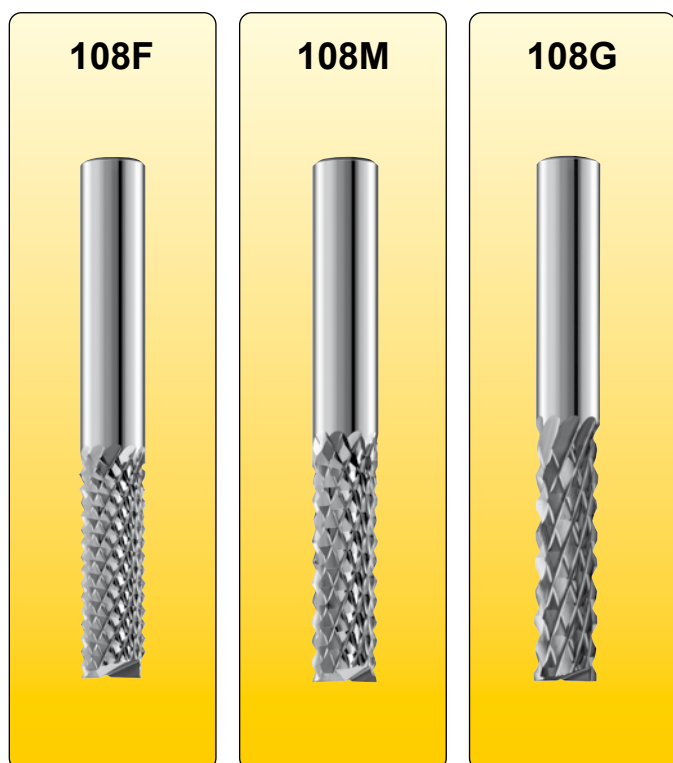
HM
CK20-30-MG
Micrograin

WN



D _c h10	L2	L1	D2 h6	107F	107M	107G
2	7	40	2	107F.020020740	107M.020020740	107G.020020740
2	7	50	6	107F.020060750	107M.020060750	107G.020060750
3	10	40	3	107F.030031040	107M.030031040	107G.030031040
3	12	50	6	107F.030061250	107M.030061250	107G.030061250
3,5	12	40	3,5	107F.035351240	107M.035351240	107G.035351240
4	15	40	4	107F.040041540	107M.040041540	107G.040041540
4	20	50	6	107F.040062050	107M.040062050	107G.040062050
4,5	15	50	4,5	107F.045451550	107M.045451550	107G.045451550
5	16	50	5	107F.050051650	107M.050051650	107G.050051650
5	25	75	6	107F.050062575	107M.050062575	107G.050062575
6	18	50	6	107F.060061850	107M.060061850	107G.060061850
6	35	75	6	107F.060063575	107M.060063575	107G.060063575
7	22	60	7	107F.070072260	107M.070072260	107G.070072260
8	25	63	8	107F.080082563	107M.080082563	107G.080082563
8	40	100	8	107F.0800840100	107M.0800840100	107G.0800840100
9	25	63	9	107F.090092563	107M.090092563	107G.090092563
10	30	72	10	107F.100103072	107M.100103072	107G.100103072
12	32	83	12	107F.120123283	107M.120123283	107G.120123283
14	32	83	14	107F.140143283	107M.140143283	107G.140143283
16	36	92	16	107F.160163692	107M.160163692	107G.160163692
18	40	92	18	107F.180184092	107M.180184092	107G.180184092
20	45	104	20	107F.2002045104	107M.2002045104	107G.2002045104
Tagliente tipo Cut type				F fine F fine 	M medio M medium 	G grosso G course

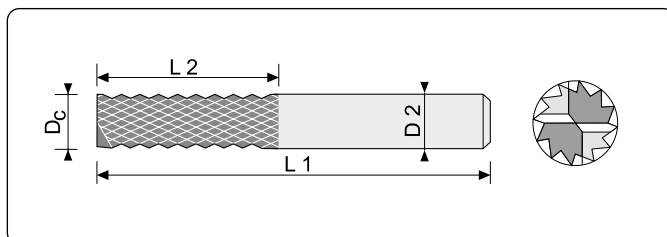
Frese per materiali compositi - taglio incrociato con taglio frontale Z=2 - norma interna Drill slot milling cutters - cross cut - Internal standard



Settori d'impiego / Range of application

A: Leghe leggere / Light alloys
A1.7

B: Plastiche - Plastiche rinforzate con fibre
B: Plastics - Reinforced plastic fibres
(AFK - CFK - GFK) - B1.4 B1.1-1.3 B2.1-2.4



2.
04

D _c h10	L2	L1	D2 h6	108F	108M	108G
2	7	40	2	108F.020020740	108M.020020740	108G.020020740
2	7	50	6	108F.020060750	108M.020060750	108G.020060750
3	10	40	3	108F.030031040	108M.030031040	108G.030031040
3	12	50	6	108F.030061250	108M.030061250	108G.030061250
3,5	12	40	3,5	108F.035351240	108M.035351240	108G.035351240
4	15	40	4	108F.040041540	108M.040041540	108G.040041540
4	20	50	6	108F.040062050	108M.040062050	108G.040062050
4,5	15	50	4,5	108F.045451550	108M.045451550	108G.045451550
5	16	50	5	108F.050051650	108M.050051650	108G.050051650
5	25	75	6	108F.050062575	108M.050062575	108G.050062575
6	18	50	6	108F.060061850	108M.060061850	108G.060061850
6	35	75	6	108F.060063575	108M.060063575	108G.060063575
7	22	60	7	108F.070072260	108M.070072260	108G.070072260
8	25	63	8	108F.080082563	108M.080082563	108G.080082563
8	40	100	8	108F.0800840100	108M.0800840100	108G.0800840100
9	25	63	9	108F.090092563	108M.090092563	108G.090092563
10	30	72	10	108F.100103072	108M.100103072	108G.100103072
12	32	83	12	108F.120123283	108M.120123283	108G.120123283
14	32	83	14	108F.140143283	108M.140143283	108G.140143283
16	36	92	16	108F.160163692	108M.160163692	108G.160163692
18	40	92	18	108F.180184092	108M.180184092	108G.180184092
20	45	104	20	108F.2002045104	108M.2002045104	108G.2002045104
Tagliante tipo Cut type				F fine F fine 	M medio M medium 	G grosso G course

Frese per materiali compositi - taglio incrociato - con tagliente frontale - norma interna Drill milling cutters - cross cut - Internal standard

109F



109M



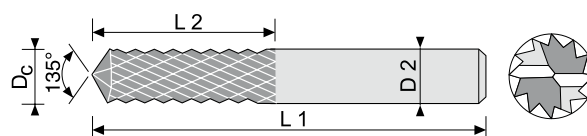
109G



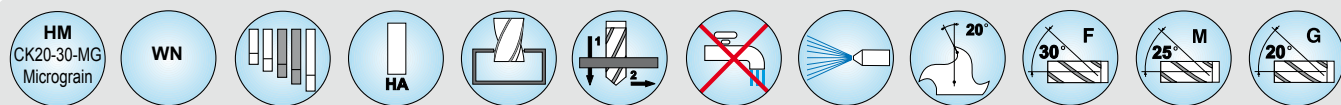
Settori d'impiego / Range of application

A: Leghe leggere / Light alloys
A1.7

B: Plastiche - Plastiche rinforzate con fibre
B: *Plastics - Reinforced plastic fibres*
(AFK - CFK - GFK) - B1.4 B1.1-1.3 B2.1-2.4



2.
04



D _c h10	L2	L1	D2 h6	109F	109M	109G
2	7	40	2	109F.020020740	109M.020020740	109G.020020740
2	7	50	6	109F.020060750	109M.020060750	109G.020060750
3	10	40	3	109F.030031040	109M.030031040	109G.030031040
3	12	50	6	109F.030061250	109M.030061250	109G.030061250
3,5	12	40	3,5	109F.035351240	109M.035351240	109G.035351240
4	15	40	4	109F.040041540	109M.040041540	109G.040041540
4	20	50	6	109F.040062050	109M.040062050	109G.040062050
4,5	15	50	4,5	109F.045451550	109M.045451550	109G.045451550
5	16	50	5	109F.050051650	109M.050051650	109G.050051650
5	25	75	6	109F.050062575	109M.050062575	109G.050062575
6	18	50	6	109F.060061850	109M.060061850	109G.060061850
6	35	75	6	109F.060063575	109M.060063575	109G.060063575
7	22	60	7	109F.070072260	109M.070072260	109G.070072260
8	25	63	8	109F.080082563	109M.080082563	109G.080082563
8	40	100	8	109F.0800840100	109M.0800840100	109G.0800840100
9	25	63	9	109F.090092563	109M.090092563	109G.090092563
10	30	72	10	109F.100103072	109M.100103072	109G.100103072
12	32	83	12	109F.120123283	109M.120123283	109G.120123283
14	32	83	14	109F.140143283	109M.140143283	109G.140143283
16	36	92	16	109F.160163692	109M.160163692	109G.160163692
18	40	92	18	109F.180184092	109M.180184092	109G.180184092
20	45	104	20	109F.2002045104	109M.2002045104	109G.2002045104
Tagliente tipo Cut type				F fine F fine 	M medio M medium 	G grosso G course 

Frese a testa raggiata per materiali compositi - taglio incrociato - norma interna Ball nose end mills - cross cut - Internal standard

106RF

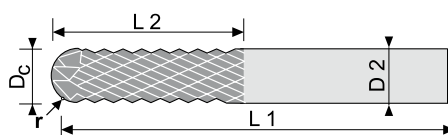


106RM



Settori d'impiego / Range of application

B: Plastiche - Plastiche rinforzate con fibre
B: Plastics - Reinforced plastic fibres
(AFK - CFK - GFK) - B1.4 B1.1-1.3 B2.1-2.4



HM
CK20-30-MG
Micrograin

WN



2.
04

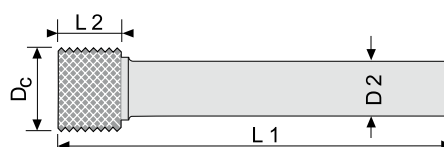
D _c h10	L2	L1	D2 h6	r	106RF	106RM
3	10	40	3	1,5	106RF.030031040	106RM.030031040
3	12	50	6	1,5	106RF.030061250	106RM.030061250
4	15	40	4	2	106RF.040041540	106RM.040041540
4	20	50	6	2	106RF.040062050	106RM.040062050
5	16	50	5	2,5	106RF.050051650	106RM.050051650
5	25	75	6	2,5	106RF.050062575	106RM.050062575
6	18	50	6	3	106RF.060061850	106RM.060061850
6	35	75	6	3	106RF.060063575	106RM.060063575
8	25	63	8	4	106RF.080082563	106RM.080082563
8	40	100	8	4	106RF.0800840100	106RM.0800840100
10	30	72	10	5	106RF.100103072	106RM.100103072
12	32	83	12	6	106RF.120123283	106RM.120123283
16	36	92	16	8	106RF.160163692	106RM.160163692
20	45	104	20	10	106RF.2002045104	106RM.2002045104
Tagliente tipo Cut type					F fine RF fine	M medio G grosso RM medium
						

"ULTRA Ra" Speed Line with fine lapped chip flutes

End mills for honeycomb - large counterwise chip breaker - Internal standard



B: Plastiche - Plastiche rinforzate con fibre
B: *Plastics - Reinforced plastic fibres*
(AFK - CFK - GFK) B1.4 B2.1-2.4



2.04

* non è possibile la lavorazione a tuffo / *Vertical machining not allowed*



2.
05

Frese per materiali plastici e Leghe leggere
End mills for plastics and light alloys

Velocità di taglio V_c (m/min) (valori approssimativi) per frese “ULTRA Ra” e “PIRAÑA”
Cutting speed V_c (m/min) (approx. values) for ULTRA Ra and PIRAÑA end mills

Gruppo A: Alluminio - Leghe d'alluminio - Rame - Leghe di rame - Magnesio Group A: Aluminium - Alu-alloys - Copper - Copper alloys - Magnesium				
	Denominazione materiale Material description	Resistenza a trazione Strenght N/mm ²	Metallo duro Carbide V_c (m/min)	Cer-Al
A 1.1	G-AlMg3	130 - 190	350	600
A 1.2	Al 99.5 / F13	100 - 250	400	650
A 1.3	GDAISI17Cu4	180 - 250		■ 250
A 1.4	GD-AISI12	220 - 300		■ 350
A 1.5	GD-AISI9Cu3	240 - 320	300	350
A 1.6	AlCuMg1 / F39	300 - 500	400	650
A 1.7	MMC - faserarmiert	600 - 1400		■ 300
A 2.1	E-Cu	220 - 350	260	350
A 2.2	GCuSn5ZnPb / Rg5	150 - 350	300	400
A 2.3	GCuSn7ZnPb / Rg7	150 - 350	260	350
A 2.4	CuZn40 / Ms60	340 - 500	260	350
A 2.5	CuZn39Pb2 / Ms58	350 - 500	260	350
A 2.6	CuZn37 / Ms63	300 - 550	260	350
A 2.7	CuAl10Ni	500 - 800	200	300
A 3.1	Ampco 16	630		65
A 3.2	Ampco 20	600		25
A 4.1	MgAl6	300 - 500	200	300
A 4.2	GMgAl9Zn1	300 - 500	250	350

■ Per questi materiali è consigliato il rivestimento Cer-Al.

■ By machining these materials Cer-Al coating is recommended

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Velocità di taglio V_c (m/min) - Numero di giri n (min⁻¹)
Cutting speeds V_c (m/min) - Revolution per minute n (min⁻¹)

D_c (mm)	V_c (m/min)												
	25	50	75	100	150	200	250	300	400	500	600	700	800
2,00	3981	7962	11943	15924	23885	31847	39809	47771	63694				
2,50	3185	6369	9554	12739	19108	25478	31847	38217	50955	63694			
3,00	2654	5308	7962	10616	15924	21231	26539	31847	42463	53079	63694	74310	
3,50	2275	4550	6824	9099	13649	18198	22748	27298	36397	45496	54595	63694	72793
4,00	1990	3981	5971	7962	11943	15924	19904	23885	31847	39809	47771	55732	63694
4,50	1769	3539	5308	7077	10616	14154	17693	21231	28309	35386	42463	49540	56617
5,00	1592	3185	4777	6369	9554	12739	15924	19108	25478	31847	38217	44586	50955
6,00	1327	2654	3981	5308	7962	10616	13270	15924	21231	26539	31847	37155	42463
8,00	995	1990	2986	3981	5971	7962	9952	11943	15924	19904	23885	27866	31847
10,00	796	1592	2389	3185	4777	6369	7962	9554	12739	15924	19108	22293	25478
12,00	663	1327	1990	2654	3981	5308	6635	7962	10616	13270	15924	18577	21231
14,00	569	1137	1706	2275	3412	4550	5687	6824	9099	11374	13649	15924	18198
16,00	498	995	1493	1990	2986	3981	4976	5971	7962	9952	11943	13933	15924
18,00	442	885	1327	1769	2654	3539	4423	5308	7077	8846	10616	12385	14154
20,00	398	796	1194	1592	2389	3185	3981	4777	6369	7962	9554	11146	12739

Avanzamento al dente f_z (mm) per frese “ULTRA” Ra e “PIRAÑA”
End mills - “ULTRA” Ra - Speed Line and “PIRAÑA” end mills

2.05

Sommario dei materiali compositi di uso più comune

Summary of common composite materials in use

Termoindurenti - truciolo corto <i>Thermosets - short chipping</i>	
Materiale - Gruppo B 1.1 <i>Material - Group B 1.1</i>	Resistenza N/mm ² <i>Strength N/mm²</i>
Albanit	110
Bakelit	110
Ferrozell	110
Harnstoff-Formaldehyd	80
Melamin-Formaldehyd	80
MF	80
Pertinax	110
Phenol-Formaldehyd	80
Resopal	80
UP	80

Termoplastici - truciolo lungo <i>Thermoplastics - long chipping</i>	
Materiale - Gruppo B 1.2 <i>Material - Group B 1.2</i>	Resistenza N/mm ² <i>Strength N/mm²</i>
ABS	35-50
ABC Copolymere	80
Bayolan	70-75
Dogalan	80
Dolin	50-70
Durethan 43	
Fluon	20-40
Hostafon TF	20-40
Hostaform	50-70
Hostalen	20-80
Hostalen PP	20-38
Hostalit	35-60
Hostyren N	40-65
HostyrenS	22-50
Lupolen	20-30/80
Luran	78
Lustran	80
Makralon 80	
Makrolon 5	
Novodur	35-56
Novolen	21-38
PA 6	43/57/80
PA 66	43/57/80
PC	5
PE-HD	20-30
Plexiglas	70-76
PMMA	70-78
Polyamid 43/57/80	
Polyamid 66	43/57/80
Polykarbonate	5
Polyethylen	20-30/80

Termoplastici - truciolo lungo <i>Thermoplastics - long chipping</i>	
Materiale - Gruppo B 1.2 <i>Material - Group B 1.2</i>	Resistenza N/mm ² <i>Strength N/mm²</i>
Continua <i>To be continued</i>	
Polymethylmethacrylat	70-76
Polyoxymethylen	50/70/80
Polypropylen	21-37
Polystrol	80
Polystyrol	2-/50/40-65
Polytetrafluorethylen	20-40
Polyvinylchlorid	32-60
PO M	50/70/80
PP	21-37
PS	40-65
PTFE	20-40
PVC-U	35-60
Resanit	70-76
Risitex	80
Rilsan	40/57/80
S/B	22-50
SAN	78
Solvic	35-60
Styrol Acrylnitril	78
Styrol Buladien	22-50
Teflon	20-40
Trogamid T	48/57/80
Ultraform 50/70/80	
Vestamid 43/57/80	
Vestolen	20-30/80
Vestolen P	21-37
Vestyron	22-50/80
Vostyron	40-50
Vinol	35-60
Vinoflex	35-60

Plastiche rinforzate con fibre <i>Reinforced plastic fibres</i>	
Materiale - Gruppo B 2.1 <i>Material - Group B 1.4</i>	Resistenza N/mm ² <i>Strength N/mm²</i>
AFK - Aramidfaser / Aramid fiber	800-1000
	1000-1500
CFK - Kohlefaser / Carbon fiber	800-1000
	1000-1500
GFK - Glasfaser / Fiberglass	800-1000
	1000-1500

Velocità di taglio V_c (m/min) - per lavorazione di plastiche e materiali compositi
Cutting speed V_c (m/min) - for machining of composite materials

Velocità di taglio V_c (m/min) / Cutting speed V_c (m/min)				
Gruppo B: Plastiche - Materiali compositi - Materiali non ferrosi				
Group B: Plastics - Reinforced plastic fibres - Nonferrous materials				
	Denominazione del materiale Material description	Resistenza a trazione N/mm ² Strength N/mm ²	Metallo duro Carbide V_c (m/min)	Rivestimento V_c (m/min)
B 1.1	Duroplastiche / Thermosets	80 - 110	200 - 300	300 - 600
B 1.2	Termoplastiche / Thermoplastics	≤ 80	250 - 400	400 - 650
B 1.3	Policarbonato / Polycarbonate	≤ 20	200 - 350	300 - 450
B 1.4	AFK - CFK - GFK	800-1500	100 - 200	150 - 300
B 1.5	Plexiglas / Plexiglass	70 - 80	150 - 300	300 - 450
B 2.1	Legno duro / Hard wood	≤ 255	200 - 300	300 - 450
B 2.2	Gomma dura / Hard rubber	≤ 255	50-150	100 - 150
B 2.3	Materiali non ferrosi / Nonferrous materials	≤ 255	200 - 350	250 - 350
B 2.4	Cartone compresso / Pressed carton	≤ 255	200 - 250	200 - 350

Numero di giri n (min^{-1})
Revolution per minute n (min^{-1})

[illegible]

Dati di taglio: f_z (mm) - per la lavorazione materiali termoindurenti (valori approssimativi)
Cutting data: f_z (mm) - for machining of thermosets (approximative values)

DIN 6527-L - norma interna corta = f_z (mm) come da tabella

DIN 6527-L - Internal standard short = f_z (mm) acc. to table

Norma standard interna lunga - extralunga = f_z (mm) come da tabella x 0,7

Internal standard long - extra long = f_z (mm) acc. to table x 0,7

2.05

Dati di taglio: f_z (mm) - per la lavorazione di termoplastiche e plastiche rinforzate con fibre
Cutting data: f_z (mm) - for machining of thermoplastics and reinforced plastic fibres (approx. values)

Frese a copiare - Frese con e senza rompitruciolo

Copy milling cutters - End mills with and without chip breaker

Gruppe B: Plastiche - Termoplastiche - Policarbonato - Materiali non ferrosi - Gomma dura Group B: Plastics - Thermoplastics - Polycarbonate - Nonferrous metals - Hard rubber					
B 1.2 B 1.3 B 2.2 B 2.3	Frese a candela con e senza rompitruciolo End mills with and without chip breaker			Frese toriche e di copiatura Torus - Ball nose milling cutters	
	Fresatura di spallamenti retti/contornatura Side-Contour milling		Fresatura di scanalature Slot milling	Fresatura a copiare - pendolare Copying mills - Z levelling	
	Sgrossatura Roughing	Finitura Finishing		Sgrossatura Roughing	Finitura Finishing-
	$a_p = 1,5 \times D_c$ $a_e = 0,8 \times D_c$	$a_p = 1,0 \times D_c$ $a_e = 0,10 \times D_c$	$a_p = 1,0 \times D_c$	$a_p = 0,5 \times D_c$ $a_e = 0,5 \times D_c$	$a_p = 0,05 \times D_c$ $a_e = 0,02 \times D_c$
D_c (mm)	f_z (mm)	f_z (mm)	f_z (mm)	f_z (mm)	f_z (mm)
2,00	0,024	0,022	0,017	0,037	0,030
3,00	0,036	0,033	0,026	0,056	0,045
4,00	0,048	0,044	0,034	0,074	0,060
5,00	0,060	0,055	0,043	0,093	0,075
6,00	0,072	0,066	0,051	0,111	0,090
8,00	0,096	0,088	0,068	0,148	0,120
10,00	0,120	0,110	0,085	0,185	0,150
12,00	0,144	0,132	0,102	0,222	0,180
14,00	0,168	0,154	0,119	0,259	0,210
16,00	0,192	0,176	0,136	0,296	0,240
18,00	0,216	0,198	0,153	0,333	0,270
20,00	0,240	0,220	0,170	0,370	0,300

Gruppe B: plastiche rinforzate con fibre - Compositi - AFK - CFK - GFK Group B: reinforced plastic fibres - AFK - CFK - GFK					
B 1.4	Frese a candela con rompitruciolo End mills with chip breaker				
	Fresatura di spallamenti retti/contornatura Side-Contour milling		Fresatura scanalature Slot milling		
	Sgrossatura Roughing	Finitura Finishing			
	$a_p = 1,0 \times D_c$ $a_e = 0,10 \times D_c$	$a_p = 0,75 \times D_c$ $a_e = 0,03 \times D_c$	$a_p = 0,3 \times D_c$		
D_c (mm)	f_z (mm)	f_z (mm)	f_z (mm)		
2,00	0,026	0,024	0,020		
3,00	0,039	0,036	0,030		
4,00	0,052	0,048	0,040		
5,00	0,065	0,060	0,050		
6,00	0,078	0,072	0,060		
8,00	0,104	0,096	0,080		
10,00	0,130	0,120	0,100		
12,00	0,156	0,144	0,120		
14,00	0,182	0,168	0,140		
16,00	0,208	0,192	0,160		
18,00	0,234	0,216	0,180		
20,00	0,260	0,240	0,200		

Frese Z=1 elica diritta - norma interna

Linea "ULTRA Ra" con gole lappate

End mills - Z=1 straight flute - Internal standard

"ULTRA Ra" Speed Line with fine lapped chip flutes

Settori d'impiego / Range of application

A: Leghe leggere / Light alloys

A1.1-1.7 A2.1-2.7 A3.1-3.2 A4.1-4.2

B: Plastiche - Plastiche rinforzate con fibre

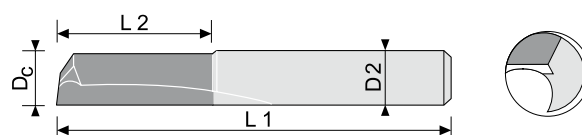
B: Plastics - Reinforced plastic fibres

B1.1-1.3 B1.5-1.6 B2.1-2.4

110TD



110TDG

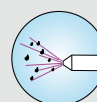
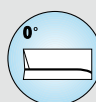
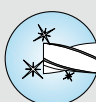
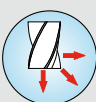


HM
CK10-20-MG
Micrograin

WN

HA

HSC



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D _c h10	L2	L1	D2 h6	110TD	110TDG
					Rivestite / Coated
1,5	6	40	3	110TD.015030640	110TD.015030640G
2	6	40	3	110TD.020030640	110TD.020030640G
2	10	60	6	110TD.020061060	110TD.020061060G
3	12	40	3	110TD.030031240	110TD.030031240G
3	15	60	6	110TD.030061560	110TD.030061560G
4	15	60	6	110TD.040061560	110TD.040061560G
4	20	75	6	110TD.040062075	110TD.040062075G
5	16	60	6	110TD.050061660	110TD.050061660G
6	20	60	6	110TD.060062060	110TD.060062060G
6	30	60	6	110TD.060063060	110TD.060063060G
6	35	75	6	110TD.060063575	110TD.060063575G
8	22	63	8	110TD.080082263	110TD.080082263G
8	40	100	8	110TD.0800840100	110TD.0800840100G
10	25	72	10	110TD.100102572	110TD.100102572G
10	55	100	10	110TD.1001055100	110TD.1001055100G
12	30	83	12	110TD.120123083	110TD.120123083G

Frese a testa raggiata - Z=1 elica dritta - norma interna

Linea "ULTRA Ra" con gole lappate

Ball nose cutter - Z=1 straight flute - Internal standard

"ULTRA Ra" Speed Line with fine lapped chip flutes

Settori d'impiego / Range of application

Leghe leggere / Light alloys

A1.1-1.7 A2.1-2.7 A3.1-3.2 A4.1-4.2

B: Plastiche - Plastiche rinforzate con fibre

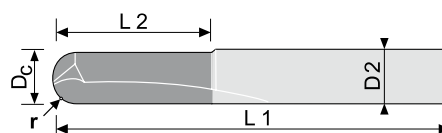
B: Plastics - Reinforced plastic fibres

B1.1-1.3 B1.5-1.6 B2.1-2.4

110TDR

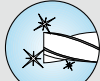


110TDRG



HM
CK10-20-MG
Micrograin

WN



D _c h10	L2	L1	D2 h6	r	110TDR	110TDRG
						Rivestite / Coated
1,5	6	40	3	0,75	110TDR.015030640	110TDR.015030640G
2	6	40	3	1	110TDR.020030640	110TDR.020030640G
2	10	60	6	1	110TDR.020061060	110TDR.020061060G
3	12	40	3	1,5	110TDR.030031240	110TDR.030031240G
3	15	60	6	1,5	110TDR.030061560	110TDR.030061560G
4	15	60	6	2	110TDR.040061560	110TDR.040061560G
4	20	75	6	2	110TDR.040062075	110TDR.040062075G
5	16	60	6	2,5	110TDR.050061660	110TDR.050061660G
6	20	60	6	3	110TDR.060062060	110TDR.060062060G
6	30	60	6	3	110TDR.060063060	110TDR.060063060G
6	35	75	6	3	110TDR.060063575	110TDR.060063575G
8	22	63	8	4	110TDR.080082263	110TDR.080082263G
8	40	100	8	4	110TDR.0800840100	110TDR.0800840100G
10	25	72	10	5	110TDR.100102572	110TDR.100102572G
10	55	100	10	5	110TDR.1001055100	110TDR.1001055100G
12	30	83	12	6	110TDR.120123083	110TDR.120123083G

2.
05

Frese Z=1 - elica destra e taglio destro - per alluminio

Linea "ULTRA Ra" con gole lappate

Single Flute routers Right hand Spiral - Right hand cut for Aluminium

"ULTRA Ra" Speed Line with fine lapped chip flutes

Settori d'impiego / Range of application

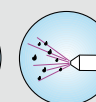
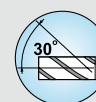
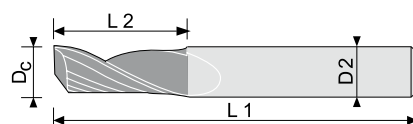
A: Leghe leggere / Light alloys

A1.1-1.7 A2.1-2.7 A3.1-3.2 A4.1-4.2

110A



110AG



2.
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D _c h10	L2	L1	D2 h6	110A	110AG
					Rivestite / Coated
1,5	6	40	3	110A.015030640	110A.015030640G
2	10	40	2	110A.020021040	110A.020021040G
2	8	40	3	110A.020030840	110A.020030840G
2	6	50	6	110A.020060650	110A.020060650G
2,5	8	50	6	110A.025060850	110A.025060850G
3	10	40	3	110A.030031040	110A.030031040G
3	7	50	6	110A.030060750	110A.030060750G
3	10	50	6	110A.030061050	110A.030061050G
3,5	10	50	6	110A.035061050	110A.035061050G
4	12	50	4	110A.040041250	110A.040041250G
4	9	50	6	110A.040060950	110A.040060950G
4	12	50	6	110A.040061250	110A.040061250G
4,5	12	50	6	110A.045061250	110A.045061250G
5	14	50	5	110A.050051450	110A.050051450G
5	11	50	6	110A.050061150	110A.050061150G
5	14	50	6	110A.050061450	110A.050061450G
5,5	14	50	6	110A.055061450	110A.055061450G
6	14	50	6	110A.060061450	110A.060061450G
6	20	60	6	110A.060062060	110A.060062060G
6	35	75	6	110A.060063575	110A.060063575G
8	17	63	8	110A.080081763	110A.080081763G
8	25	63	8	110A.080082563	110A.080082563G
10	25	72	10	110A.100102572	110A.100102572G
12	25	83	12	110A.120122583	110A.120122583G

Frese Z=1 - elica sinistra e taglio destro - per alluminio

Linea "ULTRA Ra" con gole lappate

Single Flute routers Left hand Spiral - Right hand cut for Aluminium

"ULTRA Ra" Speed Line with fine lapped chip flutes

Settori d'impiego / Range of application

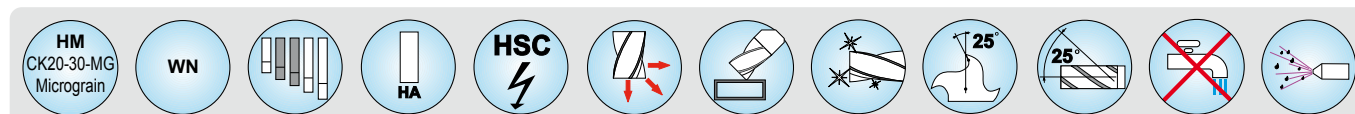
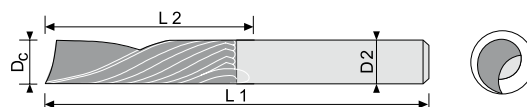
A: Leghe leggere / Light alloys

A1.1-1.7 A2.1-2.7 A3.1-3.2 A4.1-4.2

111A



111AG



D _c h10	L2	L1	D2 h6	111A	111AG
					Rivestite / Coated
1,5	6	40	3	111A.015030640	111A.015030640G
2	10	40	2	111A.020021040	111A.020021040G
2	8	40	3	111A.020030840	111A.020030840G
2	6	50	6	111A.020060650	111A.020060650G
2,5	8	50	6	111A.025060850	111A.025060850G
3	10	40	3	111A.030031040	111A.030031040G
3	7	50	6	111A.030060750	111A.030060750G
3	10	50	6	111A.030061050	111A.030061050G
3,5	10	50	6	111A.035061050	111A.035061050G
4	12	50	4	111A.040041250	111A.040041250G
4	9	50	6	111A.040060950	111A.040060950G
4	12	50	6	111A.040061250	111A.040061250G
4,5	12	50	6	111A.045061250	111A.045061250G
5	14	50	5	111A.050051450	111A.050051450G
5	11	50	6	111A.050061150	111A.050061150G
5	14	50	6	111A.050061450	111A.050061450G
5,5	14	50	6	111A.055061450	111A.055061450G
6	14	50	6	111A.060061450	111A.060061450G
6	20	60	6	111A.060062060	111A.060062060G
6	35	75	6	111A.060063575	111A.060063575G
8	17	63	8	111A.080081763	111A.080081763G
8	25	63	8	111A.080082563	111A.080082563G
10	25	72	10	111A.100102572	111A.100102572G
12	25	83	12	111A.120122583	111A.120122583G

2.
05

Frese Z=1 - elica destra e taglio destro

Linea "ULTRA Ra" con gole lappate

Single Flute routers Right hand Spiral - Right hand cut

"ULTRA Ra" Speed Line with fine lapped chip flutes

Settori d'impiego / Range of application

A: Leghe leggere / Light alloys

A1.1-1.6 A2.1-2.6 A3.1-3.2 A4.1-4.2

B: Plastiche - Plastiche rinforzate con fibre

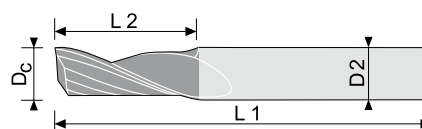
B: Plastics - Reinforced plastic fibres

B1.1-1.3 B1.5-1.6 B2.1-2.4

110



110G



HM
CK10-20-MG
Micrograin

WN



HSC



2.
05

D _c h10	L2	L1	D2 h6	110	110G
					Rivestite / Coated
1,5	6	40	3	110.015030640	110.015030640G
2	6	40	3	110.020030640	110.020030640G
2	10	40	2	110.020021040	110.020021040G
2	5	50	6	110.020060550	110.020060550G
2	10	60	6	110.020061060	110.020061060G
2,5	6	40	2,5	110.025250640	110.025250640G
3	12	40	3	110.030031240	110.030031240G
3	7	50	6	110.030060750	110.030060750G
3	10	60	6	110.030061060	110.030061060G
3	12	60	6	110.030061260	110.030061260G
3	15	60	6	110.030061560	110.030061560G
4	15	40	4	110.040041540	110.040041540G
4	9	50	6	110.040060950	110.040060950G
4	12	60	6	110.040061260	110.040061260G
4	15	60	6	110.040061560	110.040061560G
4	20	75	6	110.040062075	110.040062075G
5	11	50	6	110.050061150	110.050061150G
5	16	50	5	110.050051650	110.050051650G
5	16	60	6	110.050061660	110.050061660G
5	28	75	6	110.050062875	110.050062875G
6	13	50	6	110.060061350	110.060061350G
6	20	60	6	110.060062060	110.060062060G

D _c h10	L2	L1	D2 h6	110	110G
					Rivestite / Coated
6	22	60	6	110.060062260	110.060062260G
6	30	60	6	110.060063060	110.060063060G
6	35	75	6	110.060063575	110.060063575G
8	17	63	8	110.080081763	110.080081763G
8	22	63	8	110.080082263	110.080082263G
8	35	75	8	110.080083575	110.080083575G
8	45	100	8	110.0800845100	110.0800845100G
10	25	72	10	110.100102572	110.100102572G
10	35	80	10	110.100103580	110.100103580G
10	55	100	10	110.1001055100	110.1001055100G
12	30	83	12	110.120123083	110.120123083G
12	55	110	12	110.1201255110	110.1201255110G
14	30	83	14	110.140143083	110.140143083G
16	35	92	16	110.160163592	110.160163592G
16	70	125	16	110.1601670125	110.1601670125G
20	40	104	20	110.2002040104	110.2002040104G
20	60	125	20	110.2002060125	110.2002060125G

Frese Z=1 - elica sinistra e taglio destro

Linea "ULTRA Ra" con gole lappate

Single Flute routers Left hand Spiral - Right hand cut

"ULTRA Ra" Speed Line with fine lapped chip flutes

Settori d'impiego / Range of application

A: Leghe leggere / Light alloys

A1.1-1.6 A2.1-2.6 A3.1-3.2 A4.1-4.2

B: Plastiche - Plastiche rinforzate con fibre

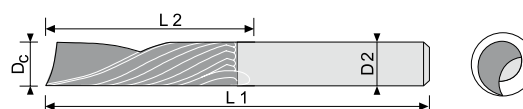
B: Plastics - Reinforced plastic fibres

B1.1-1.3 B1.5-1.6 B2.1-2.4

111



111G

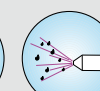
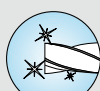


HM
CK10-20-MG
Micrograin

WN



HSC



2.
05

D _c h10	L2	L1	D2 h6	111	111G
					Rivestite / Coated
1,5	6	40	3	111.015030640	111.015030640G
2	6	40	3	111.020030640	111.020030640G
2	10	40	2	111.020021040	111.020021040G
2	5	50	6	111.020060550	111.020060550G
2	10	60	6	111.020061060	111.020061060G
2,5	6	40	2,5	111.025250640	111.025250640G
3	12	40	3	111.030031240	111.030031240G
3	7	50	6	111.030060750	111.030060750G
3	10	60	6	111.030061060	111.030061060G
3	12	60	6	111.030061260	111.030061260G
3	15	60	6	111.030061560	111.030061560G
4	15	40	4	111.040041540	111.040041540G
4	9	50	6	111.040060950	111.040060950G
4	12	60	6	111.040061260	111.040061260G
4	15	60	6	111.040061560	111.040061560G
4	20	75	6	111.040062075	111.040062075G
5	11	50	6	111.050061150	111.050061150G
5	16	50	5	111.050051650	111.050051650G
5	16	60	6	111.050061660	111.050061660G
5	28	75	6	111.050062875	111.050062875G
6	13	50	6	111.060061350	111.060061350G
6	20	60	6	111.060062060	111.060062060G

D _c h10	L2	L1	D2 h6	111	111G
					Rivestite / Coated
6	22	60	6	111.060062260	111.060062260G
6	30	60	6	111.060063060	111.060063060G
6	35	75	6	111.060063575	111.060063575G
8	17	63	8	111.080081763	111.080081763G
8	22	63	8	111.080082263	111.080082263G
8	35	75	8	111.080083575	111.080083575G
8	45	100	8	111.0800845100	111.0800845100G
10	25	72	10	111.100102572	111.100102572G
12	30	83	12	111.120123083	111.120123083G
14	30	83	14	111.140143083	111.140143083G
16	35	92	16	111.160163592	111.160163592G
20	40	104	20	111.2002040104	111.2002040104G

Frese Z=1 - testa raggiata - elica destra e taglio destro

Linea "ULTRA Ra" con gole lappate

Radius Single Flute routers Right hand Spiral - Right hand cut

"ULTRA Ra" Speed Line with fine lapped chip flutes

Settori d'impiego / Range of application

A: Leghe leggere / Light alloys

A1.1-1.6 A2.1-2.6 A3.1-3.2 A4.1-4.2

B: Plastiche - Plastiche rinforzate con fibre

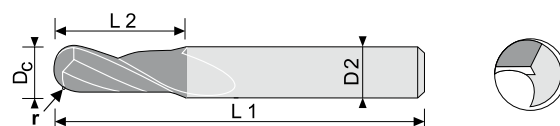
B: Plastics - Reinforced plastic fibres

B1.1-1.3 B1.5-1.6 B2.1-2.4

110R



110RG



HM
CK10-20-MG
Micrograin

WN



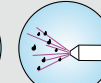
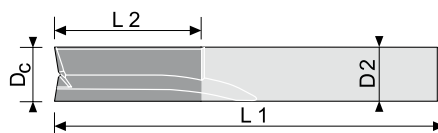
2.
05

D _c h10	L2	L1	D2 h6	r	110R	110RG
						Rivestite / Coated
2	6	40	3	1	110R.020030640	110R.020030640G
2	10	60	6	1	110R.020061060	110R.020061060G
3	12	40	3	1,5	110R.030031240	110R.030031240G
3	12	60	6	1,5	110R.030061260	110R.030061260G
4	15	40	4	2	110R.040041540	110R.040041540G
4	15	60	6	2	110R.040061560	110R.040061560G
5	16	60	6	2,5	110R.050061660	110R.050061660G
5	16	50	5	2,5	110R.050051650	110R.050051650G
6	20	60	6	3	110R.060062060	110R.060062060G
6	30	60	6	3	110R.060063060	110R.060063060G
6	35	75	6	3	110R.060063575	110R.060063575G
8	22	63	8	4	110R.080082263	110R.080082263G
8	40	100	8	4	110R.0800840100	110R.0800840100G
10	25	72	10	5	110R.100102572	110R.100102572G
10	55	100	10	5	110R.1001055100	110R.1001055100G
12	30	83	12	6	110R.120123083	110R.120123083G

"ULTRA Ra" Speed Line with fine lapped chip flutes



B1.1-1.3 B1.5-1.6 B2.1-2.4

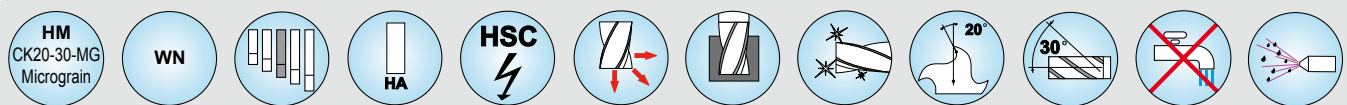
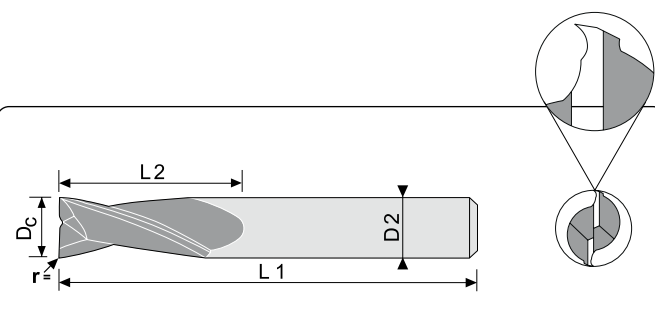


2.05

"ULTRA Ra" Speed Line with fine lapped chip flutes-with double rake angle - conical core



E1.1



2.05

Per i parametri di lavoro vedere pagina 142
For working-parameters see page 142

Frese Z=2 elica 30° - norma interna

Linea "ULTRA Ra" con gole lappate

End mills - Z=2 Helix 30° - Internal standard

"ULTRA Ra" Speed Line with fine lapped chip flutes

Settore d'impiego / Range of application

A: Leghe leggere / Light alloys

A1.1-1.7 A2.1-2.7 A3.1-3.2 A4.1-4.2

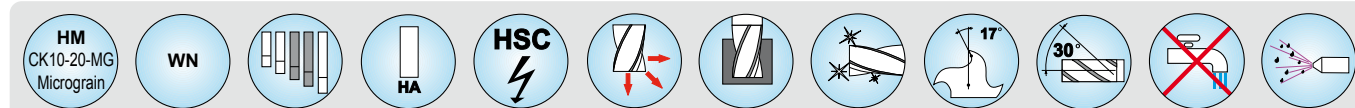
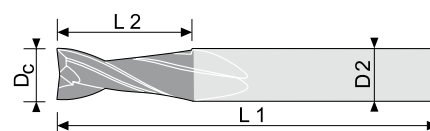
B: Plastiche

B: Plastics

B1.1-1.3 B1.5-1.6 B2.1-2.4

E: Titanio / Titanium

E1.1



D _c h10	L2	L1	D2 h6	102	102G
					Rivestite / Coated
2	6	50	6	102.020060650	102.020060650G
2	8	50	3	102.020030850	102.020030850G
3	12	40	3	102.030031240	102.030031240G
3	7	50	6	102.030060750	102.030060750G
3	12	50	6	102.030061250	102.030061250G
4	14	40	4	102.040041440	102.040041440G
4	9	50	6	102.040060950	102.040060950G
4	14	50	6	102.040061450	102.040061450G
5	11	50	6	102.050061150	102.050061150G
5	16	50	5	102.050051650	102.050051650G
6	13	50	6	102.060061350	102.060061350G
6	18	50	6	102.060061850	102.060061850G
6	25	60	6	102.060062560	102.060062560G
6	35	75	6	102.060063575	102.060063575G
8	20	63	8	102.080082063	102.080082063G
8	30	75	8	102.080083075	102.080083075G
8	40	100	8	102.0800840100	102.0800840100G
10	25	72	10	102.100102572	102.100102572G
12	30	83	12	102.120123083	102.120123083G
16	35	92	16	102.160163592	102.160163592G
20	45	104	20	102.2002045104	102.2002045104G

2.
05

Linea "ULTRA Ra" con gole lappate

End mills - Z=2 Left hand spiral - Right hand cut - Internal standard

"ULTRA Ra" Speed Line with fine lapped chip flutes

Settori d'impiego / *Range of application*

A: Leghe leggere / *Light alloys*

A1.1-1.7 A2.1-2.7 A3.1-3.2 A4.1-4.2

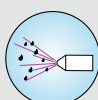
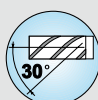
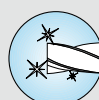
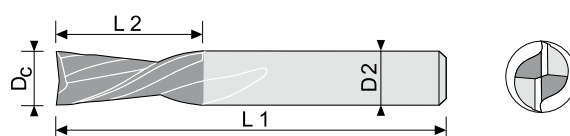
B: Plastiche

B: *Plastics*

B1.1-1.3 B1.5-1.6 B2.1-2.4

E: Titanio / *Titanium*

E1.1



2.05

[illegible]

Frese Z=2 - elica 45° - norma interna

Linea "ULTRA Ra" con gole lappate

End mills - Z=2 Helix 45° - Internal standard

"ULTRA Ra" Speed Line with fine lapped chip flutes

Settori d'impiego / Range of application

A: Leghe leggere / Light alloys

A1.1-1.7 A2.1-2.7 A3.1-3.2 A4.1-4.2

B: Plastiche

B: Plastics

B1.1-1.3 B1.5-1.6 B2.1-2.4

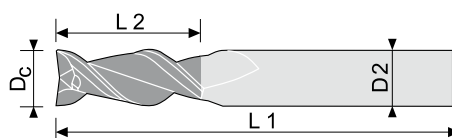
Titanio / Titanium

E1.1

102-45°



102-45°G



HM
CK10-20-MG
Micrograin

WN



HSC



D _c h10	L2	L1	D2 h6	102-45°	102-45°G
					Rivestite / Coated
2	8	50	3	102.020030850-45°	102.020030850G-45°G
3	12	40	3	102.030031240-45°	102.030031240G-45°G
3	12	50	6	102.030061250-45°	102.030061250G-45°G
4	14	40	4	102.040041440-45°	102.040041440G-45°G
4	14	50	6	102.040061450-45°	102.040061450G-45°G
5	11	50	6	102.050061150-45°	102.050061150G-45°G
5	16	50	6	102.050061650-45°	102.050061650G-45°G
6	18	50	6	102.060061850-45°	102.060061850G-45°G
6	25	60	6	102.060062560-45°	102.060062560G-45°G
6	35	75	6	102.060063575-45°	102.060063575G-45°G
8	20	63	8	102.080082063-45°	102.080082063G-45°G
8	30	75	8	102.080083075-45°	102.080083075G-45°G
8	40	100	8	102.0800840100-45°	102.0800840100G-45°G
10	25	72	10	102.100102572-45°	102.100102572G-45°G
12	30	83	12	102.120123083-45°	102.120123083G-45°G
16	35	92	16	102.160163592-45°	102.160163592G-45°G
20	45	104	20	102.2002045104-45°	102.2002045104G-45°G

2.
05

Linea "ULTRA Ra" con gole lappate

End mills - Z=3 straight flute - Internal standard

"ULTRA Ra" Speed Line with fine lapped chip flutes

Settori d'impiego / *Range of application*

A: Leghe leggere / *Light alloys*

A1.1-1.7 A2.1-2.7 A3.1-3.2 A4.1-4.2

B: Plastiche

B: *Plastics*

B1.1-1.3 B1.5-1.6 B2.1-2.4

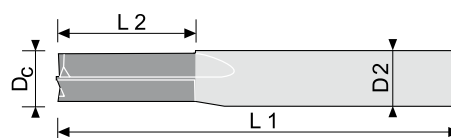
Titanio / *Titanium*

E1.1

101



101G



2.05

[illegible]

Linea "ULTRA Ra" con gole lappate

End mills - Z=3 Helix 30° - Left hand spiral - Right hand cut - Internal standard

"ULTRA Ra" Speed Line with fine lapped chip flutes

Settori d'impiego / *Range of application*

A: Leghe leggere / *Light alloys*

A1.1-1.7 A2.1-2.7 A3.1-3.2 A4.1-4.2

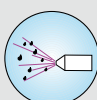
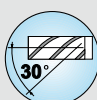
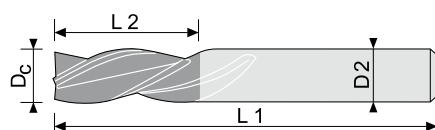
B: Plastiche - Plastiche rinforzate con fibre

B: *Plastics - Reinforced plastic fibres*

B1.1-1.3 B1.5-1.6 B2.1-2.4

Titanio / *Titanium*

E1.1

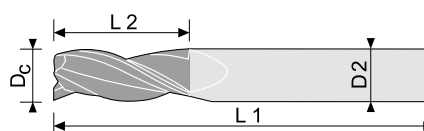


2.05

[illegible]



E1.1

2.05

Linea "PIRAÑA" con divisione irregolare taglienti - gole lappate

Torus cutters - Z=3 Helix 30° - Similar to DIN 6527-L

"PIRAÑA" uneven division of cutting edges - fine lapped chip flutes

Settori d'impiego / *Range of application*

A: Leghe leggere / *Light alloys*

A1.1-1.7 A2.1-2.7 A3.1-3.2 A4.1-4.2

B: Plastiche - Plastiche rinforzate con fibre

B: *Plastics - Reinforced plastic fibres*

B1.1-1.3 B1.5-1.6 B2.1-2.4

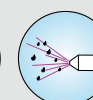
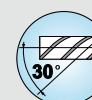
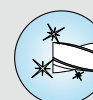
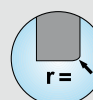
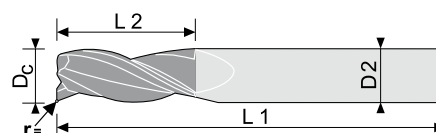
Titanio / *Titanium*

E1.1

103TI



103TIG



2.05

[illegible]

Frese Z=3 - elica 45° - simili a DIN 6527 L

Linea "PIRAÑA" con divisione irregolare taglienti - gole lappate

End mills - Z=3 Helix 45° - Similar to DIN 6527-L

“PIRAÑA” uneven division of cutting edges - fine lapped chip flutes

1031-45°



103I-45°G

Settori d'impiego / *Range of application*

A: Leghe leggere / *Light alloys*

A1.1-1.7 A2.1-2.7 A3.1-3.2 A4.1-4.2

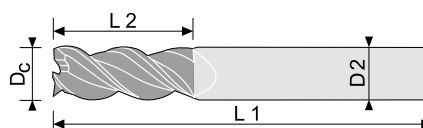
B: Plastiche - Plastiche rinforzate con fibre

B: *Plastics - Reinforced plastic fibres*

B1.1-1.3 B1.5-1.6 B2.1-2.4

E: Titanio / *Titanium*

E1.1

[illegible]

2.05

Linea "PIRANA" con divisione irregolare taglienti - gole lappate

Ball nose cutters - Z=3 Helix 30° - Similar to DIN 6527-L

“PIRAÑA” uneven division of cutting edges - fine lapped chip flutes

Settori d'impiego / *Range of application*

A: Leghe leggere / *Light alloys*

A1.1-1.7 A2.1-2.7 A3.1-3.2 A4.1-4.2

B: Plastiche - Plastiche rinforzate con fibre

B: *Plastics - Reinforced plastic fibres*

B1.1-1.3 B1.5-1.6 B2.1-2.4

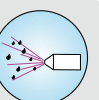
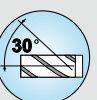
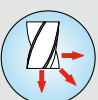
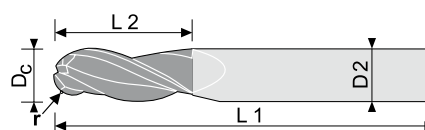
Titanio / *Titanium*

E1.1

103RI



103RIG



2.05

[illegible]

Frese Z=1 - elica destra e rompitruciolo - norma interna

Linea "ULTRA Ra" con gole lappate

Z=1 with right helix and chip breaker - Internal standard

"ULTRA Ra" Speed Line with fine lapped chip flutes

Settori d'impiego / Range of application

A: Leghe leggere / Light alloys

A1.1-1.6

B: Plastiche - Plastiche rinforzate con fibre

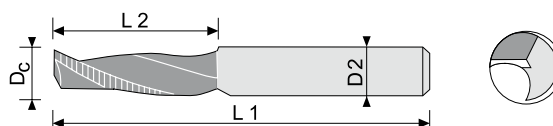
B: Plastics - Reinforced plastic fibres

B1.1-1.3 B1.4-1.6 B2.1-2.4

110SP



110SPG



HM
CK10-20-MG
Micrograin

WN



D _c h10	L2	L1	D2 h6	110SP	110SPG
					Rivestite / Coated
3	7	50	6	110SP.030060750	110SP.030060750G
3	12	60	6	110SP.030061260	110SP.030061260G
4	9	50	6	110SP.040060950	110SP.040060950G
4	15	60	6	110SP.040061560	110SP.040061560G
5	11	50	6	110SP.050061150	110SP.050061150G
5	16	60	6	110SP.050061660	110SP.050061660G
6	13	50	6	110SP.060061350	110SP.060061350G
6	20	60	6	110SP.060062060	110SP.060062060G
8	22	63	8	110SP.080082263	110SP.080082263G
10	25	72	10	110SP.100102572	110SP.100102572G
12	30	83	12	110SP.120123083	110SP.120123083G
16	35	92	16	110SP.160163592	110SP.160163592G
20	40	104	20	110SP.2002040104	110SP.2002040104G

2.
05

Frese di sgrossatura *Roughing end mills*

Velocità di taglio V_c (m/min) per frese per di sgrossatura
Cutting speed V_c (m/min) for roughing end mills

Velocità di taglio V_c (m/min) / Cutting speed V_c (m/min)				
Gruppo C: Acciai in generale - Leghe d'acciaio - Acciai temprati Group C: General steels - Steel alloys - Hardened steels				
	Denominazione materiale Material description	Resistenza Strength N/mm ²	VHM Carbide V_c (m/min)	Cer-T
C 1.1	Q-St-37-3	< 400	200	250
C 1.2	R-Fe80	< 400	200	250
C 1.3	9SMnPb28	500 - 700	150	200
C 1.4	St37-2	320 - 470	150	200
C 1.5	16MnCr5	500 - 700	100	150
C 1.6	Ck45	600 - 800	100	150
C 1.7	Gs25CrMo4	650 - 950	100	180
C 1.8	St70-2	700 - 900	120	180
C 2.1	100Cr6	700 - 900	100	150
C 2.2	X155CrVMo12-1	900 - 1100	80	120
C 2.3	X30WCrV5-3	1100	80	120
C 2.4	42CrMo4V	1200 - 1400	80	120
C 3.1	X38CrMoV5-3	900 - 1100	80	120
C 3.2	55NiCrMoV6	47 - 52 HRC		100
C 3.3	45WCrV7	56 - 60 HRC		100
C 3.4	X155CrVMo12-1	60 - 63 HRC		80
C 3.5	X210CrW12	63 - 66 HRC		80
C 4.1	FeroTiC	800 - 900		40
C 4.2	Hardox500	1300 - 1400		30

Gruppo F: Ghise Group F: Cast irons				
	Denominazione del materiale Material description	Resistenza Strength N/mm ²	VHM Carbide V_c (m/min)	Cer-T
F 1.1	GG 20	120-220 HB	120	160
F 1.2	GG 30	220 - 270 HB	100	150
F 1.3	Ghisa dura / Hard cast iron	< 400 HB		80
F 1.4	GTW40	360 - 420	100	160
F 1.5	GTS65	560 - 650	90	150
F 2.1	GGG 40	400	100	150
F 2.2	GGG 70	700 - 1050	100	150
F 2.3	GGV (80% Perlite)	220 HB	70	100
F 2.4	GGV (100% Perlite)	230 HB	60	100

Velocità di taglio (m/min) - Numero di giri n (min⁻¹)

Cutting speed V_c (m/min) - Revolution per minute n (min⁻¹)

Formule di calcolo: Velocità di taglio V_c (m/min) - Numero di giri n (min⁻¹)
Calculation formula: Cutting speed V_c (m/min) - Revolution per minute n (min⁻¹)

$$V_c \text{ (m/min)} = \frac{D_c \text{ (mm)} \times 3,14 \times n \text{ (min}^{-1}\text{)}}{1000}$$

$$n \text{ (min}^{-1}\text{)} = \frac{V_c \text{ (m/min)} \times 1000}{D_c \text{ (mm)} \times 3,14}$$

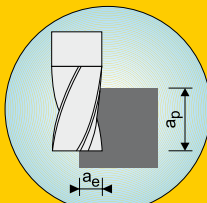
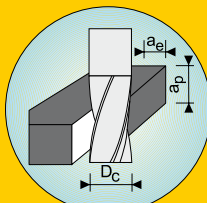
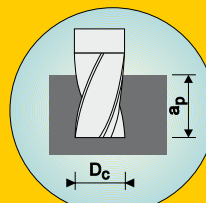
D_c (mm)	V_c (m/min)										
	40	50	60	80	100	120	150	160	200	250	300
	Numero di giri al minuto n (min ⁻¹) / Revolution per minute n (min ⁻¹)										
2,00	6369	7962	9554	12739	15924	19108	23885	25478	31847	39809	47771
2,50	5096	6369	7643	10191	12739	15287	19108	20382	25478	31847	38217
3,00	4246	5308	6369	8493	10616	12739	15924	16985	21231	26539	31847
3,50	3640	4550	5460	7279	9099	10919	13649	14559	18198	22748	27298
4,00	3185	3981	4777	6369	7962	9554	11943	12739	15924	19904	23885
4,50	2831	3539	4246	5662	7077	8493	10616	11323	14154	17693	21231
5,00	2548	3185	3822	5096	6369	7643	9554	10191	12739	15924	19108
6,00	2123	2654	3185	4246	5308	6369	7962	8493	10616	13270	15924
8,00	1592	1990	2389	3185	3981	4777	5971	6369	7962	9952	11943
10,00	1274	1592	1911	2548	3185	3822	4777	5096	6369	7962	9554
12,00	1062	1327	1592	2123	2654	3185	3981	4246	5308	6635	7962
14,00	910	1137	1365	1820	2275	2730	3412	3640	4550	5687	6824
16,00	796	995	1194	1592	1990	2389	2986	3185	3981	4976	5971
18,00	708	885	1062	1415	1769	2123	2654	2831	3539	4423	5308
20,00	637	796	955	1274	1592	1911	2389	2548	3185	3981	4777
25,00	510	637	764	1019	1274	1529	1911	2038	2548	3185	3822
30,00	425	531	637	849	1062	1274	1592	1699	2123	2654	3185
32,00	398	498	597	796	995	1194	1493	1592	1990	2488	2986
35,00	364	455	546	728	910	1092	1365	1456	1820	2275	2730

Avanzamento al dente f_z (mm) - per frese di sgrossatura (valori approssimativi)
Feed per tooth f_z (mm) - for roughing end mills (approximative values)

Frese per sgrossatura-finitura f_z (mm) = tabella x 0,85
Roughing finishing end mills f_z (mm) = table x 0,85

Frese per sgrossatura f_z (mm) = come da tabella
Roughing end mills f_z (mm) = according to table

Gruppo C - Acciai in generale - Leghe d'acciaio - Acciai temprati
Group C - General steels - Steel alloys - Hardened steels

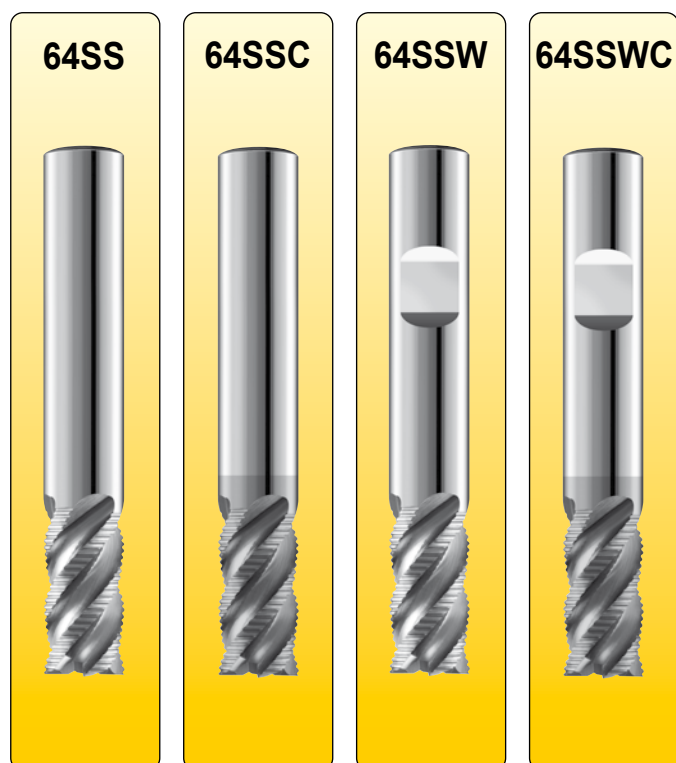
	Fresatura di spallamenti retti/contornatura Side-Contour milling							Fresatura di scanalature Slot milling					
													
	$a_p = 1,5 \times D_c$			$a_e = 0,40 \times D_c$				$a_p = 1,0 \times D_c$					
	D_c (mm)												
	4,0	5,0	6,0	8,0	10,0	12,0	14,0	16,0	18,0	20,0	25,0	30,0	32,0
	f_z (mm) per utensili con rivestimento Cer-T / f_z (mm) for tools with a coating of Cer-T												
C 1.1	0,013	0,017	0,020	0,026	0,032	0,040	0,046	0,052	0,058	0,064	0,079	0,084	0,088
C 1.2	0,013	0,017	0,020	0,026	0,032	0,040	0,046	0,052	0,058	0,064	0,079	0,084	0,088
C 1.3	0,013	0,017	0,020	0,026	0,032	0,040	0,046	0,052	0,058	0,064	0,079	0,084	0,088
C 1.4	0,013	0,017	0,020	0,026	0,032	0,040	0,046	0,052	0,058	0,064	0,079	0,084	0,088
C 1.5	0,011	0,014	0,017	0,022	0,027	0,033	0,038	0,043	0,048	0,053	0,066	0,070	0,073
C 1.6	0,011	0,014	0,017	0,022	0,027	0,033	0,038	0,043	0,048	0,053	0,066	0,070	0,073
C 1.7	0,012	0,015	0,019	0,024	0,030	0,036	0,042	0,047	0,053	0,058	0,073	0,077	0,080
C 1.8	0,012	0,015	0,019	0,024	0,030	0,036	0,042	0,047	0,053	0,058	0,073	0,077	0,080
C 2.1	0,011	0,014	0,017	0,022	0,027	0,033	0,038	0,043	0,048	0,053	0,066	0,070	0,073
C 2.2	0,009	0,011	0,014	0,018	0,022	0,026	0,030	0,034	0,038	0,042	0,053	0,056	0,058
C 2.3	0,009	0,011	0,014	0,018	0,022	0,026	0,030	0,034	0,038	0,042	0,053	0,056	0,058
C 2.4	0,009	0,011	0,014	0,018	0,022	0,026	0,030	0,034	0,038	0,042	0,053	0,056	0,058
C 3.1	0,009	0,011	0,014	0,018	0,022	0,026	0,030	0,034	0,038	0,042	0,053	0,056	0,058

Gruppo F - Ghise
Group F - Cast irons

F 1.1	0,012	0,015	0,019	0,024	0,030	0,036	0,042	0,047	0,053	0,058	0,073	0,077	0,080
F 1.2	0,012	0,015	0,019	0,024	0,030	0,036	0,042	0,047	0,053	0,058	0,073	0,077	0,080
F 1.4	0,012	0,015	0,019	0,024	0,030	0,036	0,042	0,047	0,053	0,058	0,073	0,077	0,080
F 1.5	0,012	0,015	0,019	0,024	0,030	0,036	0,042	0,047	0,053	0,058	0,073	0,077	0,080
F 2.1	0,012	0,015	0,019	0,024	0,030	0,036	0,042	0,047	0,053	0,058	0,073	0,077	0,080
F 2.2	0,012	0,015	0,019	0,024	0,030	0,036	0,042	0,047	0,053	0,058	0,073	0,077	0,080
F 2.3	0,012	0,015	0,019	0,024	0,030	0,036	0,042	0,047	0,053	0,058	0,073	0,077	0,080
F 2.4	0,011	0,014	0,017	0,022	0,027	0,033	0,038	0,043	0,048	0,053	0,066	0,070	0,073
	0,011	0,014	0,017	0,022	0,027	0,033	0,038	0,043	0,048	0,053	0,066	0,070	0,073

Per i materiali dei gruppi "E" e "D" consigliamo le nostre frese tipo "PIRAÑA"
For material groups "E" and "D" end mills type "PIRAÑA" are suggested

Frese per sgrossatura ad alte prestazioni - elica 45° - simile a DIN 6527 L
High performance roughing end mills helix 45° - Similar to DIN 6527-L

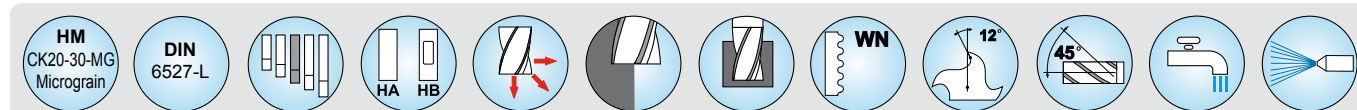
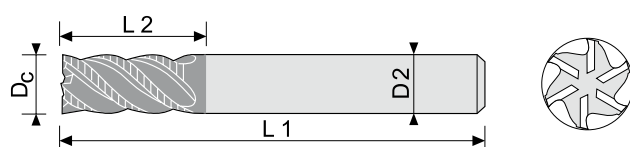
Settori d'impiego / *Range of application*

C: Acciai / Steels
C1.1-1.8 C2.1-2.4 C4.1

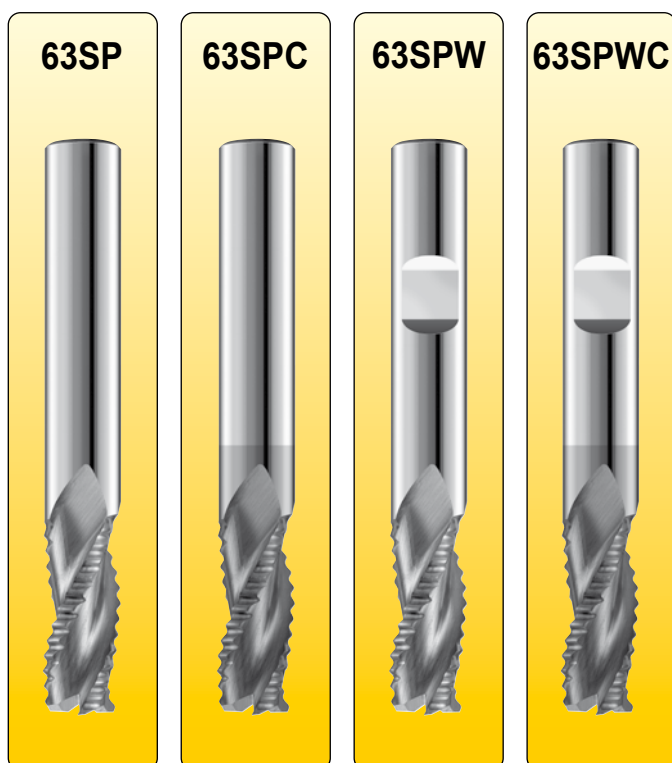
D: Acciai inossidabili / *Stainless Steel*
D1.1-1.4

E: Titanio / *Titanium*
E2.1 E1.1-1.3 E2.1-2.3

F: Ghise / *Cast irons*
F1.1-1.2 F1.4-1.5 F2.1-2.2

[illegible]

Frese per sgrossatura - Z=3 elica 30° - simile a DIN 6527 L
Roughing end mills - Z=3 Helix 30° - Similar to DIN 6527-L

Settori d'impiego / *Range of application*

C: Acciai / Steels

C1.3 C2.1-2.3 C3.1 C4.1

D: Acciai inossidabili / *Stainless Steel*

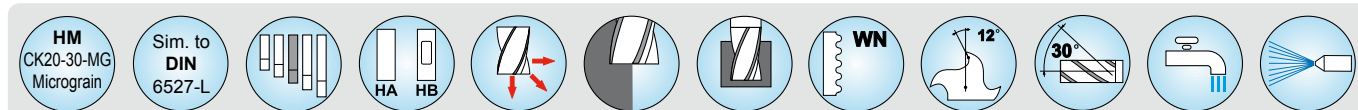
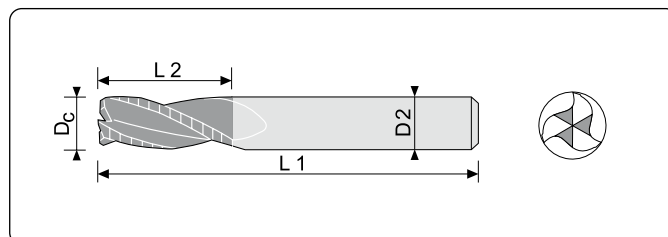
D1.1-1.4

E: Titanio / *Titanium*

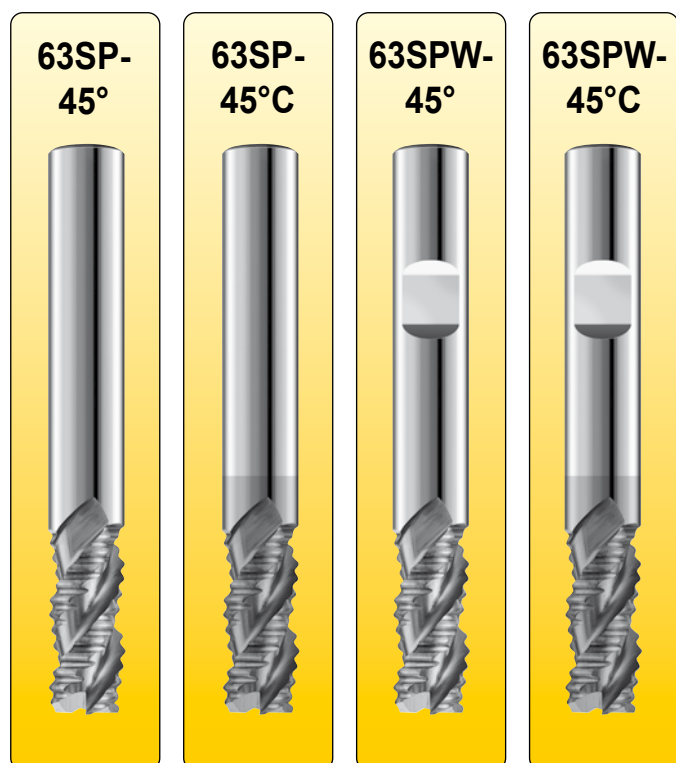
E2.1 E1.1-1.3 E2.1-2.3

F: Ghise / *Cast irons*

F1.1-1.2 F1.4-1.5 F2.1-2.2

[illegible]

Frese per sgrossatura - Z=3 elica 45° - simile a DIN 6527 L
Roughing end mills - Z=3 Helix 45° - Similar to DIN 6527-L

Settori d'impiego / *Range of application*

A: Leghe Leggere / *Light alloys*

A1.1-1.6 A2.1-2.7 A3.1-3.2 A4.1-4.2

C: Acciai / Steels

C1.1-1.8 C2.1-2.3 C3.1 C4.1

D: Acciai inossidabili / *Stainless Steel*

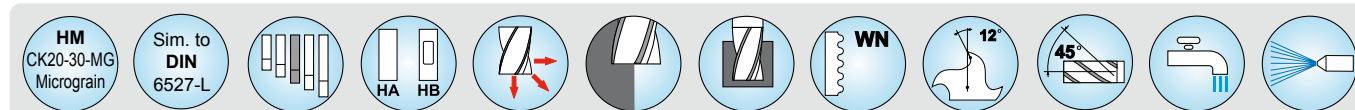
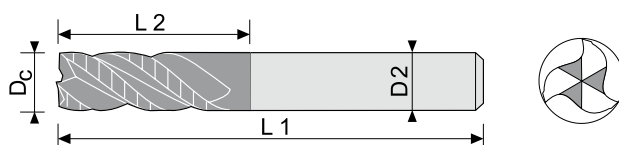
D1.1-1.4

E: Titanio / *Titanium*

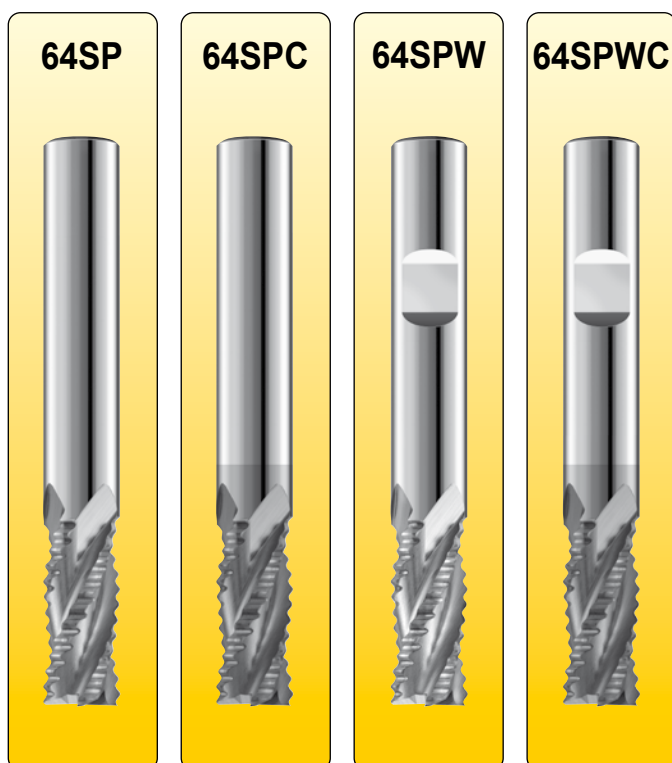
E2.1

F: Ghise / *Cast irons*

F1.1-1.2 F1.4-1.5 F2.1-2.2

[illegible]

Frese per sgrossatura - Z=4 elica 30° - DIN 6527 L
Roughing end mills - Z=4 Helix 30° - DIN 6527-L

Settori d'impiego / *Range of application*

C: Acciai / Steels

C1.1-1.8 C2.1-2.3 C3.1 C4.1

D: Acciai inossidabili / *Stainless Steel*

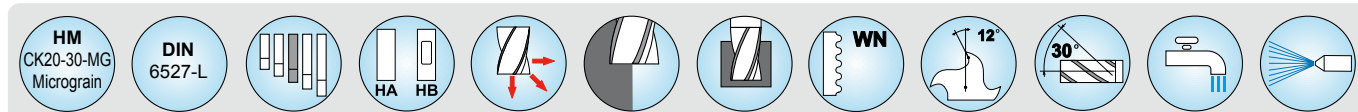
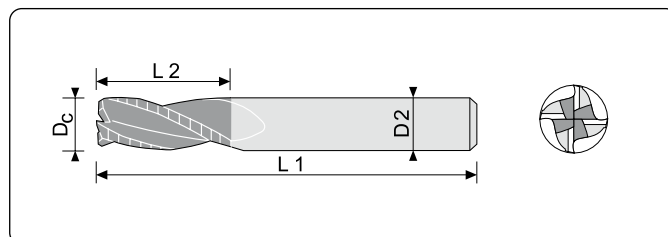
D1.1-1.4

E: Titanio / *Titanium*

E2.1

F: Ghise / Cast irons

F1.1-1.2 F1.4-1.5 F2.1-2.2

[illegible]



2.
07

Frese a 2 taglienti
2 flutes end mills

Velocità di taglio V_c (m/min) - per frese standard
Cutting speed V_c (m/min) - for standard end mills

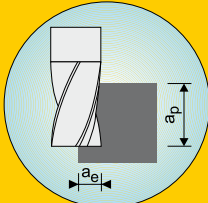
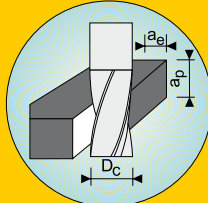
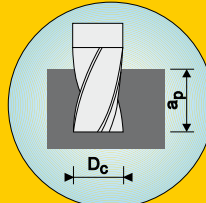
Velocità di taglio V_c (m/min) / Cutting speed V_c (m/min)				
Gruppo C: Acciai in generale - Leghe d'acciaio - Acciai temprati Group C - General steels - Steel alloys - Hardened steels				
	Denominazione materiale Material description	Resistenza Strength N/mm ²	VHM Carbide V_c (m/min)	Cer-T
C 1.1	Q-St-37-3	< 400	200	250
C 1.2	R-Fe80	< 400	200	250
C 1.3	9SMnPb28	500 - 700	150	200
C 1.4	St37-2	320 - 470	150	200
C 1.5	16MnCr5	500 - 700	100	150
C 1.6	Ck45	600 - 800	100	150
C 1.7	Gs25CrMo4	650 - 950	100	180
C 1.8	St70-2	700 - 900	120	180
C 2.1	100Cr6	700 - 900	100	150
C 2.2	X155CrVMo12-1	900 - 1100	80	120
C 2.3	X30WCrV5-3	1100	80	120
C 2.4	42CrMo4V	1200 - 1400	80	120
C 3.1	X38CrMoV5-3	900 - 1100	80	120
C 3.2	55NiCrMoV6	47 - 52 HRC		100
C 4.1	FeroTiC	800 - 900		40
C 4.2	Hardox500	1300 - 1400		30
Gruppo D: Acciai resistenti alla corrosione e agli acidi Group D: corrosion-acid-resistant steels				
D 1.1	X10NiCrAlTi32-20 (INCOLOY800)	610 - 850	60	90
D 1.2	X12CrNiTi18-9	500 - 700	60	90
D 1.3	X6CrNiMoTi17-12-2	500 - 730	60	90
D 1.4	X45SiCr4	900 - 1100		70
D 1.5	X5NiCrTi26-15	1200		50
Gruppo E: Leghe di nichel/cobalto - Titanio - Leghe di titanio Group E: Nickel/Cobalt alloys - Titanium - Titanium alloys				
E 1.1	Ti3 (Ti99.4)	700	100	120
E 1.2	TiAl6V4	700 - 900	80	100
E 1.3	TiAlMo4Sn2	900 - 1250		80
E 2.1	NiCu30Fe (MONEL400I)	420 - 610		70
E 2.2	NiCr19NbMo (INCONEL718)	850-1200		60
E 2.3	Haynes 25 (L605)	1550 - 2000		40
Gruppo F - Ghise Group F - Cast irons				
F 1.1	GG 20	120-220 HB	140	160
F 1.2	GG 30	220 - 270 HB	100	150
F 1.3	Ghisa dura / Hard cast iron	< 400 HB		80
F 1.4	GTW40	360 - 420	120	160
F 1.5	GTS65	560 - 650	100	150
F 2.1	GGG 40	400	120	150
F 2.2	GGG 70	700 - 1050	100	150
F 2.3	GGV (80% Perlite)	220 HB	70	100
F 2.4	GGV (100% Perlite)	230 HB	60	100

Avanzamento al dente f_z (mm) - per frese standard (valori indicativi)
Feed per tooth f_z (mm) - for standard end mills (approximative values)

Frese raggate e cilindriche
Ball nose cutters and end mills

DIN 6527/28 con elica a $30^\circ = f_z$ (mm) come da tabella / a $45^\circ = f_z$ tabella x 0,70
DIN 6527/28 with helix angle / $30^\circ = f_z$ (mm) according to table / $45^\circ = f_z$ (mm) Table x 0,70

Norma interna lunga - extralunga = f_z (mm) x 0,65
Internal standard long - extra long f_z (mm) x 0,65

Gruppo C - Acciai in generale - Leghe di Acciaio - Acciai temprati Group C - General steels - Steel alloys - Hardened steels															
	Fresatura di spallamenti retti / Contornatura Side-Contour milling								Fresatura di cave piene Slot milling						
															
	$a_p = 1,5 \times D_c$			$a_e = 0,25 \times D_c$					$a_p = 0,50 \times D_c$						
	D_c (mm)														
	2,0	3,0	4,0	5,0	6,0	8,0	10,0	12,0	14,0	16,0	18,0	20,0	25,0		
	f_z (mm) per utensili non rivestiti / f_z (mm) for uncoated tools														
	C 1.1	0,005	0,008	0,012	0,014	0,017	0,023	0,034	0,034	0,038	0,044	0,050	0,055	0,070	
C 1.2	0,005	0,008	0,012	0,014	0,017	0,023	0,034	0,034	0,038	0,044	0,050	0,055	0,070		
C 1.3	0,005	0,008	0,012	0,014	0,017	0,023	0,034	0,034	0,038	0,044	0,050	0,055	0,070		
C 1.4	0,005	0,008	0,012	0,014	0,017	0,023	0,034	0,034	0,038	0,044	0,050	0,055	0,070		
C 1.5	0,004	0,007	0,010	0,012	0,014	0,019	0,028	0,028	0,032	0,037	0,042	0,046	0,058		
C 1.6	0,004	0,007	0,010	0,012	0,014	0,019	0,028	0,028	0,032	0,037	0,042	0,046	0,058		
C 1.7	0,004	0,008	0,011	0,013	0,015	0,021	0,031	0,031	0,035	0,041	0,046	0,051	0,064		
C 1.8	0,004	0,008	0,011	0,013	0,015	0,021	0,031	0,031	0,035	0,041	0,046	0,051	0,064		
C 2.1	0,004	0,007	0,010	0,012	0,014	0,019	0,028	0,028	0,032	0,037	0,042	0,046	0,058		
C 2.2	0,003	0,006	0,008	0,010	0,011	0,015	0,022	0,022	0,026	0,030	0,034	0,037	0,046		
C 2.3	0,003	0,006	0,008	0,010	0,011	0,015	0,022	0,022	0,026	0,030	0,034	0,037	0,046		
■ C 2.4	0,003	0,006	0,008	0,010	0,011	0,015	0,022	0,022	0,026	0,030	0,034	0,037	0,046		
■ C 3.1	0,003	0,006	0,008	0,010	0,011	0,015	0,022	0,022	0,026	0,030	0,034	0,037	0,046		
■ C 3.2	0,003	0,005	0,007	0,008	0,010	0,013	0,020	0,020	0,022	0,026	0,029	0,032	0,041		
C 4.1	0,003	0,005	0,007	0,008	0,010	0,013	0,020	0,020	0,022	0,026	0,029	0,032	0,041		
■ C 4.2	0,003	0,005	0,007	0,008	0,010	0,013	0,020	0,020	0,022	0,026	0,029	0,032	0,041		

■ **ATTENZIONE:** per questi tipi di materiali le frese con elica 45° non sono idonee
 ■ **NOTE:** For this kind of materials 45° helix cutters are not suitable

Con i nostri utensili ad alte prestazioni HPC (per es. PIRAÑA-SV) è possibile aumentare notevolmente i parametri di taglio, usando macchine utensili e bloccaggi di tipo appropriato.
 With our HPC High Performance Cutters (i.e. PIRAÑA-SV) the cutting data, using appropriate machine tools, material and work piece clamping, can be substantially increased.

Avanzamento al dente f_z (mm) - per frese standard (valori indicativi)
Feed per tooth f_z (mm) - for standard end mills (approximative values)

Frese raggiate e a candela / Ball nose cutters and end mills

Gruppo D: Acciai resistenti alla corrosione e agli acidi
Group D: corrosion-acid-resistant steels

	Fresatura di spallamenti retti/contornatura <i>Side-Contour milling</i>									Fresatura di cave piene <i>Slot milling</i>				
	a _p = 1,5 x D _c					a _e = 0,20 x D _c				a _p = 0,40 x D _c				
	D _c (mm)													
	2,0	3,0	4,0	5,0	6,0	8,0	10,0	12,0	14,0	16,0	18,0	20,0	25,0	
	f _z (mm) per utensili non rivestiti / f _z (mm) for uncoated tools													
D 1.1	0,004	0,007	0,009	0,010	0,013	0,018	0,022	0,027	0,031	0,036	0,040	0,044	0,056	
D 1.2	0,004	0,007	0,009	0,010	0,013	0,018	0,022	0,027	0,031	0,036	0,040	0,044	0,056	
D 1.3	0,004	0,007	0,009	0,010	0,013	0,018	0,022	0,027	0,031	0,036	0,040	0,044	0,056	
D 1.4	0,004	0,006	0,008	0,009	0,012	0,016	0,020	0,024	0,028	0,032	0,036	0,040	0,050	
D 1.5	0,003	0,005	0,006	0,007	0,009	0,013	0,015	0,019	0,022	0,025	0,028	0,031	0,039	

Gruppo E: Leghe di nichel/cobalto - Titanio - Leghe di titanio
Group E: Nickel/Cobalt alloys - Titanium - Titanium alloys

	Eck-/ Konturenfräsen Side-Contour milling								Nutenfräsen Slot milling				
	a _p = 1,5 x D _c				a _e = 0,20 x D _c				a _p = 0,40 x D _c				
	D _c (mm)												
	2,0	3,0	4,0	5,0	6,0	8,0	10,0	12,0	14,0	16,0	18,0	20,0	25,0
	f _z (mm) per utensili non rivestiti / f _z (mm) for uncoated tools												
E 1.1	0,004	0,007	0,009	0,010	0,013	0,018	0,022	0,027	0,031	0,036	0,040	0,044	0,056
E 1.2	0,004	0,007	0,009	0,010	0,013	0,018	0,022	0,027	0,031	0,036	0,040	0,044	0,056
E 1.3	0,004	0,006	0,008	0,009	0,012	0,016	0,020	0,024	0,028	0,032	0,036	0,040	0,050
E 2.1	0,004	0,008	0,010	0,011	0,014	0,020	0,024	0,030	0,034	0,040	0,044	0,048	0,062
E 2.2	0,004	0,007	0,009	0,010	0,013	0,018	0,022	0,027	0,031	0,036	0,040	0,044	0,056
E 2.3	0,003	0,005	0,006	0,007	0,009	0,013	0,015	0,019	0,022	0,025	0,028	0,031	0,039

Gruppo F - Ghise
Group F - Cast irons

	Eck-/ Konturenfräsen Side-Contour milling									Nutenfräsen Slot milling				
	a _p = 1,5 x D _c					a _e = 0,25 x D _c				a _p = 0,50 x D _c				
	D _c (mm)													
	2,0	3,0	4,0	5,0	6,0	8,0	10,0	12,0	14,0	16,0	18,0	20,0	25,0	
	f _z (mm) per utensili non rivestiti / f _z (mm) for uncoated tools													
F 1.1	0,004	0,008	0,010	0,011	0,014	0,020	0,024	0,030	0,034	0,040	0,044	0,048	0,062	
F 1.2	0,004	0,008	0,010	0,011	0,014	0,020	0,024	0,030	0,034	0,040	0,044	0,048	0,062	
F 1.3	0,003	0,006	0,007	0,008	0,010	0,014	0,018	0,022	0,025	0,029	0,032	0,035	0,045	
F 1.4	0,004	0,008	0,010	0,011	0,014	0,020	0,024	0,030	0,034	0,040	0,044	0,048	0,062	
F 1.5	0,004	0,008	0,010	0,011	0,014	0,020	0,024	0,030	0,034	0,040	0,044	0,048	0,062	
F 2.1	0,004	0,008	0,010	0,011	0,014	0,020	0,024	0,030	0,034	0,040	0,044	0,048	0,062	
F 2.2	0,004	0,008	0,010	0,011	0,014	0,020	0,024	0,030	0,034	0,040	0,044	0,048	0,062	
F 2.3	0,004	0,007	0,009	0,010	0,013	0,018	0,022	0,027	0,031	0,036	0,040	0,044	0,056	
F 2.4	0,004	0,007	0,009	0,010	0,013	0,018	0,022	0,027	0,031	0,036	0,040	0,044	0,056	

"ULTRA Ra" Speed Line con scanalature lappate

End mills Z=2 straight flute - Internal standard

"ULTRA Ra" Speed Line with fine lapped chip flutes

62TD



62TDA

Settori d'impiego / *Range of application*

C: Acciai / Steels

C1.1-1.8 C2.1-2.3 C4.1

D: Acciai inossidabili / *Stainless Steel*

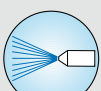
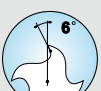
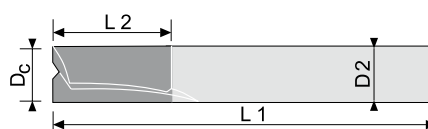
D1.1-1.3

E: Titanio / *Titanium*

E1.1 E2.1

F: Ghise / *Cast irons*

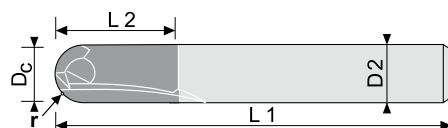
F1.1-1.2 F1.4-1.5 F2.1-2.2

[illegible]

"ULTRA Ra" Speed Line with fine lapped chip flutes

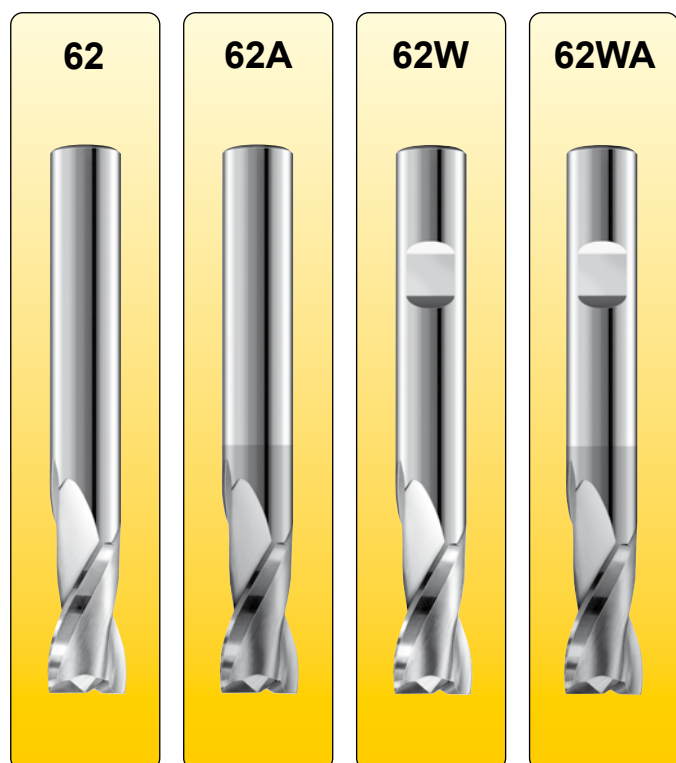


F1.1-1.2 F1.4-1.5 F2.1



2.07

Frese Z=2 - elica 30° - simili a DIN 6527-L End mills - Z=2 Helix 30° - Similar to DIN 6527-L



Settori d'impiego / Range of application

C: Acciai / Steels

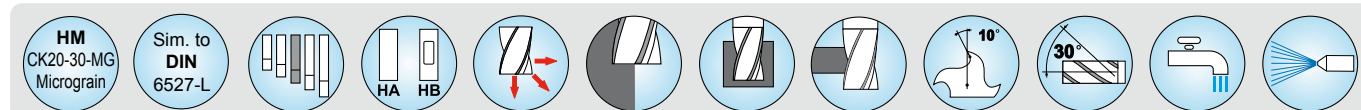
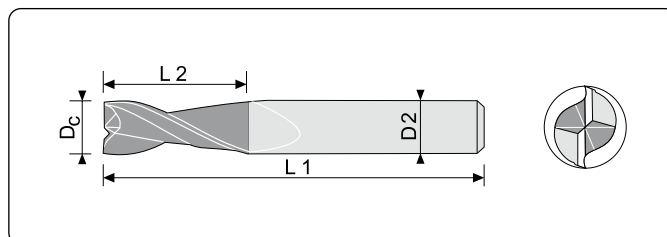
C1.1-1.8 C2.1-2.3 C3.1-3.2 C4.1-4.2

D: Acciai inossidabili / Stainless Steel

D1.1-1.5

F: Ghise / Cast irons

F1.1-1.5 F2.1-2.4

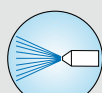
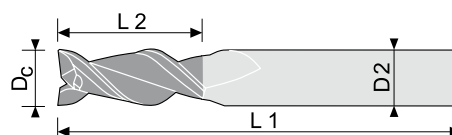


D _c h10	L2	L1	D2 h6	62	62A	62W	62WA
				■	Rivestite/Coated	■	Rivestite /Coated
2	6	40	2	62.020020640	62.020020640A		
2	3	50	6	62.020060350	62.020060350A		
2,5	7	40	2,5	62.025250740	62.025250740A		
2,5	3	50	6	62.025060350	62.025060350A		
3	7	57	6	62.030060757	62.030060757A	62W.030060757	62W.030060757A
3	8	40	3	62.030030840	62.030030840A		
3,5	8	40	3,5	62.035350840	62.035350840A		
4	8	57	6	62.040060857	62.040060857A	62W.040060857	62W.040060857A
4	10	40	4	62.040041040	62.040041040A		
4,5	10	50	4,5	62.045451050	62.045451050A		
5	12	50	5	62.050051250	62.050051250A		
5,5	12	50	5,5	62.055551250	62.055551250A		
6	10	57	6	62.060061057	62.060061057A	62W.060061057	62W.060061057A
6	14	50	6	62.060061450	62.060061450A		
6,5	14	50	6,5	62.065651450	62.065651450A		
7	15	60	7	62.070071560	62.070071560A		
8	16	63	8	62.080081663	62.080081663A	62W.080081663	62W.080081663A
9	19	63	9	62.090091963	62.090091963A		
10	19	72	10	62.100101972	62.100101972A	62W.100101972	62W.100101972A
11	22	72	11	62.110112272	62.110112272A		
12	22	83	12	62.120122283	62.120122283A	62W.120122283	62W.120122283A
13	22	83	13	62.130132283	62.130132283A		
14	22	83	14	62.140142283	62.140142283A	62W.140142283	62W.140142283A
15	26	92	15	62.150152692	62.150152692A		
16	26	92	16	62.160162692	62.160162692A	62W.160162692	62W.160162692A
18	26	92	18	62.180182692	62.180182692A	62W.180182692	62W.180182692A
20	32	104	20	62.2002032104	62.2002032104A	62W.2002032104	62W.2002032104A
25	45	120	25	62.2502545120	62.2502545120A	62W.2502545120	62W.2502545120A

End Mills - Z=2 Helix 45° - DIN 6527-L



F1.1-1.2 F1.4-1.5 F2.1-2.4



2.
07

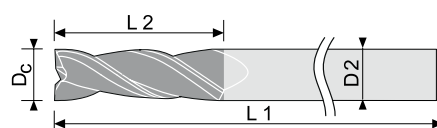
End Mills - Z=2 Helix 30° - Internal standard long



C1.1-1.8 C2.1-2.4 C3.1-3.2 C4.1-4.2

D1.1-1.5

F1.1-1.5 F2.1-2.4

2.07

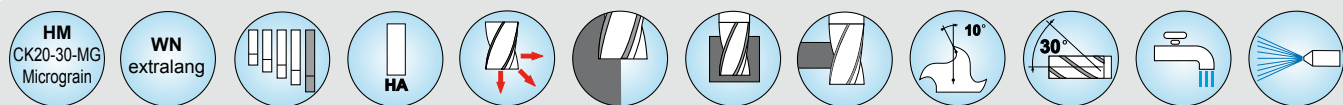
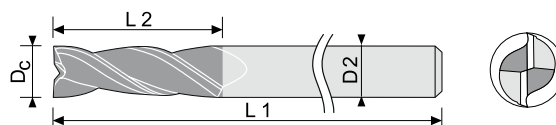
End mills - Z=2 Helix 30° - Internal standard extra long



C1.1-1.8 C2.1-2.4 C3.1-3.2 C4.1-4.2

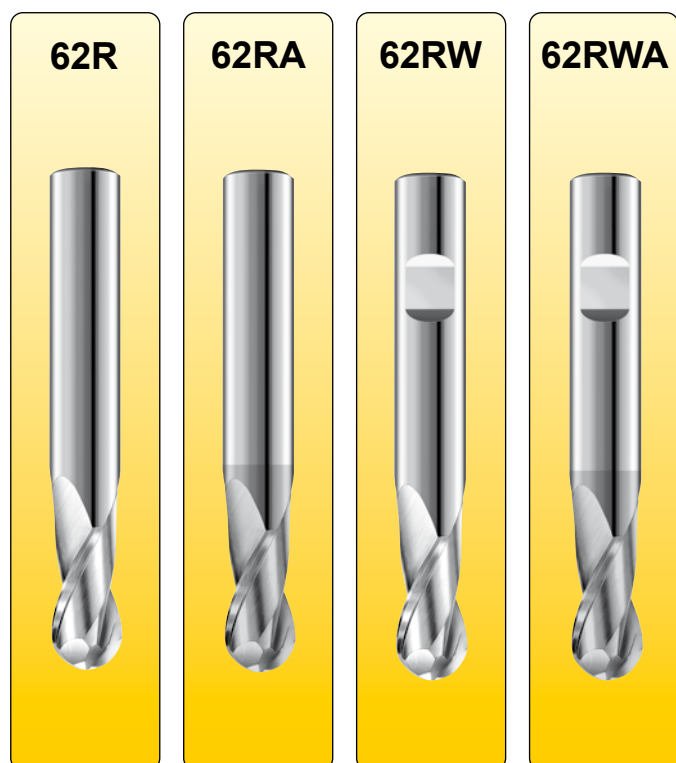
D1.1-1.5

F1.1-1.5 F2.1-2.4



2.
07

Frese a testa raggata - Z=2 - elica 30° - simile a DIN 6527-L Ball nose end mills - Z=2 Helix 30° - Similar to DIN 6527-L



Settori d'impiego / Range of application

C: Acciai / Steels

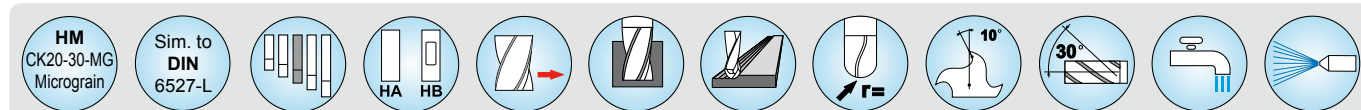
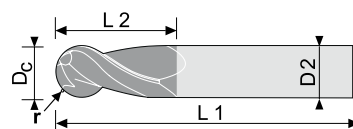
C1.1-1 C2.1-2.4 C3.1-3.2 C4.1-4.2

D: Acciai inossidabili / Stainless Steel

D1.1-1.5

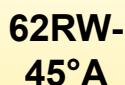
F: Ghise / Cast irons

F1.1-1.5 F2.1-2.4

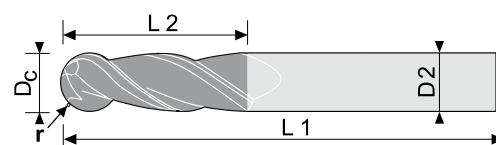


D _c h10	L2	L1	D2 h6	r	62R	62RA Rivestite/Coated	62RW	62RWA Rivestite/Coated
2	6	40	2	1	62R.020020640	62R.020020640A		
2,5	7	40	2,5	1,25	62R.025250740	62R.025250740A		
3	7	57	6	1,5	62R.030060757	62R.030060757A	62RW.030060757	62RW.030060757A
3	8	40	3	1,5	62R.030030840	62R.030030840A		
3,5	8	40	3,5	1,75	62R.035350840	62R.035350840A		
4	8	57	6	2	62R.040060857	62R.040060857A	62RW.040060857	62RW.040060857A
4	10	40	4	2	62R.040041040	62R.040041040A		
4,5	10	50	4,5	2,25	62R.045451050	62R.045451050A		
5	12	50	5	2,5	62R.050051250	62R.050051250A		
5,5	12	50	5,5	2,75	62R.055551250	62R.055551250A		
6	10	57	6	3	62R.060061057	62R.060061057A	62RW.060061057	62RW.060061057A
6	14	50	6	3	62R.060061450	62R.060061450A		
6,5	14	50	6,5	3,25	62R.065651450	62R.065651450A		
7	15	60	7	3,5	62R.070071560	62R.070071560A		
8	16	63	8	4	62R.080081663	62R.080081663A	62RW.080081663	62RW.080081663A
9	18	63	9	4,5	62R.090091863	62R.090091863A		
10	19	72	10	5	62R.100101972	62R.100101972A	62RW.100101972	62RW.100101972A
11	22	72	11	5,5	62R.110112272	62R.110112272A		
12	22	83	12	6	62R.120122283	62R.120122283A	62RW.120122283	62RW.120122283A
13	22	83	13	6,5	62R.130132283	62R.130132283A		
14	22	83	14	7	62R.140142283	62R.140142283A	62RW.140142283	62RW.140142283A
15	26	92	15	7,5	62R.150152692	62R.150152692A		
16	26	92	16	8	62R.160162692	62R.160162692A	62RW.160162692	62RW.160162692A
18	26	92	18	9	62R.180182692	62R.180182692A	62RW.180182692	62RW.180182692A
20	32	104	20	10	62R.2002032104	62R.2002032104A	62RW.2002032104	62RW.2002032104A
25	45	120	25	12,5	62R.2502545120	62R.2502545120A	62RW.2502545120	62RW.2502545120A

Frese a testa raggiata - Z=2 - elica 45° - DIN 6527 L
Ball nose end mills - Z=2 Helix 45° - DIN 6527-L



F1.1-1.2 F1.4-1.5 F2.1-2.4

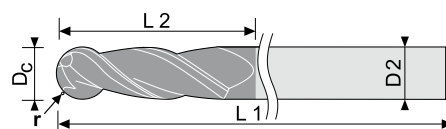


2.07

Frese a testa raggiata - Z=2 - elica 30° - norma interna - lunga
Ball nose end mills - Z=2 Helix 30° - Internal standard long



F1.1-1.5 F2.1-2.4

2.07

Frese a testa raggiata - Z=2 - elica 30° - norma interna - extralunga
Ball nose end mills - Z=2 Helix 30° - Internal standard extra long



C: Acciai / Steels

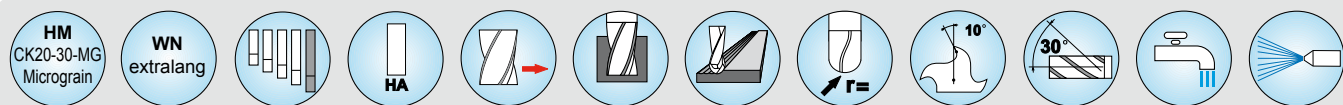
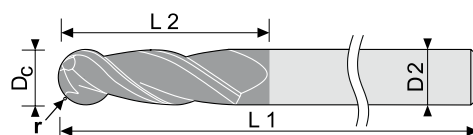
C1.1-8 C2.1-2.4 C3.1-3.2 C4.1-4.2

D: Acciai inossidabili / *Stainless Steel*

D1.1-1.5

F: Ghise / Cast irons

F1.1-1.5 F2.1-2.4



2.
07



2.
08

Frese a 3 taglienti
3 flutes end mills

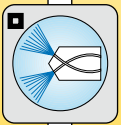
Frese Z=3 - "PIRAÑA"-SQ con divisione irregolare ed eliche differenziate - DIN 6527 L End Mills - Z=3 "PIRAÑA"-SQ uneven division of cutting edges and helix angle - DIN 6527-L

63ISQ



63ISQC





Settori d'impiego / Range of application

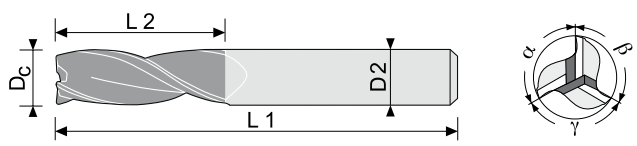
A: Leghe leggere / Light alloys
 A1.3-1.6 A2.4-2.7 A3.1-3.2 A4.1-4.2

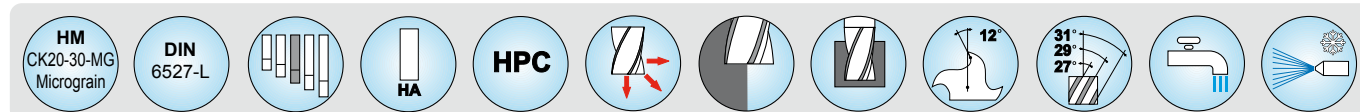
C: Acciai / Steels
 C1.1-1.8 C2.1-2.4 C4.1

D: Acciai inossidabili / Stainless Steel
 D1.1-1.4

E: Titanio / Titanium
 E1.1-1.2 E2.1

F: Ghise / Cast irons
 F1.1-1.2 F1.4-1.5 F2.1-2.4





D _c h10	L2	L1	D2 h6	63ISQ	63ISQC
				Rivestite / Coated	Rivestite / Coated
3	7	57	6	63ISQ.030	63ISQ.030C
4	8	57	6	63ISQ.040	63ISQ.040C
5	10	57	6	63ISQ.050	63ISQ.050C
6	10	57	6	63ISQ.060	63ISQ.060C
8	16	63	8	63ISQ.080	63ISQ.080C
10	19	72	10	63ISQ.100	63ISQ.100C
12	22	83	12	63ISQ.120	63ISQ.120C
14	22	83	14	63ISQ.140	63ISQ.140C
16	26	92	16	63ISQ.160	63ISQ.160C
20	32	104	20	63ISQ.200	63ISQ.200C

 Disponibile su richiesta anche con "adduzione interna" a partire da 8 mm. - Aggiungere iK alla fine del n° di codice.
 On request from 8 mm also available with "coolant ducts". - Add at the end of the Order No ... iK

Frese toriche Z=3 - "PIRAÑA"-SQ divisione irregolare ed eliche differenziate - DIN 6527 L
End Mills - Z=3 "PIRAÑA"-SQ uneven division of cutting edges and helix angle - DIN 6527-L



A: Leghe leggere / *Light alloys*

A1.3-1.6 A2.4-2.7 A3.1-3.2 A4.1-4.2

C: Acciai / Steels

C1.1-1.8 C2.1-2.4 C4.1

D: Acciai inossidabili / *Stainless Steel*

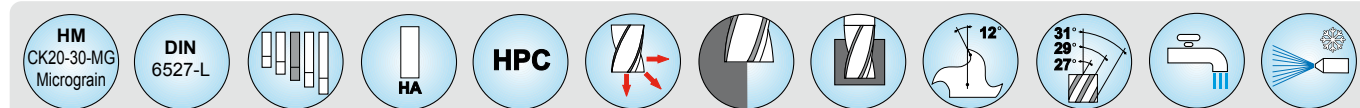
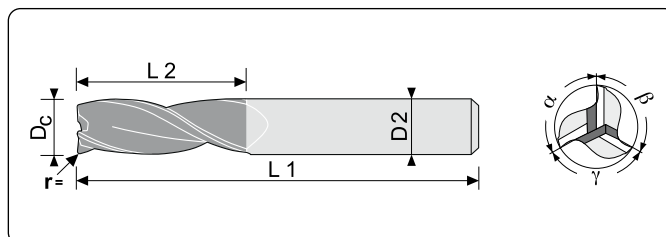
D1.1-1.4

E: Titanio / *Titanium*

E1.1-1.2 E2.1

F: Ghise / *Cast irons*

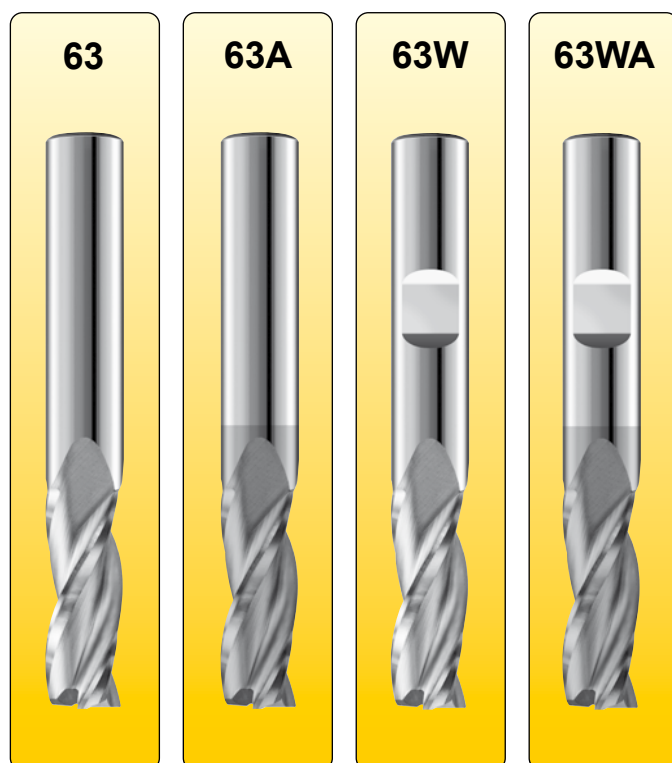
F1.1-1.2 F1.4-1.5 F2.1-2.4

[illegible]

■ Disponibile su richiesta anche con “adduzione interna” a partire da 8 mm. - Aggiungere iK alla fine del n° di codice.

■ On request from 8 mm also available with "coolant ducts". - Add at the end of the Order No ... iK

Frese Z=3 - elica 30° - norma interna End mills - Z=3 Helix 30° - Internal standard



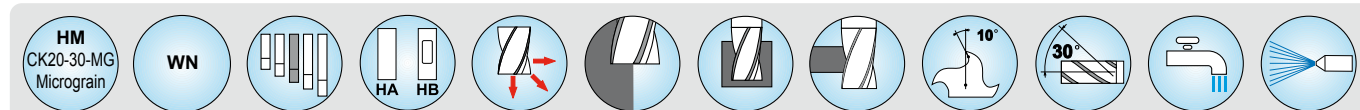
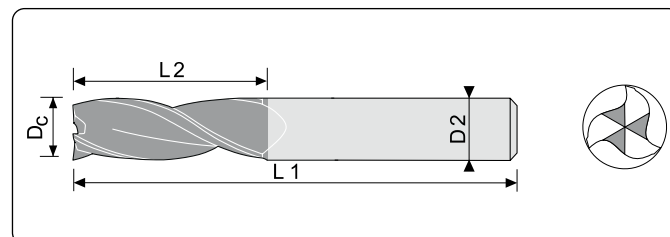
Settori d'impiego / Range of application

C: Acciaio / Steels

C1.1-1.8 C2.1-2.4 C3.1-3.2 C4.1-4.2

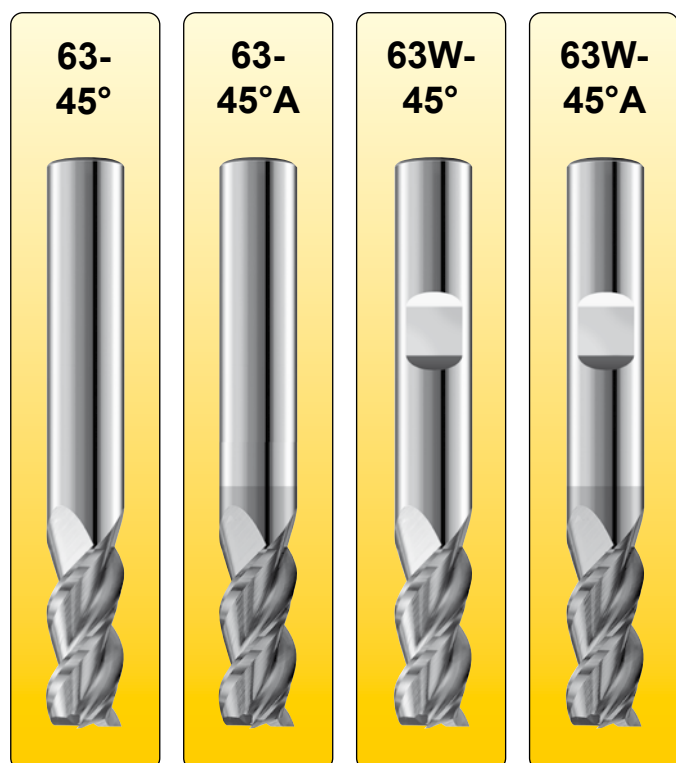
F: Ghise / Cast irons

F1.1-1.5 F2.1-2.4



D _c h10	L2	L1	D2 h6	63	63A	63W	63WA
				■	Rivestite/Coated	■	Rivestite/Coated
2	6	40	2	63.020020640	63.020020640A		
2	3	50	6	63.020060350	63.020060350A	63W.020060350	63W.020060350A
2,5	7	40	2,5	63.025250740	63.025250740A		
3	7	57	6	63.030060757	63.030060757A	63W.030060757	63W.030060757A
3	10	40	3	63.030031040	63.030031040A		
3,5	10	40	3,5	63.035351040	63.035351040A		
4	8	57	6	63.040060857	63.040060857A	63W.040060857	63W.040060857A
4	11	40	4	63.040041140	63.040041140A		
4,5	11	50	4,5	63.045451150	63.045451150A		
5	13	50	5	63.050051350	63.050051350A		
5,5	13	50	5,5	63.055551350	63.055551350A		
6	10	57	6	63.060061057	63.060061057A	63W.060061057	63W.060061057A
6	16	50	6	63.060061650	63.060061650A	63W.060061650	63W.060061650A
6,5	16	50	6,5	63.065651650	63.065651650A		
7	16	60	7	63.070071660	63.070071660A		
8	16	63	8	63.080081663	63.080081663A	63W.080081663	63W.080081663A
9	19	63	9	63.090091963	63.090091963A		
10	19	72	10	63.100101972	63.100101972A	63W.100101972	63W.100101972A
11	22	72	11	63.110112272	63.110112272A		
12	22	83	12	63.120122283	63.120122283A	63W.120122283	63W.120122283A
13	26	83	13	63.130132683	63.130132683A		
14	22	83	14	63.140142283	63.140142283A	63W.140142283	63W.140142283A
15	26	92	15	63.150152692	63.150152692A		
16	26	92	16	63.160162692	63.160162692A	63W.160162692	63W.160162692A
18	26	92	18	63.180182692	63.180182692A	63W.180182692	63W.180182692A
20	32	104	20	63.2002032104	63.2002032104A	63W.2002032104	63W.2002032104A
25	45	120	25	63.2502545120	63.2502545120A	63W.2502545120	63W.2502545120A

Frese Z=3 - elica 45° - DIN 6527 L
End mills - Z=3 Helix 45° - DIN 6527-L

Settori d'impiego / *Range of application*

A: Leghe leggere / *Light alloys*

A1.3-1.6 A2.4-2.7 A3.1-3.2 A4.1-4.2

Acciaio / Steels

C1.1-1.8 C2.1-2.3 C4.1

D: Acciai inossidabili/ *Stainless Steel*

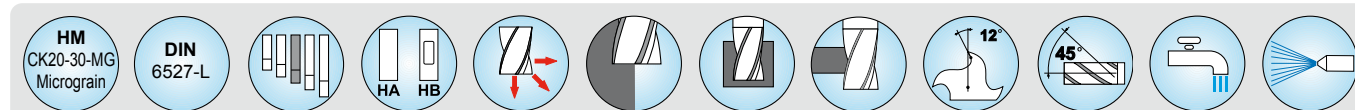
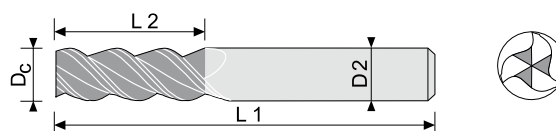
D1.1-1.4

E: Titanio / *Titanium*

E1.1-1.2 E2.1

F: Ghise / *Cast irons*

F1.1-1.2 F1.4-1.5 F2.1-2.4

[illegible]

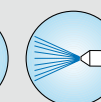
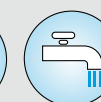
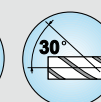
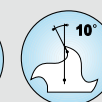
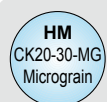
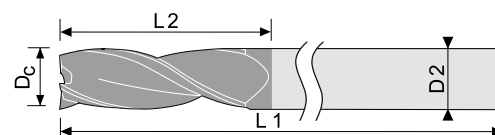
End mills - Z=3 Helix 30° - Internal standard long



C1.1-1.8 C2.1-2.4 C3.1-3.2 C4.1-4.2

D1.1-1.5

F1.1-1.5 F2.1-2.4

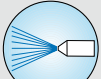
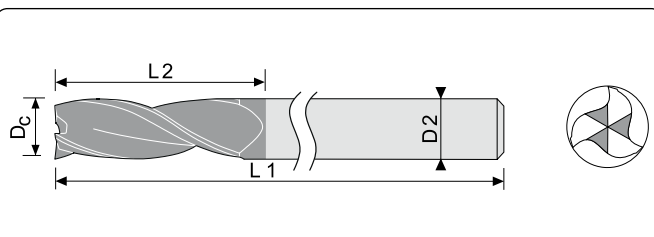


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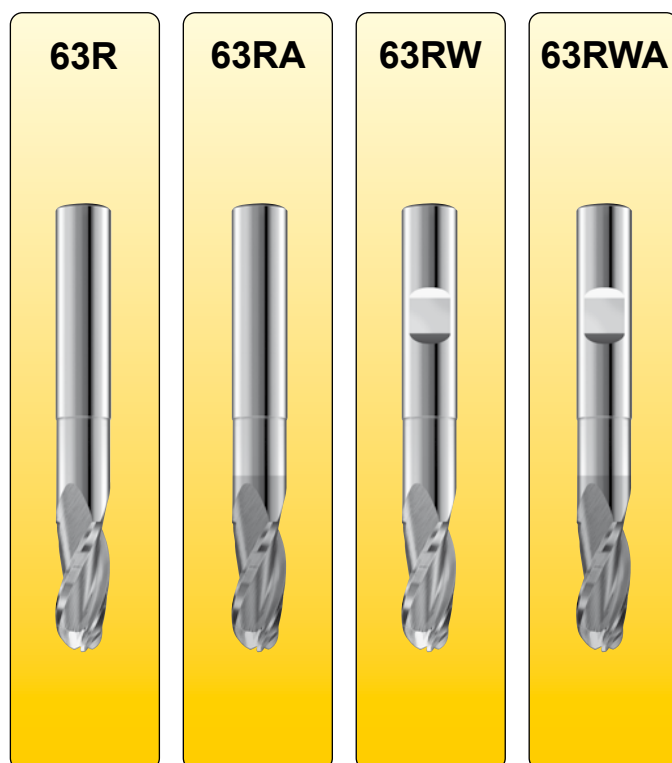
End mills - Z=3 Helix 30° - Internal standard extra long



F1.1-1.5 F2.1-2.4

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Frese a testa raggiata - Z=3 - elica 30° - norma interna Ball nose end mills - Z=3 Helix 30° - Internal standard



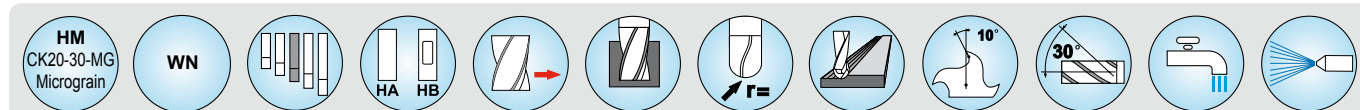
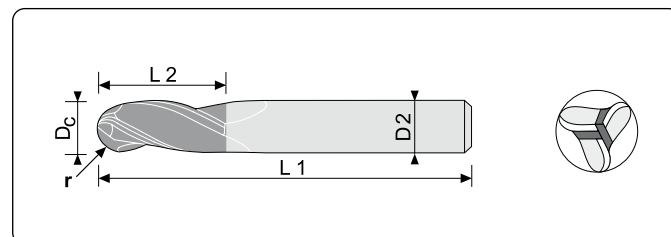
Settori d'impiego / Range of application

C: Acciai / Steels

C1.1-1.8 C2.1-2.4 C3.1-3.2 C4.1-4.2

F: Ghise / Cast irons

F1.1-1.5 F2.1-2.4



D _c h10	L2	L1	D2 h6	r	63R	63RA Rivestite/Coated	63RW	63RWA Rivestite/Coated
2	6	40	2	1	63R.020020640	63R.020020640A		
2,5	7	40	2,5	1,25	63R.025250740	63R.025250740A		
3	7	57	6	1,5	63R.030060757	63R.030060757A	63RW.030060757	63RW.030060757A
3	10	40	3	1,5	63R.030031040	63R.030031040A		
3,5	10	40	3,5	1,75	63R.035351040	63R.035351040A		
4	8	57	6	2	63R.040060857	63R.040060857A	63RW.040060857	63RW.040060857A
4	11	40	4	2	63R.040041140	63R.040041140A		
4,5	11	50	4,5	2,25	63R.045451150	63R.045451150A		
5	13	50	5	2,5	63R.050051350	63R.050051350A		
5,5	13	50	5,5	2,75	63R.055551350	63R.055551350A		
6	10	57	6	3	63R.060061057	63R.060061057A	63RW.060061057	63RW.060061057A
6	16	50	6	3	63R.060061650	63R.060061650A		
7	16	60	7	3,5	63R.070071660	63R.070071660A		
8	16	63	8	4	63R.080081663	63R.080081663A	63RW.080081663	63RW.080081663A
9	19	63	9	4,5	63R.090091963	63R.090091963A		
10	19	72	10	5	63R.100101972	63R.100101972A	63RW.100101972	63RW.100101972A
11	22	72	11	5,5	63R.110112272	63R.110112272A		
12	22	83	12	6	63R.120122283	63R.120122283A	63RW.120122283	63RW.120122283A
14	22	83	14	7	63R.140142283	63R.140142283A	63RW.140142283	63RW.140142283A
16	26	92	16	8	63R.160162692	63R.160162692A	63RW.160162692	63RW.160162692A
18	26	92	18	9	63R.180182692	63R.180182692A	63RW.180182692	63RW.180182692A
20	32	104	20	10	63R.2002032104	63R.2002032104A	63RW.2002032104	63RW.2002032104A
25	45	120	25	12,5	63R.2502545120	63R.2502545120A	63RW.2502545120	63RW.2502545120A

Le misure superiori a Ø 12 mm sono conformi a DIN 6527 L / Sizes bigger than Ø 12 mm correspond to DIN 6527-L

Frese a testa raggiata - Z=3 elica 30° - norma interna - lunga
Ball nose end mills - Z=3 Helix 30° - Internal standard long

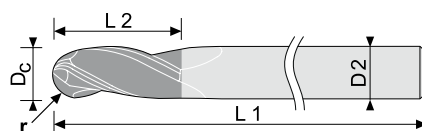


C: Acciai / Steels

C1.1-1.8 C2.1-2.4 C3.1-3.2 C4.1-4.2

D1.1-1.5

F1.1-1.5 F2.1-2.4



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Frese a testa raggiata - Z=3 - elica 30° - norma interna - extralunga
Ball nose end mills - Z=3 Helix 30° - Internal standard extra long



C: Acciai / Steels

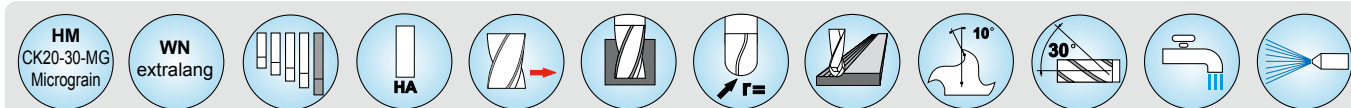
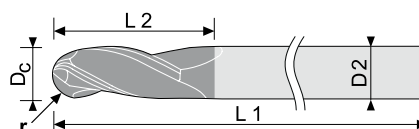
C1.1-8 C2.1-2.4 C3.1-3.2 C4.1-4.2

D: Acciai inossidabili / *Stainless Steel*

D1.1-1.5

F: Ghise / *Cast irons*

F1.1-1.5 F2.1-2.4



2.
08

Frese coniche - Z=3 - elica ad angolo costante - norma interna Taper end mills - Z=3 - constant spiral angle - Internal standard

63K



63KA



Settori d'impiego / Range of application

C: Acciai / Steels

C1.1-1.8 C2.1-2.4 C3.1-3.2 C4.1-4.2

D: Acciai inossidabili / Stainless Steel

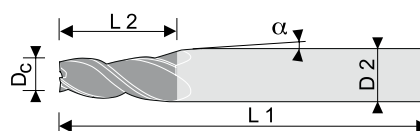
D1.1-1.5

E: Titanio / Titanium

E2.1 E2.3

F: Ghise / Cast irons

F1.1-1.5 F2.1-2.4



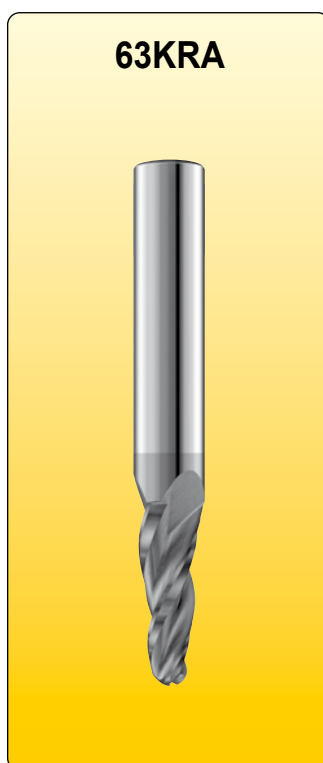
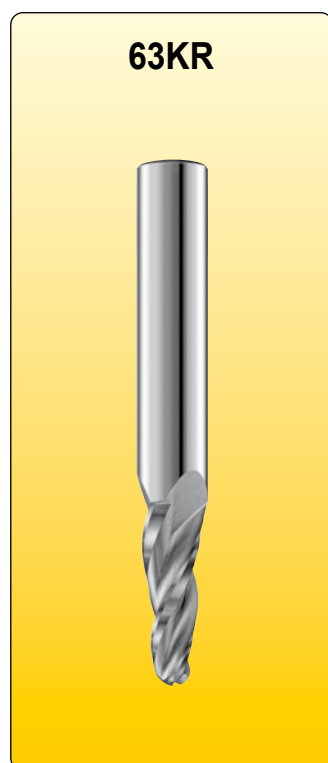
HM
CK20-30-MG
Micrograin

WN



D _c h10	L2	L1	D2 h6	α	63K	63KA
						Rivestite / Coated
4,5	20	57	6	1°	63K.06-1°	63K.06-1°A
6	30	63	8	1°	63K.08-1°	63K.08-1°A
8	30	72	10	1°	63K.10-1°	63K.10-1°A
10	35	83	12	1°	63K.12-1°	63K.12-1°A
12	35	83	14	1°	63K.14-1°	63K.14-1°A
14,5	43	92	16	1°	63K.16-1°	63K.16-1°A
16	55	100	18	1°	63K.18-1°	63K.18-1°A
18	55	104	20	1°	63K.20-1°	63K.20-1°A
2,5	20	57	6	3°	63K.06-3°	63K.06-3°A
4	30	63	8	3°	63K.08-3°	63K.08-3°A
6	30	72	10	3°	63K.10-3°	63K.10-3°A
8	35	83	12	3°	63K.12-3°	63K.12-3°A
10	35	83	14	3°	63K.14-3°	63K.14-3°A
11,3	44	92	16	3°	63K.16-3°	63K.16-3°A
12	55	100	18	3°	63K.18-3°	63K.18-3°A
14,2	55	104	20	3°	63K.20-3°	63K.20-3°A
2,5	20	57	6	5°	63K.06-5°	63K.06-5°A
3	25	63	8	5°	63K.08-5°	63K.08-5°A
3,5	30	72	10	5°	63K.10-5°	63K.10-5°A
4	35	83	12	5°	63K.12-5°	63K.12-5°A
8	34	83	14	5°	63K.14-5°	63K.14-5°A
9	40	92	16	5°	63K.16-5°	63K.16-5°A
11	40	100	18	5°	63K.18-5°	63K.18-5°A
12	45	104	20	5°	63K.20-5°	63K.20-5°A

Frese coniche a testa raggiata - Z=3 elica ad angolo costante - norma interna Taper ball nose end mills - Z=3 - constant spiral angle - Internal standard



Settori d'impiego / Range of application

C: Acciai / Steels

C1.1-1.8 C2.1-2.4 C3.1-3.2 C4.1-4.2

D: Acciai inossidabili / Stainless Steel

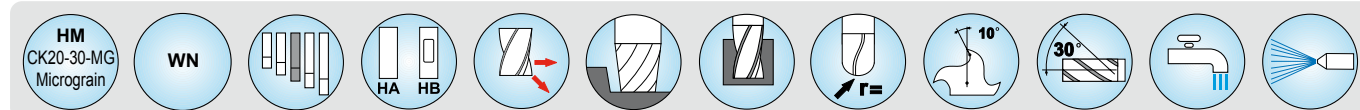
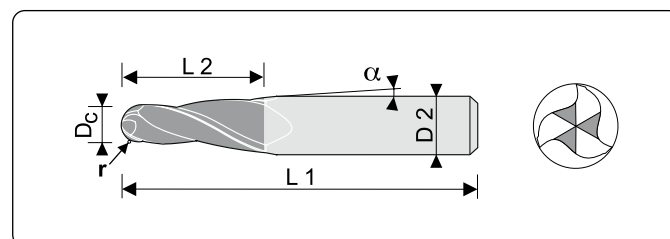
D1.1-1.5

E: Titanio / Titanium

E2.1 E2.3

F: Ghise / Cast irons

F1.1-1.5 F2.1-2.4



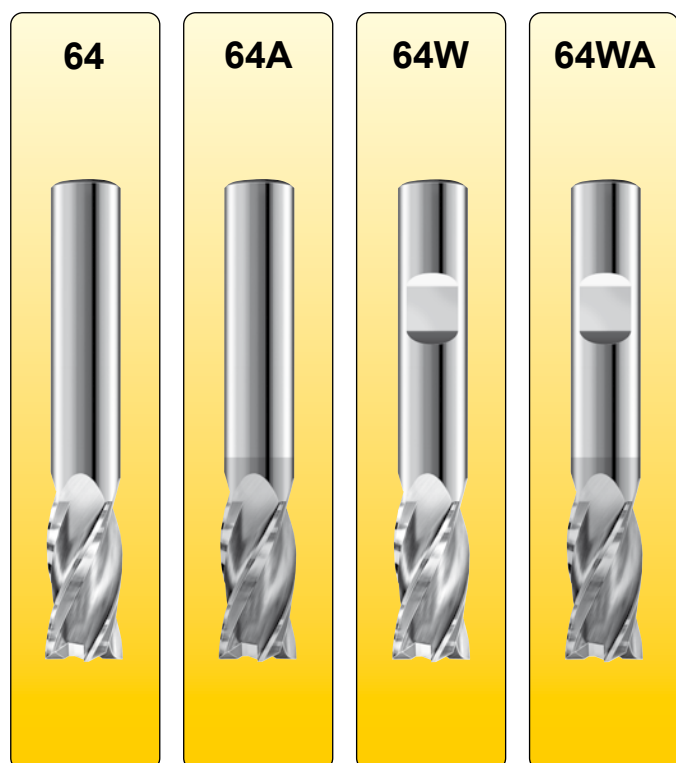
D _c h10	L2	L1	D2 h6	r	α	63KR	63KRA
							Rivestite / Coated
4,5	20	57	6	2,25	1°	63KR.06-1°	63KR.06-1°A
6	30	63	8	3	1°	63KR.08-1°	63KR.08-1°A
8	30	72	10	4	1°	63KR.10-1°	63KR.10-1°A
10	35	83	12	5	1°	63KR.12-1°	63KR.12-1°A
12	35	83	14	6	1°	63KR.14-1°	63KR.14-1°A
14,5	43	92	16	7,25	1°	63KR.16-1°	63KR.16-1°A
16	55	100	18	8	1°	63KR.18-1°	63KR.18-1°A
18	55	104	20	9	1°	63KR.20-1°	63KR.20-1°A
2,5	20	57	6	1,25	3°	63KR.06-3°	63KR.06-3°A
4	30	63	8	2	3°	63KR.08-3°	63KR.08-3°A
6	30	72	10	3	3°	63KR.10-3°	63KR.10-3°A
8	35	83	12	4	3°	63KR.12-3°	63KR.12-3°A
10	35	83	14	5	3°	63KR.14-3°	63KR.14-3°A
11,2	44	92	16	5,6	3°	63KR.16-3°	63KR.16-3°A
12	55	100	18	6	3°	63KR.18-3°	63KR.18-3°A
14	55	104	20	7	3°	63KR.20-3°	63KR.20-3°A
2,5	20	57	6	1,25	5°	63KR.06-5°	63KR.06-5°A
3	25	63	8	1,5	5°	63KR.08-5°	63KR.08-5°A
3,5	30	72	10	1,75	5°	63KR.10-5°	63KR.10-5°A
4	35	83	12	2	5°	63KR.12-5°	63KR.12-5°A
8	34	83	14	4	5°	63KR.14-5°	63KR.14-5°A
9	40	92	16	4,5	5°	63KR.16-5°	63KR.16-5°A
11	40	100	18	5,5	5°	63KR.18-5°	63KR.18-5°A
12	45	104	20	6	5°	63KR.20-5°	63KR.20-5°A

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Frese a 4 taglienti
4 flutes end mills

Frese Z=4 - elica 30° - norma interna End mills - Z=4 Helix 30° - Internal standard



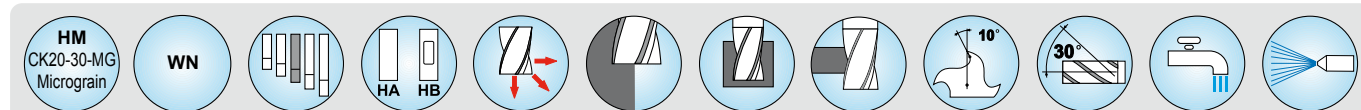
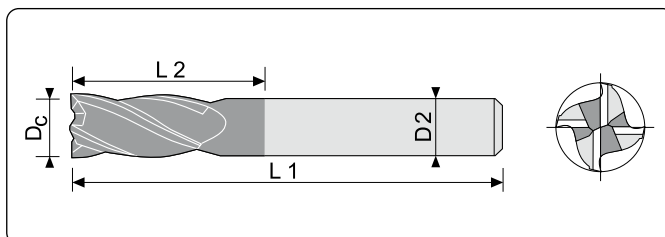
Settore d'impiego / Range of application

C: Acciai / Steels

C1.1-1.8 C2.1-2.4 C3.1-3.2 C4.1-4.2

F: Ghise / Cast irons

F1.1-1.5 F2.1-2.4

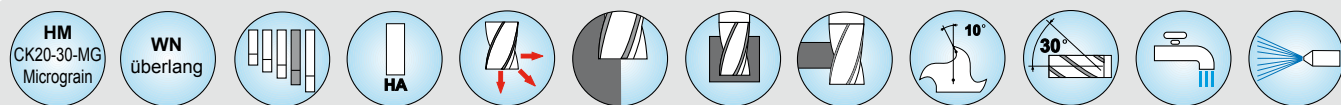


D _c h10	L2	L1	D2 h6	64	64A Beschichtet/Coated	64W	64WA Rivestite/Coated
2	6	40	2	64.020020640	64.020020640A		
2	4	50	6	64.020060450	64.020060450A		
2,5	7	40	2,5	64.025250740	64.025250740A		
3	8	57	6	64.030060857	64.030060857A	64W.030060857	64W.030060857A
3	10	40	3	64.030031040	64.030031040A		
3,5	10	40	3,5	64.035351040	64.035351040A		
4	11	40	4	64.040041140	64.040041140A		
4	11	57	6	64.040061157	64.040061157A	64W.040061157	64W.040061157A
4,5	11	50	4,5	64.045451150	64.045451150A		
5	13	50	5	64.050051350	64.050051350A		
5,5	13	50	5,5	64.055551350	64.055551350A		
6	13	57	6	64.060061357	64.060061357A	64W.060061357	64W.060061357A
6	16	50	6	64.060061650	64.060061650A		
6,5	16	50	6,5	64.065651650	64.065651650A		
7	16	60	7	64.070071660	64.070071660A		
8	19	63	8	64.080081963	64.080081963A	64W.080081963	64W.080081963A
9	19	63	9	64.090091963	64.090091963A		
10	22	72	10	64.100102272	64.100102272A	64W.100102272	64W.100102272A
11	22	72	11	64.110112272	64.110112272A		
12	26	83	12	64.120122683	64.120122683A	64W.120122683	64W.120122683A
13	26	83	13	64.130132683	64.130132683A		
14	26	83	14	64.140142683	64.140142683A	64W.140142683	64W.140142683A
15	26	92	15	64.150152692	64.150152692A		
16	32	92	16	64.160163292	64.160163292A	64W.160163292	64W.160163292A
18	32	92	18	64.180183292	64.180183292A	64W.180183292	64W.180183292A
20	38	104	20	64.2002038104	64.2002038104A	64W.2002038104	64W.2002038104A
25	45	120	25	64.2502545120	64.2502545120A	64W.2502545120	64W.2502545120A

Frese Z=4 - elica 30° - norma interna - lunga
End mills - Z=4 Helix 30° - Internal standard long



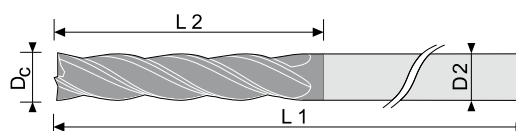
F1.1-1.5 F2.1-2.4

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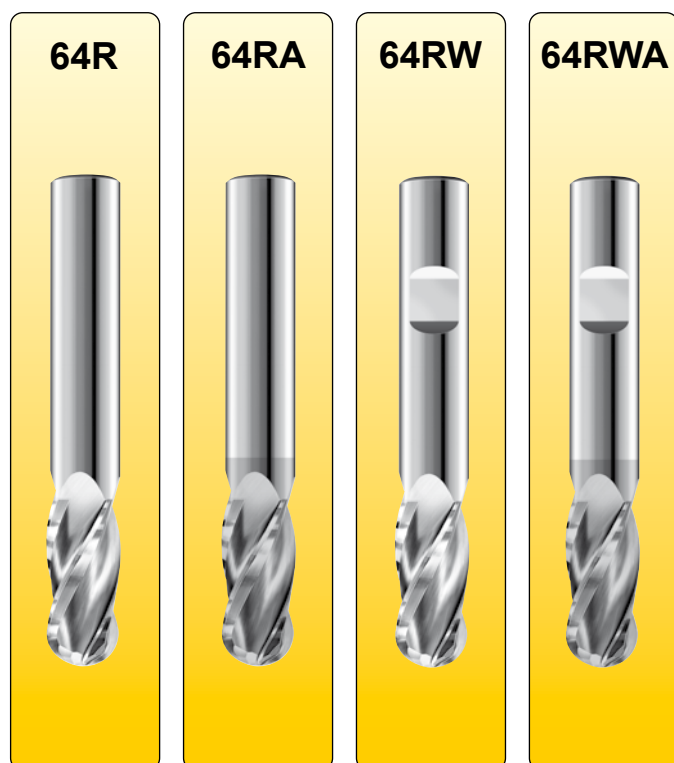
End mills - Z=4 Helix 30° - Internal standard extra long



F1.1-1.5 F2.1-2.4

2.09

Frese a testa raggiata - Z=4 - elica 30° - norma interna Ball nose cutters - Z=4 Helix 30° - Internal standard



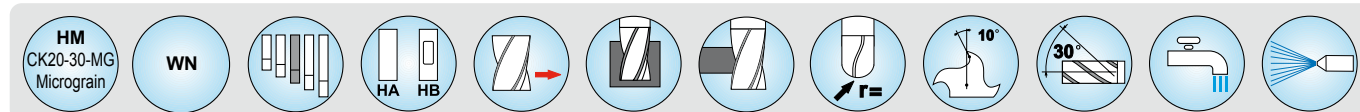
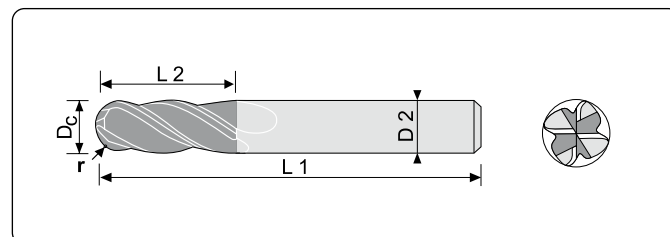
Settori d'impiego / Range of application

C: Acciai / Steels

C1.1-1.8 C2.1-2.4 C3.1-3.2 C4.1-4.2

F: Ghise / Cast irons

F1.1-1.5 F2.1-2.4



D _c h10	L2	L1	D2 h6	r	64R	64RA Rivestite/Coated	64RW	64RWA Rivestite/Coated
2	6	40	2	1	64R.020020640	64R.020020640A		
2,5	7	40	2,5	1,25	64R.025250740	64R.025250740A		
3	8	57	6	1,5	64R.030060857	64R.030060857A	64RW.030060857	64RW.030060857A
3	10	40	3	1,5	64R.030031040	64R.030031040A		
3,5	10	40	3,5	1,75	64R.035351040	64R.035351040A		
4	11	40	4	2	64R.040041140	64R.040041140A		
4	11	57	6	2	64R.040061157	64R.040061157A	64RW.040061157	64RW.040061157A
4,5	11	50	4,5	2,25	64R.045451150	64R.045451150A		
5	13	50	5	2,5	64R.050051350	64R.050051350A		
5,5	13	50	5,5	2,75	64R.055551350	64R.055551350A		
6	13	57	6	3	64R.060061357	64R.060061357A	64RW.060061357	64RW.060061357A
6	16	50	6	3	64R.060061650	64R.060061650A		
6,5	16	50	6,5	3,25	64R.065651650	64R.065651650A		
7	16	60	7	3,5	64R.070071660	64R.070071660A		
8	19	63	8	4	64R.080081963	64R.080081963A	64RW.080081963	64RW.080081963A
9	19	63	9	4,5	64R.090091963	64R.090091963A		
10	22	72	10	5	64R.100102272	64R.100102272A	64RW.100102272	64RW.100102272A
11	22	72	11	5,5	64R.110112272	64R.110112272A		
12	26	83	12	6	64R.120122683	64R.120122683A	64RW.120122683	64RW.120122683A
13	26	83	13	6,5	64R.130132683	64R.130132683A		
14	26	83	14	7	64R.140142683	64R.140142683A	64RW.140142683	64RW.140142683A
15	26	92	15	7,5	64R.150152692	64R.150152692A		

D _c h10	L2	L1	D2 h6	r	64R	64RA	64RW	64RWA
						Rivestite/Coated		Rivestite/Coated
16	32	92	16	8	64R.160163292	64R.160163292A	64RW.160163292	64RW.160163292A
18	32	92	18	9	64R.180183292	64R.180183292A	64RW.180183292	64RW.180183292A
20	38	104	20	10	64R.2002038104	64R.2002038104A	64RW.2002038104	64RW.2002038104A
25	45	120	25	12,5	64R.2502545120	64R.2502545120A	64RW.2502545120	64RW.2502545120A

Frese a testa raggiata - Z=4 - elica 30° - norma interna - lunga
Ball nose cutters - Z=4 Helix 30° - Internal standard long

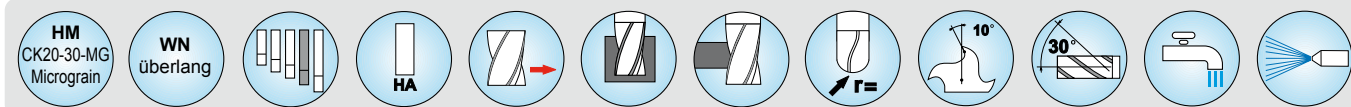
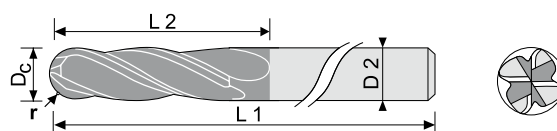


C: Acciai / Steels

C1.1-1.8 C2.1-2.4 C3.1-3.2 C4.1-4.2

F: Ghise / *Cast irons*

F1.1-1.5 F2.1-2.4



2.
09

Frese a testa raggiata - Z=4 - elica 30° - norma interna - extralunga
Ball nose cutters - Z=4 Helix 30° - Internal standard extra long

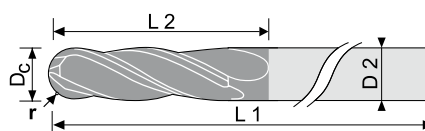


C: Acciai / Steels

C1.1-1.8 C2.1-2.4 C3.1-3.2 C4.1-4.2

F: Ghise / Cast irons

F1.1-1.5 F2.1-2.4

2.09

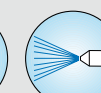
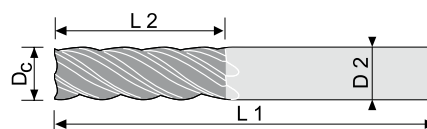


Frese di finitura multitaglienti
Multi-flute finishing end mills

End mills - Z=6 - Helix 25° - Internal standard



F1.1-1.5 F2.1-2.4

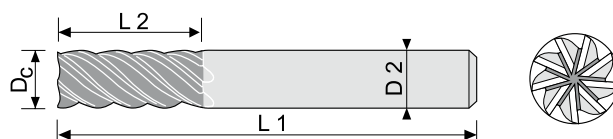


2.10

Multi-flute finishing end mills - uneven number of flutes - Internal standard



E2.1 E2.3



2.10

Frese a taglio fine - con rompitruciolo - norma interna End mills - Fine cut with chipbreaker - Internal standard

66M



66MA



Settore d'impiego / Range of application

C: Acciai / Steels

C1.3-1.8 C2.1-2.4 C3.1-3.2 C4.1-4.2

D: Acciai inossidabili / Stainless Steel

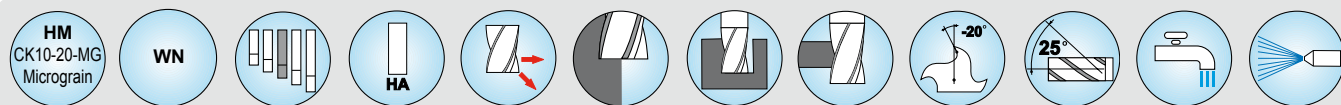
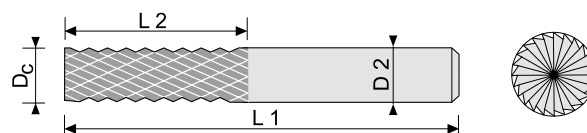
D1.1-1.4

E: Titanio / Titanium

E2.2 E2.3

F: Ghisa / Cast irons

F1.1-1.3 F2.1-2.4



D _c h10	L2	L1	D2 h6	66M	66MA
				■	Rivestite / Coated
3	10	40	3	66M.030	66M.030A
4	11	40	4	66M.040	66M.040A
5	13	50	5	66M.050	66M.050A
6	16	50	6	66M.060	66M.060A
8	19	63	8	66M.080	66M.080A
10	22	72	10	66M.100	66M.100A
12	26	83	12	66M.120	66M.120A
16	32	92	16	66M.160	66M.160A
18	32	92	18	66M.180	66M.180A
20	38	104	20	66M.200	66M.200A
3,5	10	40	3,5	66M.035	66M.035A
4,5	11	50	4,5	66M.045	66M.045A
7	16	60	7	66M.070	66M.070A
9	19	63	9	66M.090	66M.090A
11	22	72	11	66M.110	66M.110A
14	26	83	14	66M.140	66M.140A

Frese a testa raggiata - taglio fine - con rompitruciolo - norma interna Ball nose end mills - Fine cut with chipbreaker - Internal standard

66MR



66MRA



Settore d'impiego / Range of application

C: Acciai / Steels

C1.3-1.8 C2.1-2.4 C3.1-3.2 C4.1-4.2

D: Acciai inossidabili / Stainless Steel

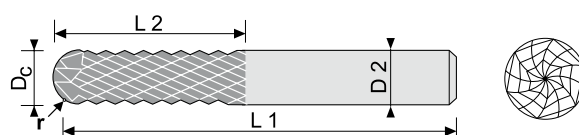
D1.1-1.4

E: Titanio / Titanium

E2.1 E2.3

F: Ghisa / Cast irons

F1.1-1.3 F2.1-2.4



HM
CK10-20-MG
Micrograin

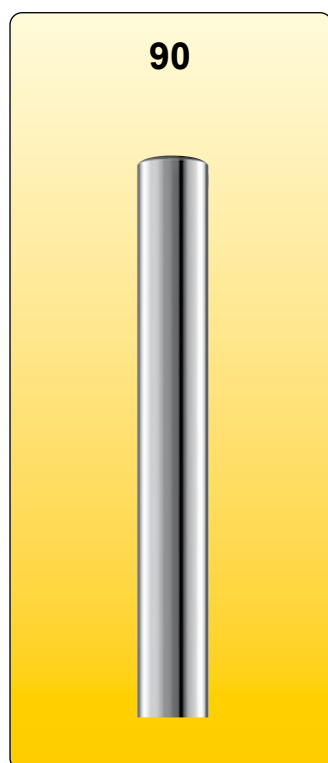
WN



D _c h10	L2	L1	D2 h6	r	66MR	66MRA
					■	Rivestite / Coated
3	10	40	3	1,5	66MR.030	66MR.030A
4	11	40	4	2	66MR.040	66MR.040A
5	13	50	5	2,5	66MR.050	66MR.050A
6	16	50	6	3	66MR.060	66MR.060A
8	19	63	8	4	66MR.080	66MR.080A
10	22	72	10	5	66MR.100	66MR.100A
12	26	83	12	6	66MR.120	66MR.120A
16	32	92	16	8	66MR.160	66MR.160A
18	32	92	18	9	66MR.180	66MR.180A
20	38	104	20	10	66MR.200	66MR.200A
3,5	10	40	3,5	1,75	66MR.035	66MR.035A
4,5	11	50	4,5	2,25	66MR.045	66MR.045A
7	16	60	7	3,5	66MR.070	66MR.070A
9	19	63	9	4,5	66MR.090	66MR.090A
11	22	72	11	5,5	66MR.110	66MR.110A
14	26	83	14	7	66MR.140	66MR.140A



Cilindretti grezzi Round blanks



Settori d'impiego / Range of application

A: Leghe leggere / *Light alloys*

A1.1-1.6 A2.1-2.7 A3.1-3.2 A4.1-4.2

C: Acciai / *Steels*

C1.1-1.8 C2.1-2.4 C3.1-3.2 C4.1-4.2

D: Acciai inossidabili / *Stainless Steel*

D1.1-1.5

E: Titanio / *Titanium*

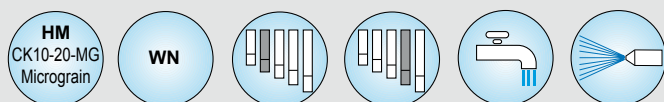
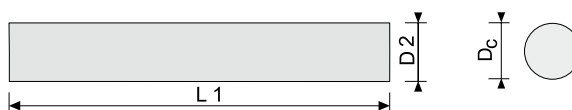
E1.1-1.3 E2.1-2.2

F: Ghise / *Cast irons*

F1.1-1.5 F2.1-2.4

G: Grafite / *Graphite*

G1.1 G2.1



D _c h6	L1	D2 h6	90
2	40	2	90.02040
2	100	2	90.020100
2,5	40	2,5	90.02540
2,5	100	2,5	90.025100
3	50	3	90.03050
3	100	3	90.030100
4	55	4	90.04055
4	100	4	90.040100
5	62	5	90.05062
5	100	5	90.050100
6	66	6	90.06066
6	100	6	90.060100
8	79	8	90.08079
8	100	8	90.080100
10	100	10	90.100100
12	100	12	90.120100
14	100	14	90.140100
16	100	16	90.160100
18	100	18	90.180100
20	100	20	90.200100

Bulini sgrossati su un lato Engraving tool preshaped on one side

91



Settori d'impiego / Range of application

A: Leghe leggere / Light alloys

A1.1-1.6 A2.1-2.7 A3.1-3.2 A4.1-4.2

C: Acciai / Steels

C1.1-1.8 C2.1-2.4 C3.1-3.2 C4.1-4.2

D: Acciai inossidabili / Stainless Steel

D1.1-1.5

E: Titanio / Titanium

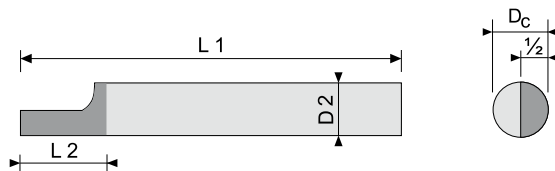
E1.1-1.3 E2.1-2.2

F: Ghise / Cast irons

F1.1-1.5 F2.1-2.4

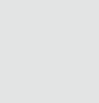
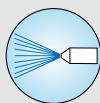
G: Grafite / Graphite

G1.1 G2.1



HM
CK10-20-MG
Micrograin

WN

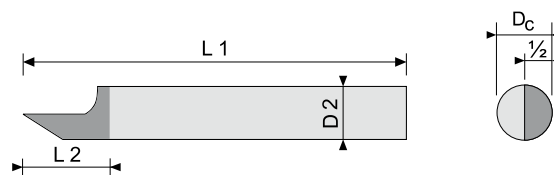


D _c h6	L2	L1	D2 h6	91
2	3	40	2	91.02040
2	3	100	2	91.020100
2,5	3	40	2,5	91.02540
2,5	3	100	2,5	91.025100
3	4	50	3	91.03050
3	4	100	3	91.030100
4	5	55	4	91.04055
4	5	100	4	91.040100
5	6	62	5	91.05062
5	6	100	5	91.050100
6	7	66	6	91.06066
6	7	100	6	91.060100
8	9	79	8	91.08079
8	9	100	8	91.080100
10	11	100	10	91.100100
12	13	100	12	91.120100

Engraving tool 90° - 60° shaped on one side

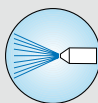
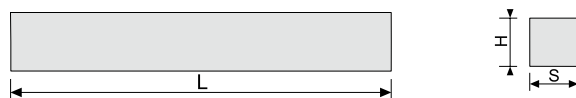


G1.1 G2.1

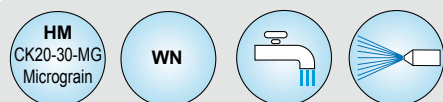
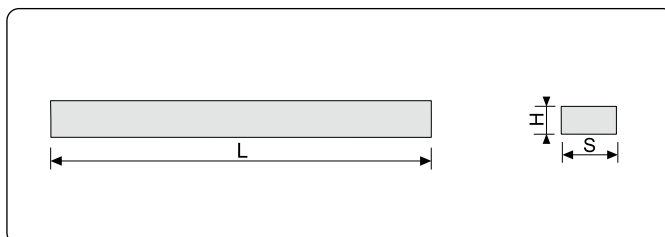
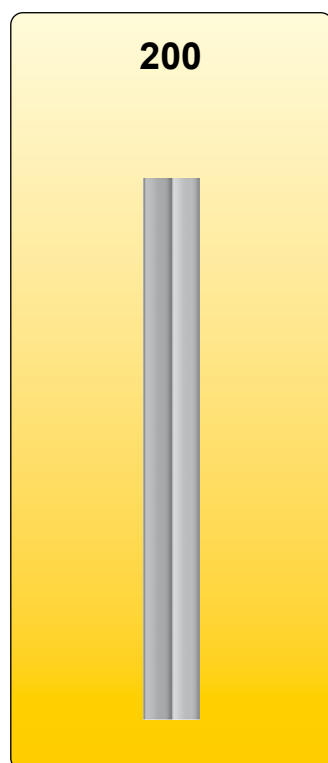


2.11

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[illegible]

Barre rettangolari grezze Rectangular blanks



H mm	S mm	L mm	200
4	2	100	200.0204
5	2	100	200.0205
6	2	100	200.0206
8	2	100	200.0208
10	2	100	200.0210
12	2	100	200.0212
6	3	100	200.0306
8	3	100	200.0308
10	3	100	200.0310
12	3	100	200.0312
8	4	100	200.0408
10	4	100	200.0410
12	4	100	200.0412
10	5	100	200.0510
12	5	100	200.0512
16	5	100	200.0516
8	6	100	200.0608
10	6	100	200.0610
12	6	100	200.0612
16	6	100	200.0616
10	8	100	200.0810
12	8	100	200.0812
16	8	100	200.0816
20	8	100	200.0820



Punte elicoidali
Drills

Indice

Index

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Punte a 2 eliche per leghe leggere - lunghe DIN 338	<i>Twist drills for cast iron and light alloys - long according to DIN 338</i>	166 166F	256
Punte a 2 eliche ad elevato avanzamento - DIN 6539	<i>High performance twist drills-self centering - DIN 6539</i>	172 172F	258
Punte a 2 eliche ad elevato avanzamento - norma interna	<i>High performance twist drills-self centering - WN</i>	173 173F	260
Punte a 2 eliche ad elevato avanzamento - con adduzione interna - DIN 6537 K	<i>High performance twist drills with coolant ducts-self centering-short acc. to DIN 6537-K</i>	175 175F	262
Punte a 2 eliche ad elevato avanzamento - con adduzione interna - lunga - DIN 6537 K	<i>High performance twist drills with coolant ducts-self centering-long acc. to DIN 6537-L</i>	176 176F	264



Velocità di taglio V_c (m/min)
Cutting speed V_c (m/min)

	◆	f (mm)	171 171F	170-90° 170-90°F 170-120° 170-120°F	181 181F	182 182F	117 117D	217 217D	118 118E	150 150F	162 162F	162L 162LF	163 163F
			V _c (m/min) - per punte senza rivestimento V _c (m/min) - for drills without coating										
Alluminio - Leghe d'alluminio - Rame - Leghe di rame - Magnesio Aluminium - Alu-alloys - Copper - Copper alloys - Magnesium													
A 1.1	1	K	130	130	130	130	-	-	-	150	-	-	130
A 1.2	1	K	140	140	140	140	-	-	-	-	-	-	150
A 1.3	1	H	130	130	130	130	-	-	-	150	-	-	-
A 1.4	1	H	100	100	100	100	-	-	-	-	-	-	100
A 1.5	1	K	130	130	130	130	-	-	-	150	-	-	120
A 1.6	1	H	160	160	160	160	-	-	-	-	-	-	120
A 1.7	3	C	50	50	50	50	-	-	-	-	50	42	60
A 2.1	1	G	70	70	70	70	-	-	-	-	-	-	85
A 2.2	1	G	70	70	70	70	-	-	-	85	-	-	85
A 2.3	2	F	70	70	70	70	-	-	-	90	-	-	90
A 2.4	2	E	70	70	70	70	-	-	-	-	-	-	90
A 2.5	1	H	150	150	150	150	-	-	-	180	-	-	200
A 2.6	1	G	100	100	100	100	-	-	-	-	-	-	100
A 2.7	2	F	60	60	60	60	-	-	-	70	-	-	70
A 3.1	1	E	70	70	70	70	-	-	-	-	-	-	70
A 3.2	1	E	70	70	70	70	-	-	-	-	-	-	70
A 4.1	3	G	*150	*150	*150	*150	-	-	-	-	-	-	*180
A 4.2	3	G	*150	*150	*150	*150	-	-	-	*120	-	-	*180
Acciai da costruzione - Leghe d'acciaio - Acciai temprati General - Construction steels - Steel alloys - Hardened steels													
C 1.1	1	G	90	90	90	90	-	-	-	-	-	-	100
C 1.2	1	G	90	90	90	90	-	-	-	-	-	-	100
C 1.3	1	G	85	85	85	85	-	-	-	-	-	-	100
C 1.4	1	G	80	80	80	80	-	-	-	90	90	76	90
C 1.5	1	G	90	90	90	90	-	-	-	100	100	85	100
C 1.6	1	G	80	80	80	80	-	-	-	90	90	76	90
C 1.7	1	G	60	60	60	60	-	-	-	70	70	60	70
C 1.8	1	G	80	80	80	80	-	-	-	90	90	76	90
C 2.1	1	E	65	65	65	65	-	-	-	45	45	38	45
C 2.2	1	E	40	40	40	40	-	-	-	45	45	38	45
C 2.3	2	C	40	40	40	40	-	-	-	45	45	38	45
C 2.4	2	B	50	50	50	50	-	-	-	50	60	51	60
C 3.1	1	B	30	30	30	30	-	-	-	-	40	34	40
C 3.2	2	A	25	25	25	25	-	-	-	-	30	25	30
C 3.3	2	A	-	-	-	-	-	-	-	-	25	21	25
C 3.4	2	A	-	-	-	-	-	-	-	-	-	-	25
C 3.5	2	A	-	-	-	-	-	-	-	-	-	-	20
C 4.1	2	C	35	35	35	35	-	-	-	-	40	34	40
C 4.2	2	C	25	25	25	25	-	-	-	-	30	25	30

Refrigerante
Coolant

1 = emulsione
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2 = oil

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3 = air (*3 = only air without additives)

◆ **Refrigerante**
Coolant

Velocità di taglio V_c (m/min)
Cutting speed V_c (m/min)

	◆	f (mm)	164 164F	160 160F	161 161F	165 165F	166 166F	172 172F	Code f (mm) f (mm)	174 174F	174L 174LF	175 175F	176 176F	177 177F
			V _c (m/min) - per punte senza rivestimento V _c (m/min) - for drills without coating											
			Alluminio - Leghe d'alluminio - Rame - Leghe di rame - Magnesio Aluminium - Alu-alloys - Copper - Copper alloys - Magnesium											
A 1.1	1	K	130	150	130	160	140	130	K	150	127	220	220	220
A 1.2	1	K	140	170	140	200	170	140	K	170	144	220	220	220
A 1.3	1	H	130	150	130	160	140	130	K	150	127	200	200	200
A 1.4	1	H	80	130	100	150	110	80	K	130	110	170	170	170
A 1.5	1	K	140	150	130	160	140	140	K	150	127	200	200	200
A 1.6	1	H	160	180	160	200	170	160	K	180	153	220	220	220
A 1.7	3	C	-	60	50	-	-	-	D	70	59	-	-	-
A 2.1	1	G	80	85	70	90	75	80	G	85	72	100	100	100
A 2.2	1	G	80	85	70	90	75	80	G	85	72	100	100	100
A 2.3	2	F	90	90	70	-	-	90	G	90	76	100	100	100
A 2.4	2	E	90	90	70	100	80	90	F	90	76	100	100	100
A 2.5	1	H	140	180	150	-	-	140	H	180	153	250	250	250
A 2.6	1	G	130	130	100	110	100	130	G	130	110	180	180	180
A 2.7	2	F	60	70	60	80	70	60	F	70	59	100	100	100
A 3.1	1	E	80	85	70	90	80	80	F	85	72	100	100	100
A 3.2	1	E	80	85	70	70	60	80	F	85	72	100	100	100
A 4.1	3	G	*180	*180	*150	*200	*170	*180	H	*180	*153	*220	*220	*220
A 4.2	3	G	*180	*180	*150	*200	*170	*180	H	*180	*153	*220	*220	*220
Acciai da costruzione - Leghe d'acciaio - Acciai temprati General - Construction steels - Steel alloys - Hardened steels														
C 1.1	1	G	-	100	90	100	90	-	G	110	93	120	120	120
C 1.2	1	G	-	100	90	100	90	-	G	110	93	120	120	120
C 1.3	1	G	-	100	85	90	75	-	H	100	85	140	140	140
C 1.4	1	G	-	90	80	80	70	-	H	90	76	100	100	100
C 1.5	1	G	-	100	90	90	75	-	G	110	93	120	120	120
C 1.6	1	G	-	90	80	70	60	-	H	100	85	110	110	110
C 1.7	1	G	-	70	60	-	-	-	G	75	63	90	90	90
C 1.8	1	G	-	90	80	-	-	-	H	90	76	100	100	100
C 2.1	1	E	-	45	65	-	-	-	F	80	68	90	90	90
C 2.2	1	E	-	45	40	-	-	-	F	65	55	60	60	60
C 2.3	2	C	-	45	40	-	-	-	D	50	42	55	55	55
C 2.4	2	B	-	60	50	-	-	-	C	65	55	70	70	70
C 3.1	1	B	-	40	30	-	-	-	C	45	38	50	50	50
C 3.2	2	A	-	30	25	-	-	-	B	35	29	40	40	40
C 3.3	2	A	-	-	-	-	-	-	B	30	25	30	30	30
C 3.4	2	A	-	-	-	-	-	-	A	30	25	30	30	30
C 3.5	2	A	-	-	-	-	-	-	A	25	21	25	25	25
C 4.1	2	C	-	40	35	-	-	-	D	50	42	60	60	60
C 4.2	2	C	-	30	25	-	-	-	D	60	51	70	70	70

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◆ Refrigerante
Coolant

Velocità di taglio V_c (m/min)
Cutting speed V_c (m/min)

	◆	f (mm)	171 171F	170-90° 170-90°F 170-120° 170-120°F	181 181F	182 182F	117 117D	217 217D	118 118E	150 150F	162 162F	162L 162LF	163 163F
			V _c (m/min) - per punte senza rivestimento V _c (m/min) - for drills without coating										
			Acciai resistenti alla corrosione e agli acidi - Acciai inossidabili Stainless steels										
D 1.1	2	D	40	40	40	40	-	-	-	-	-	-	45
D 1.2	2	D	25	25	25	25	-	-	-	-	-	-	30
D 1.3	2	C	25	25	25	25	-	-	-	-	-	-	30
D 1.4	2	B	20	20	20	20	-	-	-	20	25	21	25
D 1.5	2	A	18	18	18	18	-	-	-	18	20	17	20
Leghe di nichel/cobalto - Titanio - Leghe di titanio Nickel/Cobalt alloys - Titanium - Titanium alloys													
E 1.1	2	D	30	30	30	30	-	-	-	-	-	-	45
E 1.2	2	C	25	25	25	25	-	-	-	-	-	-	40
E 1.3	2	B	25	25	25	25	-	-	-	-	-	-	35
E 2.1	2	B	25	25	25	25	-	-	-	25	35	30	40
E 2.2	1	B	20	20	20	20	-	-	-	20	20	17	35
E 2.3	2	A	18	18	18	18	-	-	-	-	18	15	25
Ghise Cast irons													
F 1.1	1	H	100	100	100	100	-	-	-	100	100	85	140
F 1.2	1	H	85	85	85	85	-	-	-	85	85	72	110
F 1.3	1	B	20	20	20	20	-	-	-	20	20	17	30
F 1.4	1	G	85	85	85	85	-	-	-	85	85	72	90
F 1.5	1	F	80	80	80	80	-	-	-	80	80	68	70
F 2.1	1	G	85	85	85	85	-	-	-	85	85	72	90
F 2.2	1	G	80	80	80	80	-	-	-	70	80	68	70
F 2.3	1	E	90	90	90	90	-	-	-	-	-	-	70
F 2.4	1	E	70	70	70	70	-	-	-	-	-	-	70
Grafite - Leghe tungsteno/rame Graphite - Tungsten/Copper alloys													
G 1.1	3	D	70	70	70	70	-	-	-	-	-	-	80
G 2.1	1	F	75	75	75	75	-	-	-	-	-	-	80
Plastiche - Plastiche rinforzate con fibre - Materiali non ferrosi Plastics - Reinforced plastic fibres - Non ferrous materials													
B 1.1	1	G	80	80	80	80	-	-	180	-	-	-	-
B 1.2	2	E	70	70	70	70	-	-	150	-	-	-	-
B 1.3	1	E	70	70	70	70	-	-	120	-	-	-	-
B 1.4	1	C	40	40	40	40	300	300	150	-	-	-	60
B 1.5	1	D	50	50	50	50	-	-	120	-	-	-	-
B 2.1	-	C	70	70	70	70	-	-	120	-	-	-	-
B 2.2	1	B	-	-	-	-	-	-	120	-	-	-	-
B 2.3	-	E	80	80	80	80	-	-	120	-	-	-	-
B 2.4	-	E	-	-	-	-	-	-	120	-	-	-	-

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◆ Refrigerante
Coolant

Velocità di taglio V_c (m/min)
Cutting speed V_c (m/min)

			164 164F	160 160F	161 161F	165 165F	166 166F	172 172F	Code f (mm) <i>f (mm)</i>	174 174F	174L 174LF	175 175F	176 176F	177 177F
	◆	f (mm)	V _c (m/min) - per punte senza rivestimento V _c (m/min) - <i>for drills without coating</i>											
Acciai resistenti alla corrosione e agli acidi - Acciai inossidabili <i>Stainless steels</i>														
D 1.1	2	D	35	45	40	30	20	35	E	50	42	55	55	55
D 1.2	2	D	30	30	25	25	20	30	E	40	34	50	50	50
D 1.3	2	C	-	30	25	-	-	-	E	40	34	45	45	45
D 1.4	2	B	-	25	20	20	-	-	D	35	29	40	40	40
D 1.5	2	A	-	20	18	-	-	-	C	30	25	35	35	35
Leghe di nichel/cobalto - Titanio - Leghe di titanio <i>Nickel/Cobalt alloys - Titanium - Titanium alloys</i>														
E 1.1	2	D	-	35	30	30	25	-	D	35	29	40	40	40
E 1.2	2	C	-	30	25	25	20	-	D	30	25	35	35	35
E 1.3	2	B	-	30	25	25	20	-	C	30	25	35	35	35
E 2.1	2	B	-	35	25	-	-	-	B	40	34	45	45	45
E 2.2	1	B	-	30	20	-	-	-	B	35	29	40	40	40
E 2.3	2	A	-	20	18	-	-	-	B	25	21	25	25	25
Ghise <i>Cast irons</i>														
F 1.1	1	H	-	130	100	150	135	-	K	170	144	180	180	180
F 1.2	1	H	-	100	85	100	80	-	K	120	102	130	130	130
F 1.3	1	B	-	25	20	-	-	-	C	30	25	35	35	35
F 1.4	1	G	100	100	85	100	80	100	K	130	110	120	120	120
F 1.5	1	F	80	90	80	80	70	80	H	100	85	110	110	110
F 2.1	1	G	100	100	85	100	80	100	H	130	110	120	120	120
F 2.2	1	G	90	90	80	80	70	90	H	100	85	110	110	110
F 2.3	1	E	80	70	90	80	70	80	F	90	76	100	100	100
F 2.4	1	E	80	70	70	80	70	80	F	90	76	100	100	100
Grafite - Leghe tungsteno/rame <i>Graphite - Tungsten/Copper alloys</i>														
G 1.1	3	D	-	70	70	70	70	-	-	-	-	-	-	-
G 2.1	1	F	-	90	75	100	80	-	G	90	76	120	120	120
Plastiche - Plastiche rinforzate con fibre - Materiali non ferrosi <i>Plastics - Reinforced plastic fibres - Non ferrous materials</i>														
B 1.1	1	G	-	100	80	80	60	-	-	-	-	-	-	-
B 1.2	2	E	-	80	70	80	60	-	-	-	-	-	-	-
B 1.3	1	E	-	80	70	80	60	-	-	-	-	-	-	-
B 1.4	1	C	-	40	40	-	-	-	D	40	34	-	-	-
B 1.5	1	D	-	60	50	60	50	-	-	-	-	-	-	-
B 2.1	-	C	-	70	70	60	50	-	-	-	-	-	-	-
B 2.2	1	B	-	-	-	60	50	-	-	-	-	-	-	-
B 2.3	-	E	-	80	80	80	80	-	-	-	-	-	-	-
B 2.4	-	E	-	-	-	-	-	-	-	-	-	-	-	-

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◆ Refrigerante
Coolant

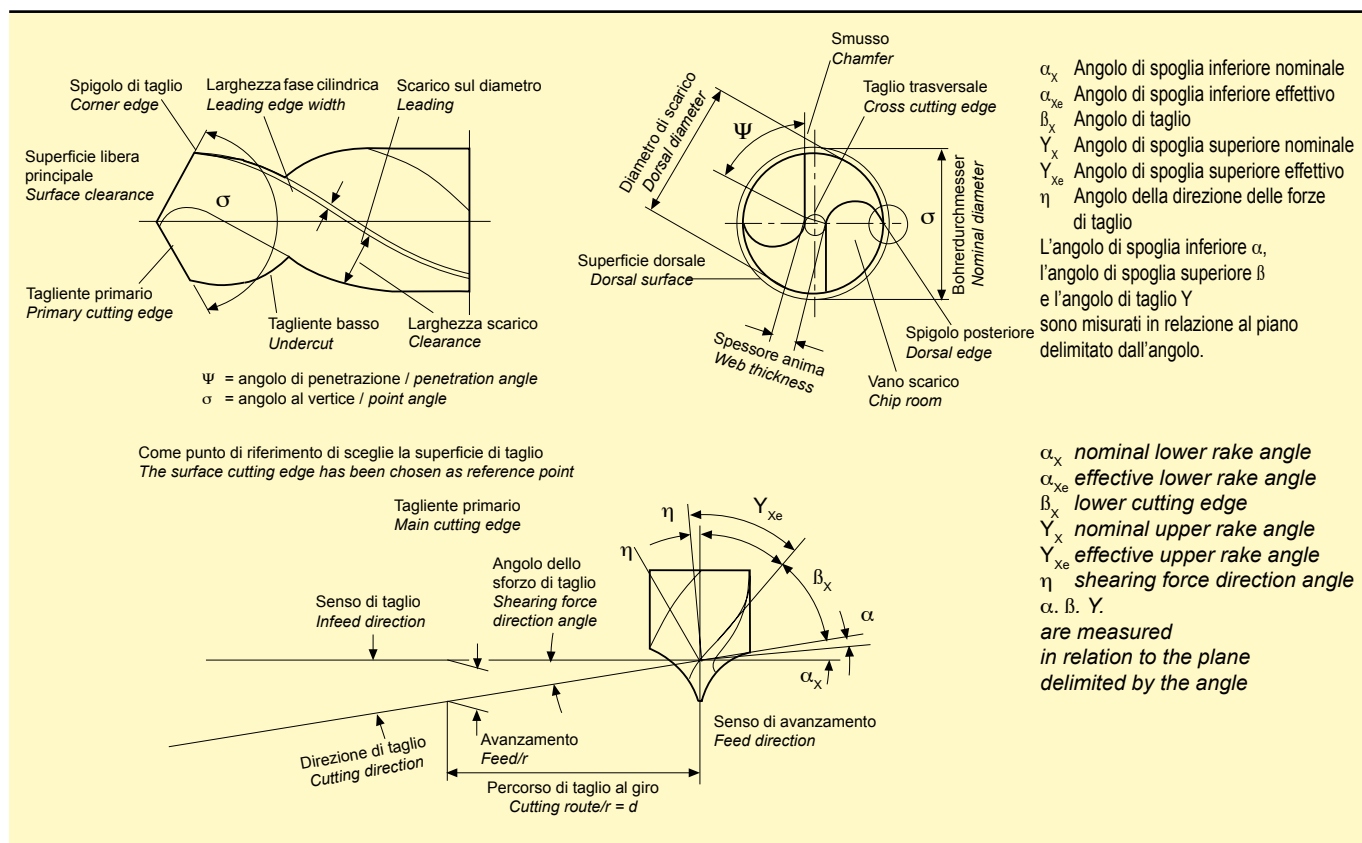
Velocità di avanzamento consigliata f mm/giro (valori approssimativi)
Recommended feed rate f (mm) (Reference values)

D _c (mm)	Codice avanzamento / Feed code								
	A	B	C	D	E	F	G	H	K
	f mm/giro - Utensili a forare / f (mm) - drilling tools								
1,00	0,006	0,008	0,012	0,014	0,016	0,018	0,020	0,023	0,025
1,50	0,012	0,015	0,020	0,025	0,030	0,035	0,045	0,050	0,060
2,00	0,020	0,025	0,032	0,040	0,050	0,060	0,080	0,100	0,120
2,50	0,025	0,032	0,040	0,050	0,060	0,080	0,100	0,120	0,160
3,00	0,030	0,035	0,045	0,060	0,080	0,100	0,125	0,160	0,180
4,00	0,040	0,050	0,060	0,080	0,100	0,120	0,160	0,200	0,220
5,00	0,040	0,050	0,060	0,080	0,100	0,120	0,160	0,200	0,250
6,00	0,050	0,060	0,080	0,100	0,120	0,160	0,200	0,250	0,300
7,00	0,050	0,060	0,080	0,100	0,120	0,160	0,200	0,250	0,320
8,00	0,060	0,080	0,100	0,120	0,160	0,200	0,250	0,300	0,350
9,00	0,060	0,080	0,100	0,120	0,160	0,200	0,250	0,300	0,380
10,00	0,080	0,100	0,120	0,160	0,200	0,250	0,300	0,400	0,400
11,00	0,080	0,100	0,120	0,160	0,200	0,250	0,300	0,400	0,450
12,00	0,080	0,100	0,120	0,160	0,200	0,250	0,300	0,400	0,500
13,00	0,080	0,100	0,120	0,160	0,200	0,250	0,300	0,400	0,500
14,00	0,090	0,120	0,140	0,180	0,220	0,280	0,350	0,450	0,550
15,00	0,090	0,120	0,140	0,180	0,220	0,280	0,350	0,450	0,550
16,00	0,100	0,120	0,160	0,200	0,250	0,300	0,400	0,500	0,600
18,00	0,100	0,120	0,160	0,200	0,250	0,300	0,400	0,500	0,600
20,00	0,120	0,160	0,200	0,250	0,300	0,400	0,500	0,600	0,600

Velocità di taglio V_c (m/min) - Numero di giri n (min⁻¹)
Cutting speed V_c (m/min) - Revolution speed n (min⁻¹)

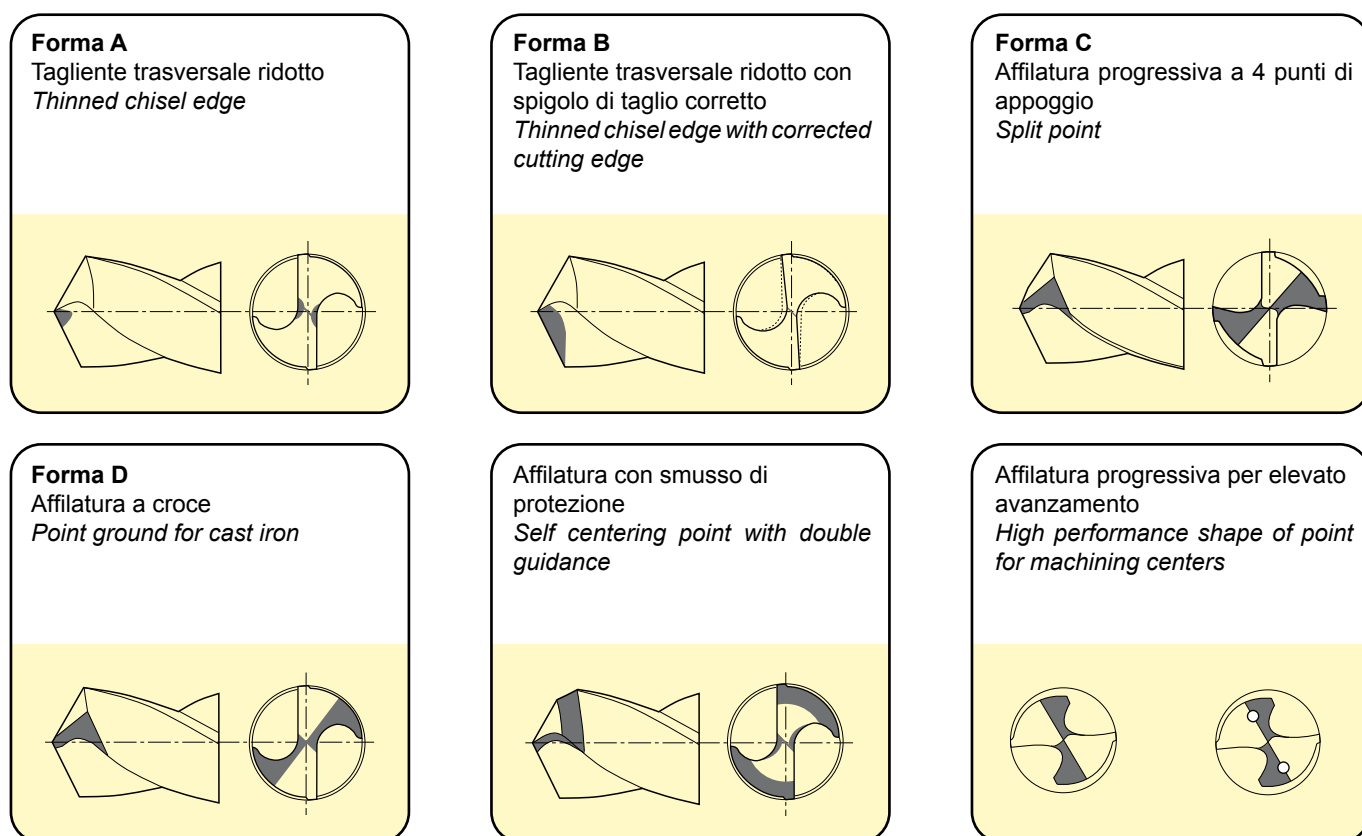
D _c (mm)	V _c (m/min)														
	12	16	20	25	30	40	50	60	80	100	120	160	180	200	250
	Numero di giri n (min ⁻¹) / Revolution speed n (min ⁻¹)														
1,00	3822	5096	6369	7962	9554	12739	15924	19108	25478	31847	38217	50955	57325	63694	79618
1,50	2548	3397	4246	5308	6369	8493	10616	12739	16985	21231	25478	33970	38217	42463	53079
2,00	1911	2548	3185	3981	4777	6369	7962	9554	12739	15924	19108	25478	28662	31847	39809
2,50	1529	2038	2548	3185	3822	5096	6369	7643	10191	12739	15287	20382	22930	25478	31847
3,00	1274	1699	2123	2654	3185	4246	5308	6369	8493	10616	12739	16985	19108	21231	26539
4,00	955	1274	1592	1990	2389	3185	3981	4777	6369	7962	9554	12739	14331	15924	19904
5,00	764	1019	1274	1592	1911	2548	3185	3822	5096	6369	7643	10191	11465	12739	15924
6,00	637	849	1062	1327	1592	2123	2654	3185	4246	5308	6369	8493	9554	10616	13270
7,00	546	728	910	1137	1365	1820	2275	2730	3640	4550	5460	7279	8189	9099	11374
8,00	478	637	796	995	1194	1592	1990	2389	3185	3981	4777	6369	7166	7962	9952
9,00	425	566	708	885	1062	1415	1769	2123	2831	3539	4246	5662	6369	7077	8846
10,00	382	510	637	796	955	1274	1592	1911	2548	3185	3822	5096	5732	6369	7962
11,00	347	463	579	724	869	1158	1448	1737	2316	2895	3474	4632	5211	5790	7238
12,00	318	425	531	663	796	1062	1327	1592	2123	2654	3185	4246	4777	5308	6635
13,00	294	392	490	612	735	980	1225	1470	1960	2450	2940	3920	4410	4900	6124
14,00	273	364	455	569	682	910	1137	1365	1820	2275	2730	3640	4095	4550	5687
15,00	255	340	425	531	637	849	1062	1274	1699	2123	2548	3397	3822	4246	5308
16,00	239	318	398	498	597	796	995	1194	1592	1990	2389	3185	3583	3981	4976
18,00	212	283	354	442	531	708	885	1062	1415	1769	2123	2831	3185	3539	4423
20,00	191	255	318	398	478	637	796	955	1274	1592	1911	2548	2866	3185	3981

Punte elicoidali - Dati tecnici e denominazioni Twist drills - Technical data and descriptions

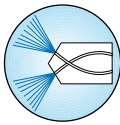
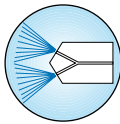
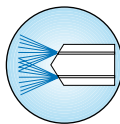
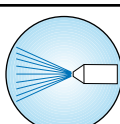
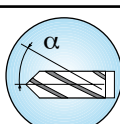
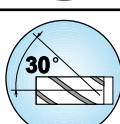
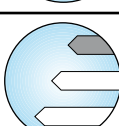
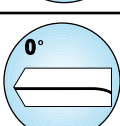
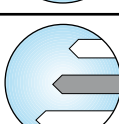
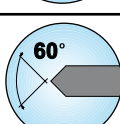
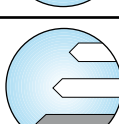
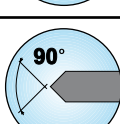
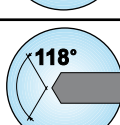
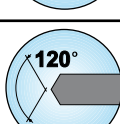


03

Esempi di affilatura - in parte secondo DIN 1412 Examples of shape points - Partially according to DIN 1412

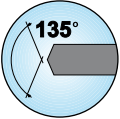
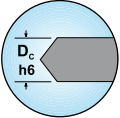
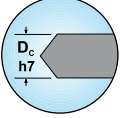
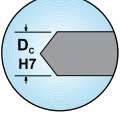
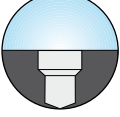
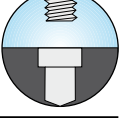


SPIEGAZIONE PITTOGRAMMI **ICONS DESCRIPTION**

Qualità metallo duro <i>Carbide grade</i>	HM CK10-20-MG Micrograin	Canali di raffreddamento a elica <i>Spiral coolant ducts</i>	
Qualità metallo duro <i>Carbide grade</i>	HM CK20-30-MG Micrograin	Canali di raffreddamento diritti <i>Straight centric coolant duct</i>	
Norma interna <i>Cutting edge design acc. to internal standard</i>	WN	Canali di raffreddamento diritti <i>Straight coolant ducts</i>	
Dimensioni secondo DIN 333-A <i>Dimensions acc. to DIN 333-A</i>	DIN 333-A	con emulsione d'olio <i>with oil emulsion</i>	
Dimensioni secondo DIN 338 <i>Dimensions acc. to DIN 338</i>	DIN 338	Lavorazione a secco <i>Dry machining</i>	
Dimensioni sec. DIN 6537-K <i>Dimensions acc. to DIN 6537-K</i>	DIN 6537-K	Lavorazione con aria compressa <i>with compressed air</i>	
Dimensioni sec. DIN 6537-L <i>Dimensions acc. to DIN 6537-L</i>	DIN 6537-L	Angolo dell'elica <i>Helix angle</i>	
Dimensioni sec. DIN 6539 <i>Dimensions acc. to DIN 6539</i>	DIN 6539	Angolo dell'elica <i>Helix angle</i>	
Lunghezza utensile <i>Tool length</i>		A tagliente diritto <i>Straight flute</i>	
Lunghezza utensile <i>Tool length</i>		Angolo al vertice <i>Point angle</i>	
Lunghezza utensile <i>Tool length</i>		Angolo al vertice <i>Point angle</i>	
Versione con gambo DIN 6535 HE <i>Shank acc. to DIN 6535 HE</i>	DIN 6535-HE	Angolo al vertice <i>Point angle</i>	
Versione con gambo DIN 6535 HEK <i>Shank acc. to DIN 6535 HEK</i>	DIN 6535-HEK	Angolo al vertice <i>Point angle</i>	

SPIEGAZIONE PITTOGRAMMI

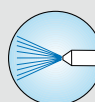
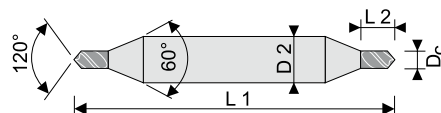
ICONS DESCRIPTION

Angolo al vertice Point angle	
Diametro utensile D_c Tool diameter D_c	
Diametro utensile D_c Tool diameter D_c	
Diametro utensile D_c Tool diameter D_c	
Esempio di lavorazione Application example	
Esempio di lavorazione Application example	

3.01



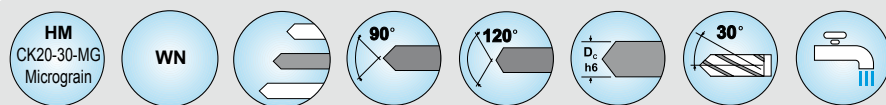
F1.1-1.5 F2.1-2.4



Per i parametri di lavoro vedere pagina 230
For working-parameters see page 230

170- 90°	170- 90°F	170- 120°	170- 120°F	Settori d'impiego / Range of application
				A: Leghe Leggere / Light alloys A1.1-1.6 A2.1-2.7 A3.1-3.2 A4.1-4.2
				C: Acciai / Steels C1.1-1.8 C2.1-2.4 C3.1 C4.1-4.2
				D: Acciai inossidabili / Stainless Steel D1.1-1.5
				E: Titanio / Titanium E1.1-1.3 E2.1-2.2
				F: Ghise / Cast irons F1.1-1.5 F2.1-2.4

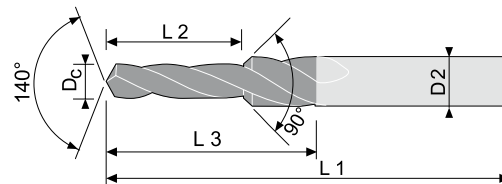
3.01

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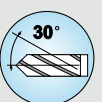
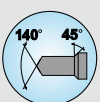
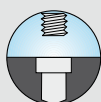
Short solid carbide 90° step drill, for core hole plus countersink for machine tapping



G2.1



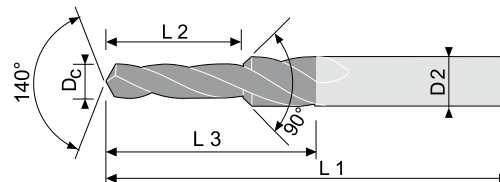
3.02

240

Short solid carbide 90° step drill, for core hole plus countersink for thread forming



G2.1



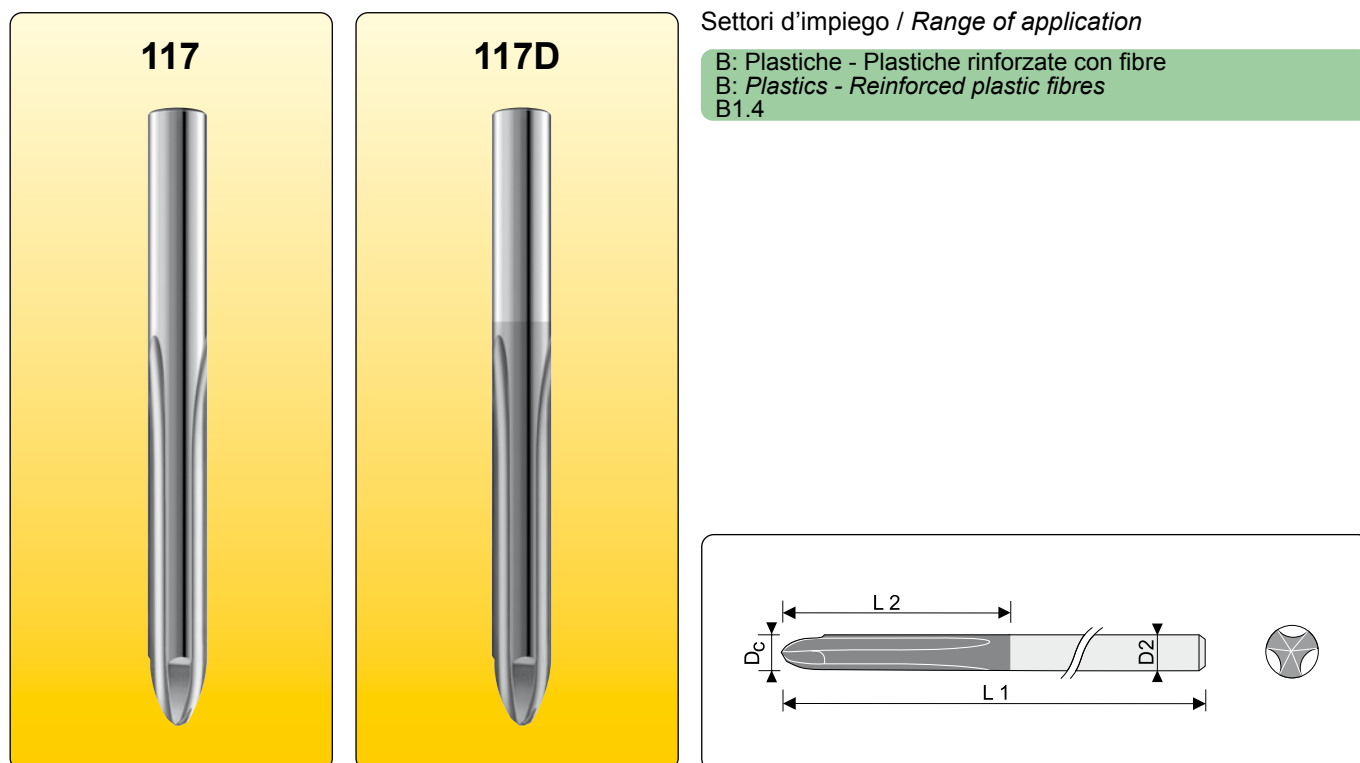
3.02

Utensile combinato per foratura-alesatura - per plastiche rinforzate con fibre - Z=3

"DUO-K"

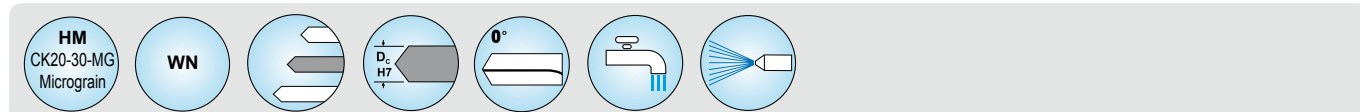
Combi drilling/reaming tool for reinforced plastic fibres - Internal standard

"DUO-K"



Settori d'impiego / Range of application

B: Plastiche - Plastiche rinforzate con fibre
B: Plastics - Reinforced plastic fibres
B1.4



3.
03

D _c H7	L2	L1	D2 H7	117	117D
					Rivestite / Coated
2	50	100	2	117.020	117.020D
2,48	50	100	2,48	117.0248	117.0248D
3	50	100	3	117.030	117.030D
3,17	50	100	3,17	117.0317	117.0317D
4	50	100	4	117.040	117.040D
4,21	50	100	4,21	117.0421	117.0421D
4,82	50	100	4,82	117.0482	117.0482D
5,05	50	100	5,05	117.0505	117.0505D
5,53	50	100	5,53	117.0553	117.0553D
6	50	100	6	117.060	117.060D
6,35	50	100	6,35	117.0635	117.0635D
7	50	100	7	117.070	117.070D
7,92	50	100	7,92	117.0792	117.0792D
8	50	100	8	117.080	117.080D
8,63	50	100	8,63	117.0863	117.0863D
9	50	100	9	117.090	117.090D
10	50	100	10	117.100	117.100D
12	50	100	12	117.120	117.120D

Utensile combinato per foratura-alesatura - per plastiche rinforzate con fibre - Z=4

"DUO-K"

Combi drilling/reaming tool for reinforced plastic fibres - Internal standard Z=4

"DUO-K"

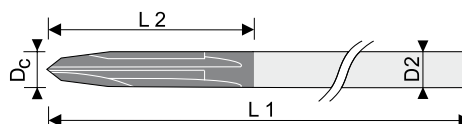
Settori d'impiego / Range of application

B: Plastiche - Plastiche rinforzate con fibre
B: *Plastics - Reinforced plastic fibres*
B1.4

217

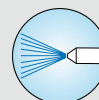
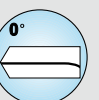
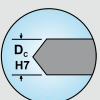


217D



HM
CK20-30-MG
Micrograin

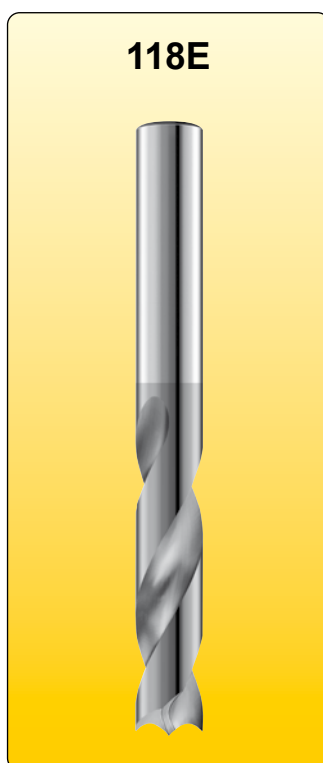
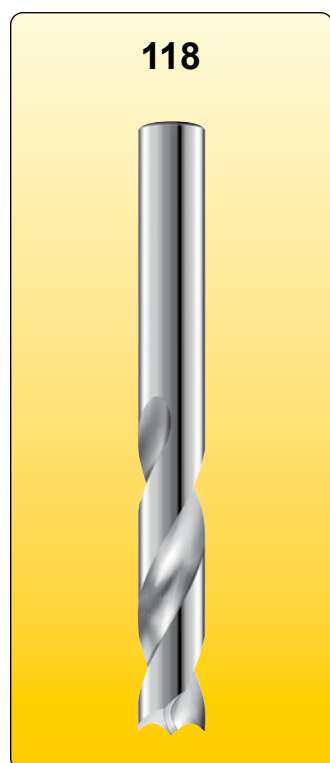
WN



D _c H7	L2	L1	D2 H7	217	217D
					Rivestite / Coated
2	50	100	2	217.020	217.020D
2,48	50	100	2,48	217.0248	217.0248D
3	50	100	3	217.030	217.030D
3,17	50	100	3,17	217.0317	217.0317D
4	50	100	4	217.040	217.040D
4,21	50	100	4,21	217.0421	217.0421D
4,82	50	100	4,82	217.0482	217.0482D
5,05	50	100	5,05	217.0505	217.0505D
5,53	50	100	5,53	217.0553	217.0553D
6	50	100	6	217.060	217.060D
6,35	50	100	6,35	217.0635	217.0635D
6,60	50	100	6,60	217.660	217.660D
7	50	100	7	217.070	217.070D
7,92	50	100	7,92	217.0792	217.0792D
8	50	100	8	217.080	217.080D
8,63	50	100	8,63	217.0863	217.0863D
9	50	100	9	217.090	217.090D
10	50	100	10	217.100	217.100D
12	50	100	12	217.120	217.120D

3.
03

Punte per Kevlar - norma interna Drills for KEVLAR - Internal standard



Settori d'impiego / Range of application

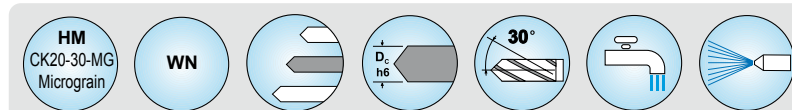
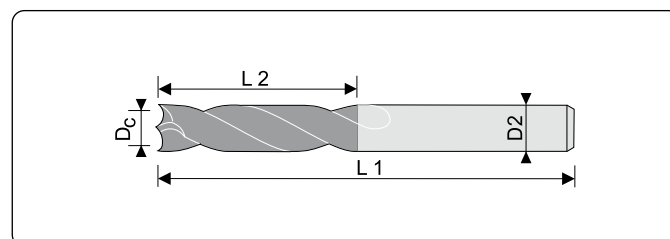
A: Leghe Leggere / Light alloys

A1.1-1.2-1.6 A2.1-2.3-2.5-2.7

B: Plastiche - Plastiche rinforzate con fibre

B: Plastics - Reinforced plastic fibres

B1.1-1.3 B1.5-1.6



3.
03

D _c h6	L2	L1	D2 h6	118	118E
					Rivestite / Coated
3	12	40	3	118.030	118.030E
3,17	12	40	3,17	118.0317	118.0317E
4	18	55	4	118.040	118.040E
5	26	62	5	118.050	118.050E
6	28	66	6	118.060	118.060E
6,35	31	70	6,35	118.0635	118.0635E
6,5	31	70	6,5	118.065	118.065E
7	34	74	7	118.070	118.070E
7,93	37	79	7,93	118.0793	118.0793E
8	37	79	8	118.080	118.080E
8,5	37	79	8,5	118.085	118.085E
9	40	84	9	118.090	118.090E
10	48	89	10	118.100	118.100E
12	50	102	12	118.120	118.120E

Punte a taglienti diritti - Z=2 - DIN 6539 2 straight flute drills - DIN 6539

150



150F



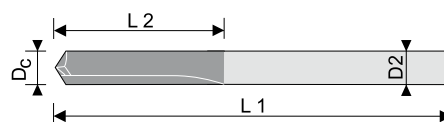
Settori d'impiego / Range of application

C: Acciai / Steels

C1.6-1.8 C2.1-2.4 C3.1-3.5 C4.1-4.2

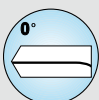
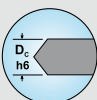
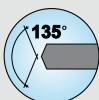
F: Ghise / Cast irons

F1.1-1.5 F2.1-2.4



HM
CK20-30-MG
Micrograin

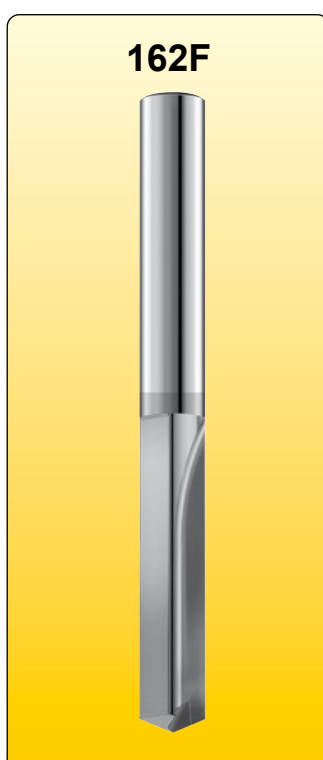
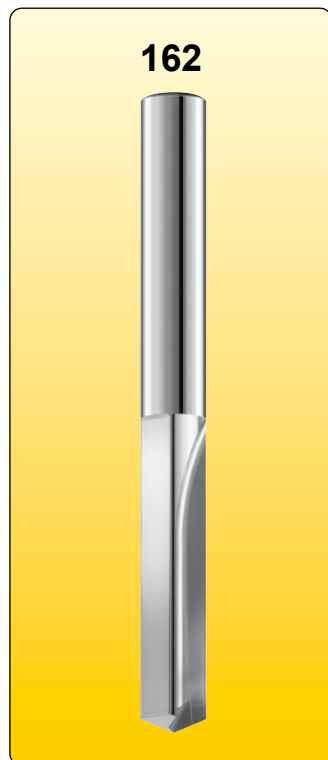
DIN
6539



D _c h6	L2	L1	D2 h6	150	150F
					Rivestite / Coated
2	12	38	2	150.020	150.020F
2,5	14	43	2,5	150.025	150.025F
3	16	46	3	150.030	150.030F
3,5	20	52	3,5	150.035	150.035F
4	22	55	4	150.040	150.040F
5	26	62	5	150.050	150.050F
6	28	66	6	150.060	150.060F
7	34	74	7	150.070	150.070F
8	37	79	8	150.080	150.080F
9	40	84	9	150.090	150.090F
10	43	89	10	150.100	150.100F
12	51	102	12	150.120	150.120F
14	54	107	14	150.140	150.140F
16	58	115	16	150.160	150.160F

**3.
03**

Punte a taglienti diritti - Z=2 - con 4 punti di appoggio - DIN 6539
Star drills straight flute - DIN 6539

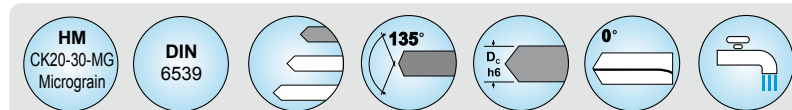
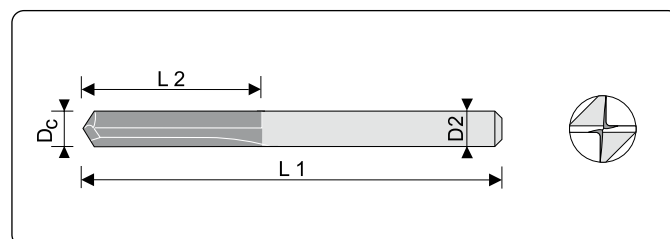


Settori d'impiego / Range of application

A: Leghe Leggere / *Light alloys*
A1.3-1.8

F: Ghise / *Cast irons*
F1.1-1.5

E: Titanio / *Titanium*
E1.1-1.3 E2.1-2.3



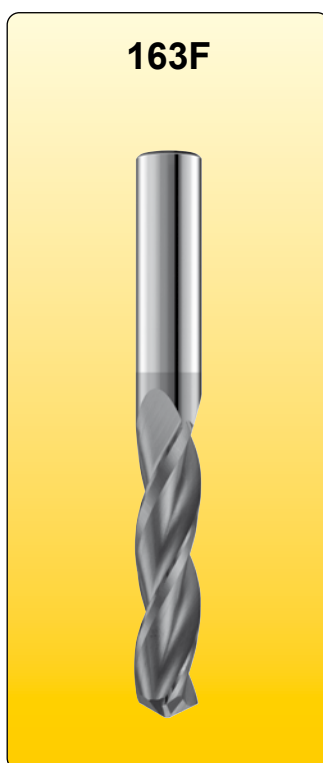
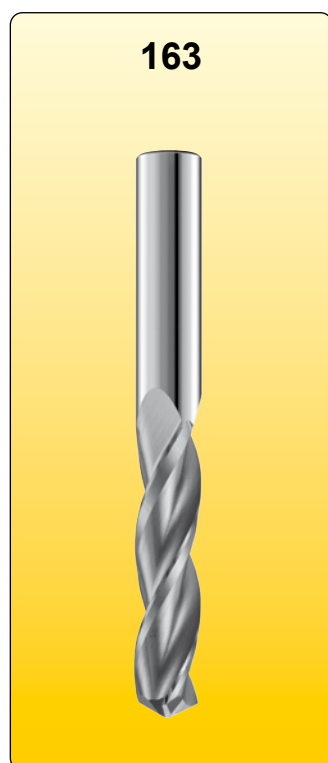
**3.
03**

D _c h6	L2	L1	D2 h6	162	162F
					Rivestite / Coated
2	12	38	2	162.020	162.020F
2,5	14	43	2,5	162.025	162.025F
3	16	46	3	162.030	162.030F
3,5	20	52	3,5	162.035	162.035F
4	22	55	4	162.040	162.040F
4,5	24	58	4,5	162.045	162.045F
5	26	62	5	162.050	162.050F
5,5	28	66	5,5	162.055	162.055F
6	28	66	6	162.060	162.060F
6,5	31	70	6,5	162.065	162.065F
8	37	79	8	162.080	162.080F
8,5	37	79	8,5	162.085	162.085F
9	40	84	9	162.090	162.090F
9,5	40	84	9,5	162.095	162.095F
9,8	43	89	9,8	162.098	162.098F
10	43	89	10	162.100	162.100F
10,5	43	89	10,5	162.105	162.105F
11	47	95	11	162.110	162.110F
11,5	47	95	11,5	162.115	162.115F
12	51	102	12	162.120	162.120F
12,5	51	102	12,5	162.125	162.125F
13	51	102	13	162.130	162.130F
13,5	54	107	13,5	162.135	162.135F



D _c h6	L2	L1	D2 h6	162	162F
					Rivestite / Coated
14	54	107	14	162.140	162.140F
14,5	56	111	14,5	162.145	162.145F
15	56	111	15	162.150	162.150F
15,5	58	115	15,5	162.155	162.155F
16	58	115	16	162.160	162.160F

Punte a 3 eliche - DIN 6539 3 flute twist drills - DIN 6539



Settori d'impiego / Range of application

A: Leghe Leggere / *Light alloys*

A1.1-1.7 A2.1-2.7 A3.1-3.2 A4.1-4.2

C: Acciai / *Steels*

C1.1-1.8 C2.1-2.4 C3.1-3.5 C4.1-4.2

D: Acciai inossidabili / *Stainless Steel*

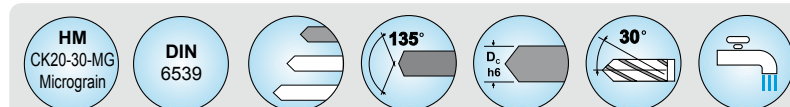
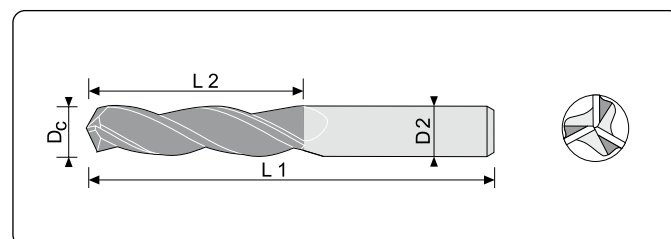
D1.2 D1.4

E: Titanio / *Titanium*

E1.1-1.3 E2.1-2.3

F: Ghise / *Cast irons*

F1.1-1.5 F2.1-2.4



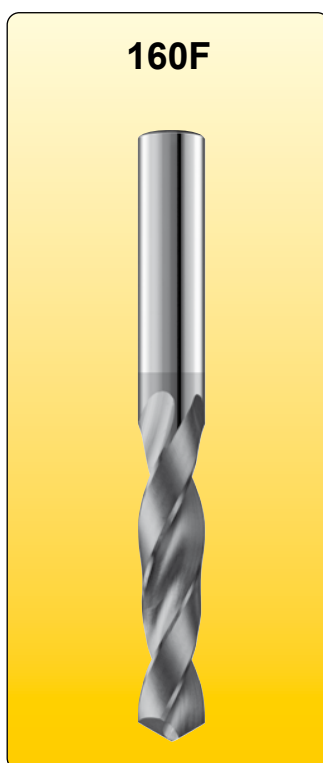
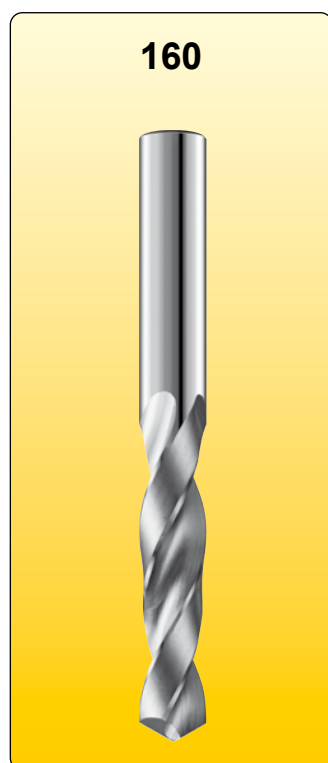
3.
03

D _c h6	L2	L1	D2 h6	163	163F
					Rivestite / Coated
3	16	46	3	163.030	163.030F
3,5	20	52	3,5	163.035	163.035F
4	22	55	4	163.040	163.040F
4,5	24	58	4,5	163.045	163.045F
5	26	62	5	163.050	163.050F
5,5	28	66	5,5	163.055	163.055F
6	28	66	6	163.060	163.060F
6,5	31	70	6,5	163.065	163.065F
7	34	74	7	163.070	163.070F
7,5	34	74	7,5	163.075	163.075F
8	37	79	8	163.080	163.080F
8,5	37	79	8,5	163.085	163.085F
9	40	84	9	163.090	163.090F
9,5	40	84	9,5	163.095	163.095F
10	43	89	10	163.100	163.100F
10,5	43	89	10,5	163.105	163.105F
11	47	95	11	163.110	163.110F
11,5	47	95	11,5	163.115	163.115F
12	51	102	12	163.120	163.120F
12,5	51	102	12,5	163.125	163.125F
13	51	102	13	163.130	163.130F
13,5	54	107	13,5	163.135	163.135F



D _c h6	L2	L1	D2 h6	163	163F
					Rivestite / Coated
14	54	107	14	163.140	163.140F
14,5	56	111	14,5	163.145	163.145F
15	56	111	15	163.150	163.150F
15,5	58	115	15,5	163.155	163.155F
16	58	115	16	163.160	163.160F
16,5	60	119	16,5	163.165	163.165F
17	60	119	17	163.170	163.170F
17,5	62	123	17,5	163.175	163.175F
18	62	123	18	163.180	163.180F
18,5	64	127	18,5	163.185	163.185F
19	64	127	19	163.190	163.190F
19,5	66	131	19,5	163.195	163.195F
20	66	131	20	163.200	163.200F

Punte a 2 eliche - DIN 6539 **2 flute twist drills - DIN 6539**



Settori d'impiego / Range of application

A: Leghe Leggere / Light alloys

A1.1-1.7 A2.1-2.7 A3.1-3.2 A4.1-4.2

B: Plastiche - Plastiche rinforzate con fibre

B: *Plastics - Reinforced plastic fibres*

B1.1-1.5 B2.1-2.4

C: Acciai / Steels

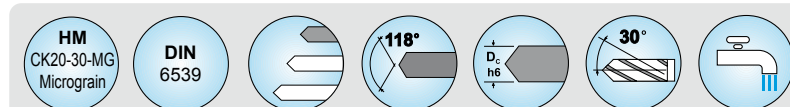
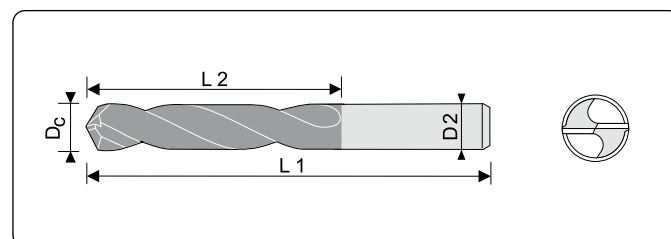
C1.1-1.8 C2.1-2.3 C3.1-3.2 C4.1-4.2

F: Ghise / Cast irons

F1.1-1.2 F1.4-1.5 F2.1-2.2

G: Grafite / Graphite

G2.1



**3.
03**

D _c h6	L2	L1	D2 h6	160	160F
					Rivestite / Coated
2	12	38	2	160.020	160.020F
2,1	12	38	2,1	160.021	160.021F
2,2	13	40	2,2	160.022	160.022F
2,3	13	40	2,3	160.023	160.023F
2,4	14	43	2,4	160.024	160.024F
2,5	14	43	2,5	160.025	160.025F
2,6	14	43	2,6	160.026	160.026F
2,7	16	46	2,7	160.027	160.027F
2,8	16	46	2,8	160.028	160.028F
2,9	16	46	2,9	160.029	160.029F
3	16	46	3	160.030	160.030F
3,1	18	49	3,1	160.031	160.031F
3,2	18	49	3,2	160.032	160.032F
3,3	18	49	3,3	160.033	160.033F
3,4	20	52	3,4	160.034	160.034F
3,5	20	52	3,5	160.035	160.035F
3,6	20	52	3,6	160.036	160.036F
3,7	20	52	3,7	160.037	160.037F
3,8	22	55	3,8	160.038	160.038F
3,9	22	55	3,9	160.039	160.039F
4	22	55	4	160.040	160.040F
4,1	22	55	4,1	160.041	160.041F
4,2	22	55	4,2	160.042	160.042F
4,3	24	58	4,3	160.043	160.043F
4,4	24	58	4,4	160.044	160.044F

D _c h6	L2	L1	D2 h6	160	160F
					Rivestite / Coated
4,5	24	58	4,5	160.045	160.045F
4,6	24	58	4,6	160.046	160.046F
4,7	24	58	4,7	160.047	160.047F
4,8	26	62	4,8	160.048	160.048F
4,9	26	62	4,9	160.049	160.049F
5	26	62	5	160.050	160.050F
5,1	26	62	5,1	160.051	160.051F
5,2	26	62	5,2	160.052	160.052F
5,3	26	62	5,3	160.053	160.053F
5,4	28	66	5,4	160.054	160.054F
5,5	28	66	5,5	160.055	160.055F
5,6	28	66	5,6	160.056	160.056F
5,7	28	66	5,7	160.057	160.057F
5,8	28	66	5,8	160.058	160.058F
5,9	28	66	5,9	160.059	160.059F
6	28	66	6	160.060	160.060F
6,1	31	70	6,1	160.061	160.061F
6,2	31	70	6,2	160.062	160.062F
6,3	31	70	6,3	160.063	160.063F
6,4	31	70	6,4	160.064	160.064F
6,5	31	70	6,5	160.065	160.065F
6,8	34	74	6,8	160.068	160.068F
7	34	74	7	160.070	160.070F
7,5	34	74	7,5	160.075	160.075F
7,8	37	79	7,8	160.078	160.078F
8	37	79	8	160.080	160.080F
8,5	37	79	8,5	160.085	160.085F
9	40	84	9	160.090	160.090F
9,5	40	84	9,5	160.095	160.095F
9,8	43	89	9,8	160.098	160.098F
10	43	89	10	160.100	160.100F
10,2	43	89	10,2	160.102	160.102F
10,5	43	89	10,5	160.105	160.105F
10,8	47	95	10,8	160.108	160.108F
11	47	95	11	160.110	160.110F
11,2	47	95	11,2	160.112	160.112F
11,5	47	95	11,5	160.115	160.115F
11,8	47	95	11,8	160.118	160.118F
12	51	102	12	160.120	160.120F
12,5	51	102	12,5	160.125	160.125F
13	51	102	13	160.130	160.130F
13,5	54	107	13,5	160.135	160.135F
14	54	107	14	160.140	160.140F
14,5	56	111	14,5	160.145	160.145F
15	56	111	15	160.150	160.150F
15,5	58	115	15,5	160.155	160.155F
16	58	115	16	160.160	160.160F
16,5	60	119	16,5	160.165	160.165F
17	60	119	17	160.170	160.170F
17,5	62	123	17,5	160.175	160.175F
18	62	123	18	160.180	160.180F
18,5	64	127	18,5	160.185	160.185F
19	64	127	19	160.190	160.190F
19,5	66	131	19,5	160.195	160.195F
20	66	131	20	160.200	160.200F

Punte a 2 eliche - lunga - DIN 338

2 flute twist drills - long according to DIN 338



Settori d'impiego / Range of application

A: Leghe Leggere / Light alloys

A1.1-1.7 A2.1-2.7 A3.1-3.2 A4.1-4.2

B: Plastiche - Plastiche rinforzate con fibre

B: *Plastics - Reinforced plastic fibres*

B1.1-1.5 B2.1-2.4

C: Acciai / Steels

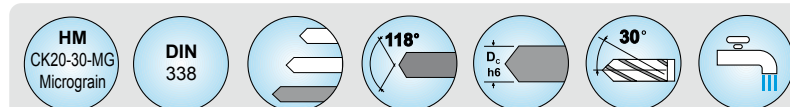
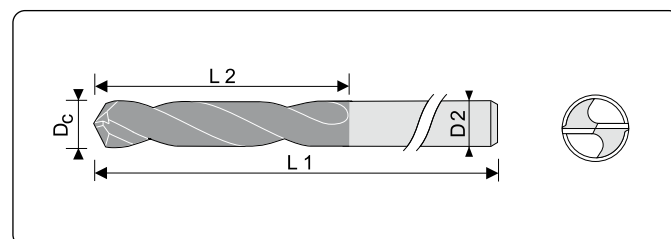
C1.1-1.8 C2.1-2.3 C3.1-3.2 C4.1-4.2

F: Ghise / Cast irons

F1.1-1.2 F1.4-1.5 F2.1-2.2

G: Grafite / Graphite

G2.1



3.
03

D _c h6	L2	L1	D2 h6	161	161F
					Rivestite / Coated
2	24	49	2	161.020	161.020F
2,1	24	49	2,1	161.021	161.021F
2,2	27	53	2,2	161.022	161.022F
2,3	27	53	2,3	161.023	161.023F
2,4	30	57	2,4	161.024	161.024F
2,5	30	57	2,5	161.025	161.025F
2,6	30	57	2,6	161.026	161.026F
2,7	33	61	2,7	161.027	161.027F
2,8	33	61	2,8	161.028	161.028F
2,9	33	61	2,9	161.029	161.029F
3	33	61	3	161.030	161.030F
3,1	36	65	3,1	161.031	161.031F
3,2	36	65	3,2	161.032	161.032F
3,3	36	65	3,3	161.033	161.033F
3,4	39	70	3,4	161.034	161.034F
3,5	39	70	3,5	161.035	161.035F
3,6	39	70	3,6	161.036	161.036F
3,7	39	70	3,7	161.037	161.037F
3,8	43	75	3,8	161.038	161.038F
3,9	43	75	3,9	161.039	161.039F
4	43	75	4	161.040	161.040F
4,1	43	75	4,1	161.041	161.041F

D _c h6	L2	L1	D2 h6	161	161F
					Rivestite / Coated
4,2	43	75	4,2	161.042	161.042F
4,3	47	80	4,3	161.043	161.043F
4,4	47	80	4,4	161.044	161.044F
4,5	47	80	4,5	161.045	161.045F
4,6	47	80	4,6	161.046	161.046F
4,7	47	80	4,7	161.047	161.047F
4,8	52	86	4,8	161.048	161.048F
4,9	52	86	4,9	161.049	161.049F
5	52	86	5	161.050	161.050F
5,1	52	86	5,1	161.051	161.051F
5,2	52	86	5,2	161.052	161.052F
5,3	52	86	5,3	161.053	161.053F
5,4	57	93	5,4	161.054	161.054F
5,5	57	93	5,5	161.055	161.055F
5,6	57	93	5,6	161.056	161.056F
5,7	57	93	5,7	161.057	161.057F
5,8	57	93	5,8	161.058	161.058F
5,9	57	93	5,9	161.059	161.059F
6	57	93	6	161.060	161.060F
6,1	63	101	6,1	161.061	161.061F
6,2	63	101	6,2	161.062	161.062F
6,3	63	101	6,3	161.063	161.063F
6,4	63	101	6,4	161.064	161.064F
6,5	63	101	6,5	161.065	161.065F
6,8	69	109	6,8	161.068	161.068F
7	69	109	7	161.070	161.070F
7,5	69	109	7,5	161.075	161.075F
8	75	117	8	161.080	161.080F
8,5	75	117	8,5	161.085	161.085F
9	81	125	9	161.090	161.090F
9,5	81	125	9,5	161.095	161.095F
10	87	133	10	161.100	161.100F
10,5	87	133	10,5	161.105	161.105F
11	94	142	11	161.110	161.110F
11,5	94	142	11,5	161.115	161.115F
12	101	151	12	161.120	161.120F
12,5	101	151	12,5	161.125	161.125F
13	101	151	13	161.130	161.130F
13,5	108	160	13,5	161.135	161.135F
14	108	160	14	161.140	161.140F
14,5	114	169	14,5	161.145	161.145F
15	114	169	15	161.150	161.150F
15,5	120	178	15,5	161.155	161.155F
16	120	178	16	161.160	161.160F

Punte a 2 eliche per leghe leggere - DIN 6539 Twist drills for cast iron and light alloys - DIN 6539



Settori d'impiego / Range of application

A: Leghe Leggere / Light alloys

A1.1-1.7 A2.1-2.7 A3.1-3.2 A4.1-4.2

B: Plastiche - Plastiche rinforzate con fibre

B: Plastics - Reinforced plastic fibres

B1.1-1.3 B1.5 B2.1-2.3

C: Acciai / Steels

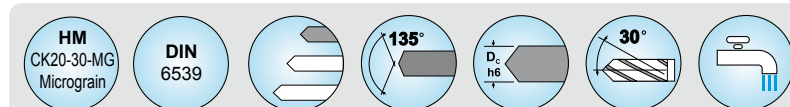
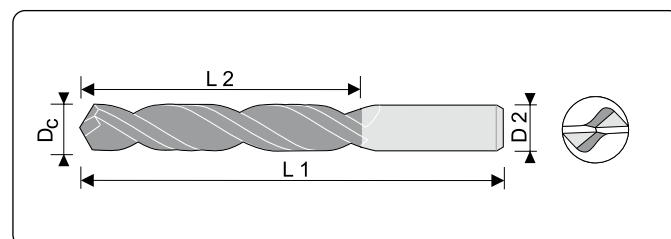
C1.1-1.5

E: Titanio / Titanium

E1.1-1.2 E2.1-2.2

F: Ghise / Cast irons

F1.1-1.5 F2.1-2.4



3.
03

D _c h6	L2	L1	D2 h6	165	165F
					Rivestite / Coated
2	12	38	2	165.020	165.020F
2,5	14	43	2,5	165.025	165.025F
3	16	46	3	165.030	165.030F
3,5	20	52	3,5	165.035	165.035F
4	22	55	4	165.040	165.040F
4,5	24	58	4,5	165.045	165.045F
5	26	62	5	165.050	165.050F
5,5	28	66	5,5	165.055	165.055F
6	28	66	6	165.060	165.060F
6,5	31	70	6,5	165.065	165.065F
7	34	74	7	165.070	165.070F
7,5	34	74	7,5	165.075	165.075F
8	37	79	8	165.080	165.080F
8,5	37	79	8,5	165.085	165.085F
9	40	84	9	165.090	165.090F
9,5	40	84	9,5	165.095	165.095F
10	43	89	10	165.100	165.100F
10,5	43	89	10,5	165.105	165.105F
11	47	95	11	165.110	165.110F
12	51	102	12	165.120	165.120F
12,5	51	102	12,5	165.125	165.125F
13	51	102	13	165.130	165.130F
13,5	54	107	13,5	165.135	165.135F
14	54	107	14	165.140	165.140F
14,5	56	111	14,5	165.145	165.145F



D _c h6	L2	L1	D2 h6	165	165F
					Rivestite / Coated
15	56	111	15	165.150	165.150F
15,5	58	115	15,5	165.155	165.155F
16	58	115	16	165.160	165.160F
16,5	60	119	16,5	165.165	165.165F
17	60	119	17	165.170	165.170F
17,5	62	123	17,5	165.175	165.175F
18	62	123	18	165.180	165.180F
18,5	64	127	18,5	165.185	165.185F
19	64	127	19	165.190	165.190F
19,5	66	131	19,5	165.195	165.195F
20	66	131	20	165.200	165.200F

Punte a 2 eliche per leghe leggere - lunga - DIN 338 Twist drills for cast iron and light alloys - long according to DIN 338

166

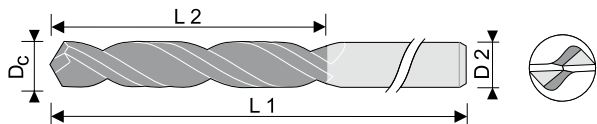


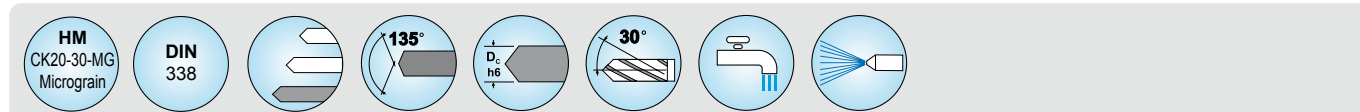
166F



Settori d'impiego / Range of application

- A: Leghe Leggere / Light alloys
A1.1-1.7 A2.1-2.7 A3.1-3.2 A4.1-4.2
- B: lastiche - Plastiche rinforzate con fibre
B: Plastics - Reinforced plastic fibres
B1.1-1.3 B1.5 B2.1-2.3
- C: Acciai / Steels
C1.1-1.5
- E: Titanio / Titanium
E1.1-1.2 E2.1-2.2
- F: Ghise / Cast irons
F1.1-1.5 F2.1-2.4





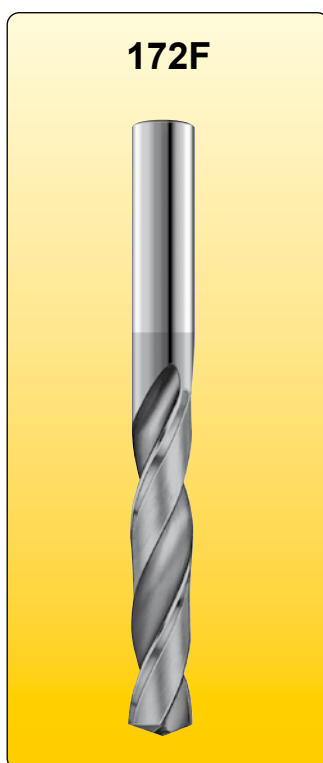
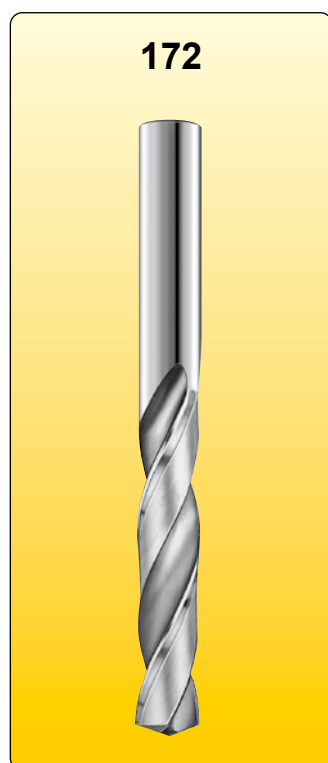
3.
03

D _c h6	L2	L1	D2 h6	166	166F
					Rivestite / Coated
2	24	49	2	166.020	166.020F
2,5	30	57	2,5	166.025	166.025F
3	33	61	3	166.030	166.030F
3,5	39	70	3,5	166.035	166.035F
4	43	75	4	166.040	166.040F
4,5	47	80	4,5	166.045	166.045F
5	52	86	5	166.050	166.050F
5,5	57	93	5,5	166.055	166.055F
6	57	93	6	166.060	166.060F
6,5	63	101	6,5	166.065	166.065F
7	69	109	7	166.070	166.070F
7,5	69	109	7,5	166.075	166.075F
8	75	117	8	166.080	166.080F
8,5	75	117	8,5	166.085	166.085F
9	81	125	9	166.090	166.090F
9,5	81	125	9,5	166.095	166.095F
10	87	133	10	166.100	166.100F
10,5	87	133	10,5	166.105	166.105F
11	94	142	11	166.110	166.110F
11,5	94	142	11,5	166.115	166.115F
12	101	151	12	166.120	166.120F
13	101	151	13	166.130	166.130F



D _c h6	L2	L1	D2 h6	166	166F
					Rivestite / Coated
14	108	155	14	166.140	166.140F
14,5	114	169	14,5	166.145	166.145F
15	114	169	15	166.150	166.150F
15,5	120	178	15,5	166.155	166.155F
16	120	178	16	166.160	166.160F

Punte a 2 eliche ad elevato avanzamento - DIN 6539 High performance twist drills-self centering - DIN 6539



Settori d'impiego / Range of application

A: Leghe leggere / Light alloys

A1.1-1.7 A2.1-2.7 A3.1-3.2 A4.1-4.2

C: Acciai / Steels

C1.1-1.8 C2.1-2.4 C3.1-3.5 C4.4-4.2

D: Acciai inossidabili / Stainless Steel

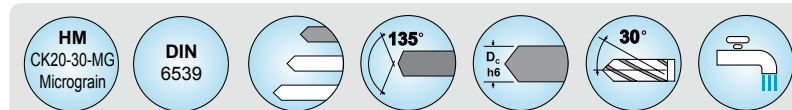
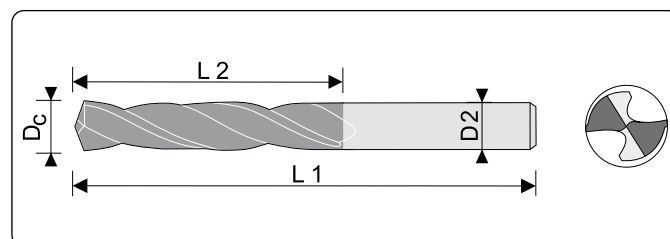
D1.1-1.5.2

E: Titanio / Titanium

E1.1-1.3 E2.1-2.2

F: Ghise / Cast irons

F1.1-1.5 F2.1-2.4

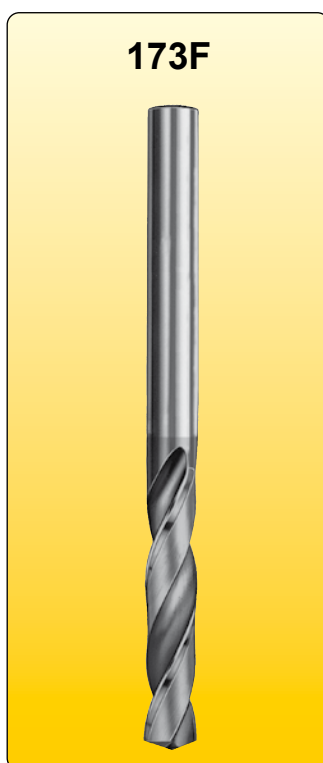
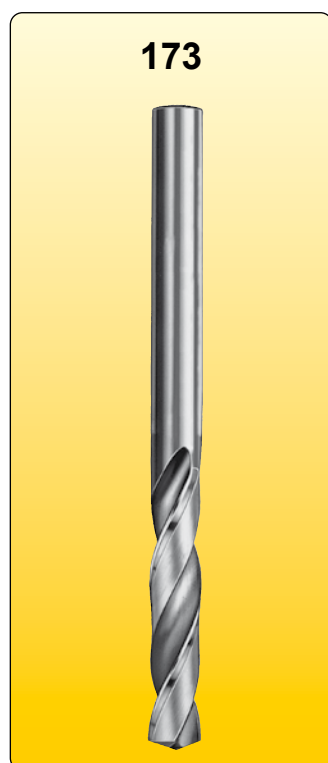


3.
03

D _c h6	L2	L1	D2 h6	172	172F
					Rivestite / Coated
3	16	46	3	172.030	172.030F
3,1	18	49	3,1	172.031	172.031F
3,2	18	49	3,2	172.032	172.032F
3,3	18	49	3,3	172.033	172.033F
3,4	20	52	3,4	172.034	172.034F
3,5	20	52	3,5	172.035	172.035F
3,6	20	52	3,6	172.036	172.036F
3,7	20	52	3,7	172.037	172.037F
3,8	22	55	3,8	172.038	172.038F
3,9	22	55	3,9	172.039	172.039F
4	22	55	4	172.040	172.040F
4,1	22	55	4,1	172.041	172.041F
4,2	22	55	4,2	172.042	172.042F
4,3	24	58	4,3	172.043	172.043F
4,4	24	58	4,4	172.044	172.044F
4,5	24	58	4,5	172.045	172.045F
4,6	24	58	4,6	172.046	172.046F
4,7	24	58	4,7	172.047	172.047F
4,8	26	62	4,8	172.048	172.048F
5	26	62	5	172.050	172.050F
5,1	26	62	5,1	172.051	172.051F
5,3	26	62	5,3	172.053	172.053F

D _c h6	L2	L1	D2 h6	172	172F
					Rivestite / Coated
5,5	28	66	5,5	172.055	172.055F
5,8	28	66	5,8	172.058	172.058F
6	28	66	6	172.060	172.060F
6,4	31	70	6,4	172.064	172.064F
6,5	31	70	6,5	172.065	172.065F
6,6	31	70	6,6	172.066	172.066F
6,8	34	74	6,8	172.068	172.068F
7	34	74	7	172.070	172.070F
7,5	34	74	7,5	172.075	172.075F
7,8	37	79	7,8	172.078	172.078F
8	37	79	8	172.080	172.080F
8,4	37	79	8,4	172.084	172.084F
8,5	37	79	8,5	172.085	172.085F
8,8	40	84	8,8	172.088	172.088F
9	40	84	9	172.090	172.090F
9,5	40	84	9,5	172.095	172.095F
9,8	43	89	9,8	172.098	172.098F
10	43	89	10	172.100	172.100F
10,2	43	89	10,2	172.102	172.102F
10,5	43	89	10,5	172.105	172.105F
10,8	47	95	10,8	172.108	172.108F
11	47	95	11	172.110	172.110F
11,5	47	95	11,5	172.115	172.115F
11,8	47	95	11,8	172.118	172.118F
12	51	102	12	172.120	172.120F
12,5	51	102	12,5	172.125	172.125F
12,8	51	102	12,8	172.128	172.128F
13	51	102	13	172.130	172.130F
13,5	54	107	13,5	172.135	172.135F
13,8	54	107	13,8	172.138	172.138F
14	54	107	14	172.140	172.140F
14,5	56	111	14,5	172.145	172.145F
14,8	56	111	14,8	172.148	172.148F
15	56	111	15	172.150	172.150F
15,5	58	115	15,5	172.155	172.155F
15,8	58	115	15,8	172.158	172.158F
16	58	115	16	172.160	172.160F
16,5	60	119	16,5	172.165	172.165F
17	60	119	17	172.170	172.170F
17,5	62	123	17,5	172.175	172.175F
18	62	123	18	172.180	172.180F
18,5	64	127	18,5	172.185	172.185F
19	64	127	19	172.190	172.190F
19,5	66	131	19,5	172.195	172.195F
20	66	131	20	172.200	172.200F

Punte a 2 eliche ad elevato avanzamento - norma interna High performance twist drills-self centering - WN



Settore d'impiego / Range of application

A: Leghe Leggere / Light alloys

A1.1-1.7 A2.1-2.7 A3.1-3.2

C: Acciai / Steels

C1.1-1.8 C2.1-2.4 C3.1-3.5 C4.4-4.2

D: Acciai inossidabili / Stainless Steel

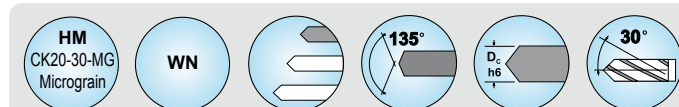
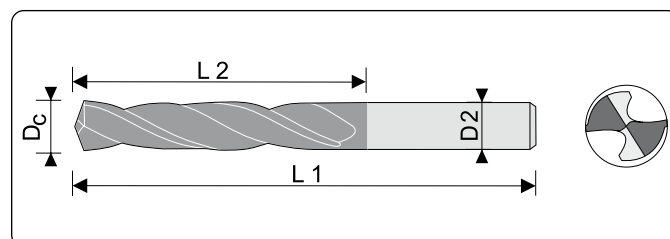
D1.1-1.5.2

E: Titanio / Titanium

E1.1-1.3 E2.1-2.2

F: Ghise / Cast irons

F1.1-1.5 F2.1-2.4

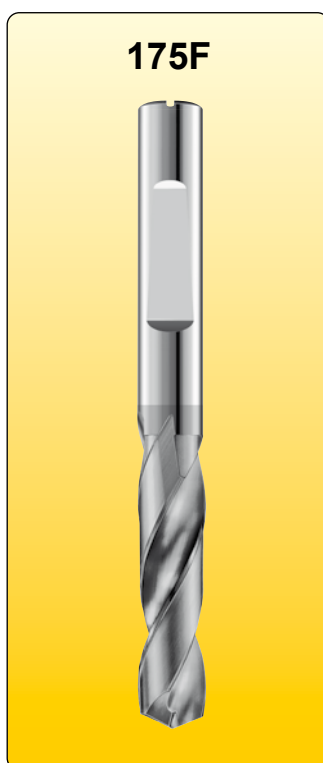
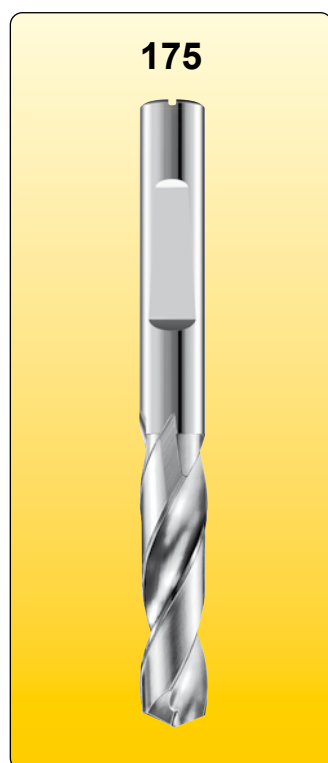


3.
03

D _c h6	L2	L1	D2 h6	173	173F
					Rivestite / Coated
4	40	75	4	173.040	173.040F
4,2	40	75	4,2	173.042	173.042F
4,3	42	80	4,3	173.043	173.043F
4,5	42	80	4,5	173.045	173.045F
4,8	45	86	4,8	173.048	173.048F
5	45	86	5	173.050	173.050F
5,1	45	86	5,1	173.051	173.051F
5,2	45	86	5,2	173.052	173.052F
5,5	48	93	5,5	173.055	173.055F
5,8	48	93	5,8	173.058	173.058F
6	48	93	6	173.060	173.060F
6,1	52	101	6,1	173.061	173.061F
6,5	52	101	6,5	173.065	173.065F
6,6	52	101	6,6	173.066	173.066F
6,8	55	109	6,8	173.068	173.068F
6,9	55	109	6,9	173.069	173.069F
7	55	109	7	173.070	173.070F
7,5	55	109	7,5	173.075	173.075F
7,8	59	117	7,8	173.078	173.078F
7,9	59	117	7,9	173.079	173.079F
8	59	117	8	173.080	173.080F
8,5	59	117	8,5	173.085	173.085F

D _c h6	L2	L1	D2 h6	173	173F
					Rivestite / Coated
8,6	65	125	8,6	173.086	173.086F
8,8	65	125	8,8	173.088	173.088F
9	65	125	9	173.090	173.090F
9,5	65	125	9,5	173.095	173.095F
9,6	69	133	9,6	173.096	173.096F
9,8	69	133	9,8	173.098	173.098F
10	69	133	10	173.100	173.100F
10,2	69	133	10,2	173.102	173.102F
10,4	69	133	10,4	173.104	173.104F
10,5	69	133	10,5	173.105	173.105F
10,8	75	142	10,8	173.108	173.108F
11	75	142	11	173.110	173.110F
11,5	75	142	11,5	173.115	173.115F
11,8	86	151	11,8	173.118	173.118F
12	86	151	12	173.120	173.120F
12,5	86	151	12,5	173.125	173.125F
13	86	151	13	173.130	173.130F
13,5	92	160	13,5	173.135	173.135F
14	92	160	14	173.140	173.140F
14,2	98	169	14,2	173.142	173.142F
14,5	98	169	14,5	173.145	173.145F
15	98	169	15	173.150	173.150F
15,5	105	178	15,5	173.155	173.155F
16	105	178	16	173.160	173.160F
16,5	110	184	16,5	173.165	173.165F
17	110	184	17	173.170	173.170F
17,5	112	191	17,5	173.175	173.175F
17,7	112	191	17,7	173.177	173.177F
18	112	191	18	173.180	173.180F
18,5	112	198	18,5	173.185	173.185F
19	112	198	19	173.190	173.190F
19,5	120	205	19,5	173.195	173.195F
20	120	205	20	173.200	173.200F

Punte a 2 eliche ad elevato avanzamento con adduzione interna - DIN 6537-K
High performance twist drills with coolant ducts-self centering-short acc. to DIN 6537-K



Settori d'impiego / Range of application

A: Leghe Leggere / Light alloys

A1.1-1.7 A2.1-2.7 A3.1-3.2

C: Acciai / Steels

C1.1-1.8 C2.1-2.4 C3.1-3.5 C4.4-4.2

D: Acciai inossidabili/ Stainless Steel

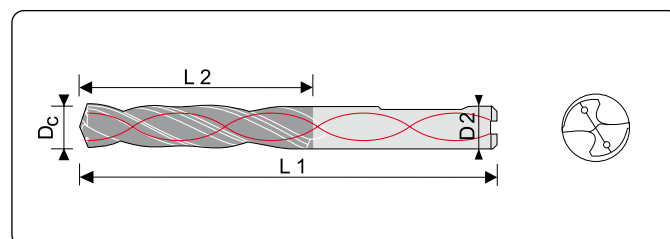
D1.1-1.5.2

E: Titanio / Titanium

E1.1-1.3 E2.1-2.2

F: Ghise / Cast irons

F1.1-1.5 F2.1-2.4



**3.
03**

D _c h6	L2	L1	D2 h6	175	175F
					Rivestite / Coated
5,8	28	66	6	175.058	175.058F
6	28	66	6	175.060	175.060F
6,8	34	79	8	175.068	175.068F
7	34	79	8	175.070	175.070F
7,8	37	79	8	175.078	175.078F
8	37	79	8	175.080	175.080F
8,5	37	89	10	175.085	175.085F
8,8	40	89	10	175.088	175.088F
9	40	89	10	175.090	175.090F
9,5	40	89	10	175.095	175.095F
9,8	43	89	10	175.098	175.098F
10	43	89	10	175.100	175.100F
10,5	43	102	12	175.105	175.105F
10,8	47	102	12	175.108	175.108F
11	47	102	12	175.110	175.110F
11,5	47	102	12	175.115	175.115F
11,8	47	102	12	175.118	175.118F
12	51	102	12	175.120	175.120F
12,5	51	107	14	175.125	175.125F
13	51	107	14	175.130	175.130F
13,5	51	107	14	175.135	175.135F
14	51	107	14	175.140	175.140F



D _c h6	L2	L1	D2 h6	175	175F
					Rivestite / Coated
14,5	56	115	16	175.145	175.145F
15	56	115	16	175.150	175.150F
15,5	58	115	16	175.155	175.155F
16	58	115	16	175.160	175.160F
16,5	60	123	18	175.165	175.165F
17	60	123	18	175.170	175.170F
17,5	62	123	18	175.175	175.175F
18	62	123	18	175.180	175.180F
18,5	64	131	20	175.185	175.185F
19	64	131	20	175.190	175.190F
19,5	66	131	20	175.195	175.195F
20	66	131	20	175.200	175.200F

Punte a 2 eliche ad elevato avanzamento con adduzione interna - lunga - DIN 6537-K
High performance twist drills with coolant ducts-self centering-long acc. to DIN 6537-L



Settori d'impiego / Range of application

A: Leghe Leggere / Light alloys

A1.1-1.7 A2.1-2.7 A3.1-3.2

C: Acciai / Steels

C1.1-1.8 C2.1-2.4 C3.1-3.5 C4.4-4.2

D: Acciai inossidabili / Stainless Steel

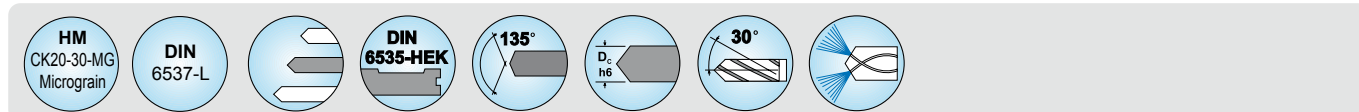
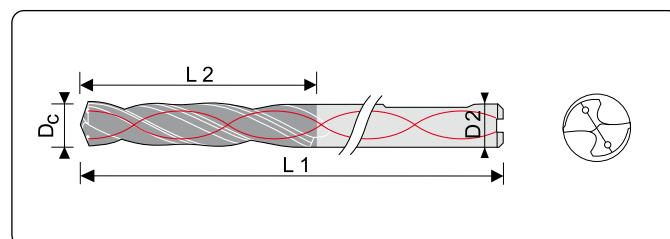
D1.1-1.5.2

E: Titanio / Titanium

E1.1-1.3 E2.1-2.2

F: Ghise / Cast irons

F1.1-1.5 F2.1-2.4



**3.
03**

D _c h6	L2	L1	D2 h6	176	176F
					Rivestite / Coated
5,8	40	82	6	176.058	176.058F
6	40	82	6	176.060	176.060F
6,8	45	91	8	176.068	176.068F
7	45	91	8	176.070	176.070F
7,8	48	91	8	176.078	176.078F
8	48	91	8	176.080	176.080F
8,5	52	103	10	176.085	176.085F
8,8	54	103	10	176.088	176.088F
9	54	103	10	176.090	176.090F
9,5	56	103	10	176.095	176.095F
9,8	58	103	10	176.098	176.098F
10	58	103	10	176.100	176.100F
10,5	65	118	12	176.105	176.105F
10,8	66	118	12	176.108	176.108F
11	66	118	12	176.110	176.110F
11,5	70	118	12	176.115	176.115F
11,8	70	118	12	176.118	176.118F
12	72	118	12	176.120	176.120F
12,5	72	124	14	176.125	176.125F
13	76	124	14	176.130	176.130F
13,5	76	124	14	176.135	176.135F
14	76	124	14	176.140	176.140F



D _c h6	L2	L1	D2 h6	176	176F
					Rivestite / Coated
14,5	78	133	16	176.145	176.145F
15	80	133	16	176.150	176.150F
15,5	80	133	16	176.155	176.155F
16	80	133	16	176.160	176.160F
16,5	82	143	18	176.165	176.165F
17	90	143	18	176.170	176.170F
17,5	92	143	18	176.175	176.175F
18	92	143	18	176.180	176.180F
18,5	100	153	20	176.185	176.185F
19	100	153	20	176.190	176.190F
19,5	100	153	20	176.195	176.195F
20	102	153	20	176.200	176.200F



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3.
03



04

Alesatori - Allargatori
Reamers - Core drills



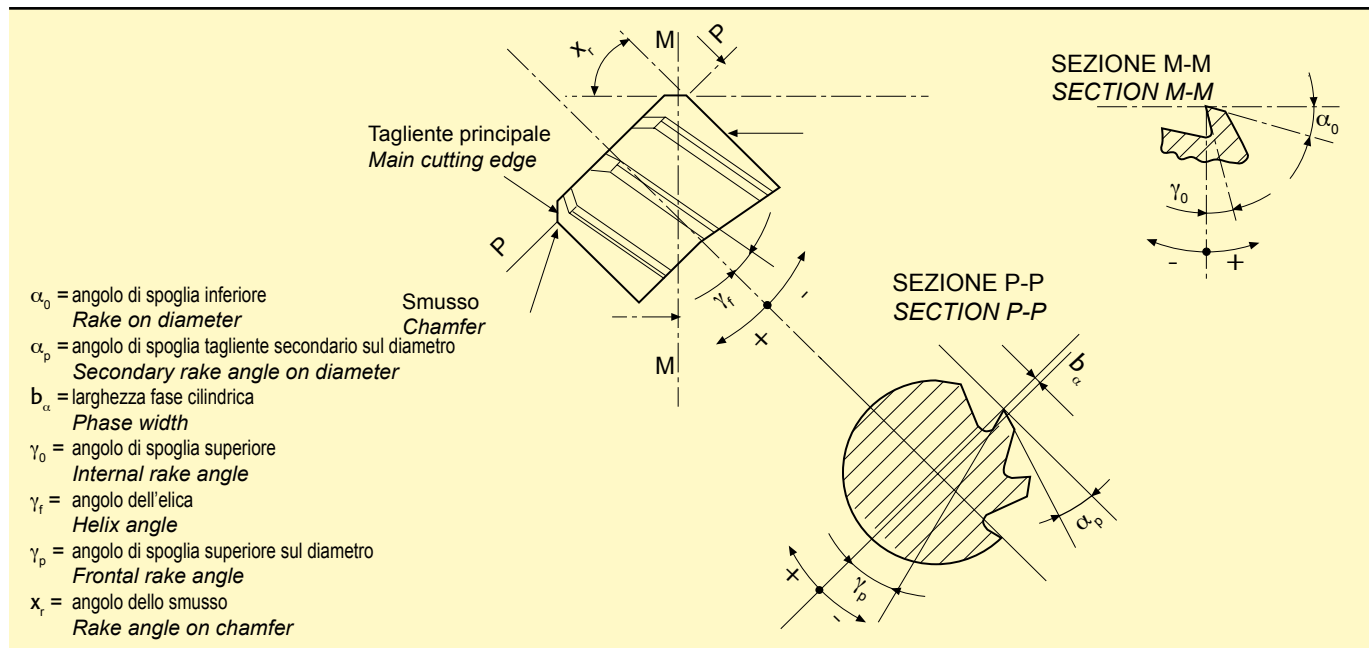
Indice Index

Utensili gruppo 4: Alesatori - Allargatori	Tools Group 4: Reamers - Core drills	N° id. Code	Pagina Page
Introduzione	Introduction		269 ÷ 275

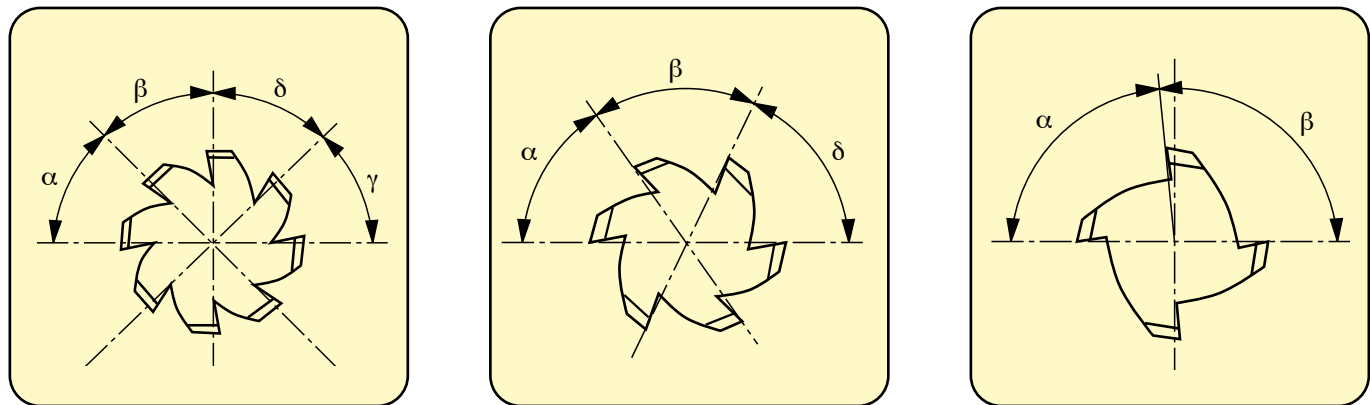
Utensili gruppo 4.1: Alesatori - Allargatori	Tools Group 4.1:	N° id. Code	Pagina Page
Alesatori ad elica sinistra e taglio destro - tipo B Tipo di metallo duro K10 - micrograna - DIN 8093 (212) - divisione irregolare - tolleranza H7	Reamers left hand spiral - right hand cut - Type «B» Tolerance H7 - DIN 8093 (212) - Uneven indexing - K10 - Micrograin carbide	122	276
Alesatori ad elica sinistra e taglio destro - tipo B Tipo di metallo duro K10 - micrograna - DIN 8093 (212) - divisione irregolare - tolleranza H7	Reamers left hand spiral - right hand cut - Type «B» Tolerance H7 - DIN 8093 (212) - Uneven indexing - K10 - Micrograin carbide	122	277
Alesatori a tagliente diritto - tipo A Tipo di metallo duro K10 - micrograna - DIN 8093 (212) - divisione irregolare - tolleranza H7	Straight flute reamers - Type «A» Tolerance H7 - K10 - Micrograin carbide - DIN 8093 (212) - Uneven indexing	131	278
Alesatori ad elica sinistra e taglio destro - tipo B Tipo di metallo duro K10 - micrograna - tolleranza H7	Reamers left hand spiral - right hand cut - Type «B» Tolerance H7 - K10 - Micrograin carbide - Internal norm	120	279
Alesatori ad elica destra e taglio destro - tipo C Tipo di metallo duro K10 - micrograna - tolleranza H7	Reamers right hand spiral - right hand cut - Type «C» Tolerance H7 - K10 - Micrograin carbide - Internal norm	125	280

Alesatori: geometria - tolleranze e divisione taglio

Reamers: geometry - tolerances and division of cutting edges



divisione di taglio irregolare uneven division of cutting edges





Velocità di taglio V_c (m/min) - Numero di giri n (min⁻¹)
Cutting speeds V_c (m/min) - Revolution per minute n (min⁻¹)

Formule di calcolo: Velocità di taglio V_c (m/min) - Numero di giri n (min⁻¹)
Calculation formula: Cutting speed V_c (m/min) - Revolution per minute n (min⁻¹)

$$V_c \text{ (m/min)} = \frac{D_c \text{ (mm)} \times 3,14 \times n \text{ (min}^{-1}\text{)}}{1000}$$

$$n \text{ (min}^{-1}\text{)} = \frac{V_c \text{ (m/min)} \times 1000}{D_c \text{ (mm)} \times 3,14}$$

D_c (mm)	V_c (m/min)										
	5	8	10	12	15	20	25	30	35	40	45
	Numero di giri n (min ⁻¹) / Revolution per minute n (min ⁻¹)										
2,00	796	1274	1592	1911	2389	3185	3981	4777	5573	6369	7166
2,50	637	1019	1274	1529	1911	2548	3185	3822	4459	5096	5732
3,00	531	849	1062	1274	1592	2123	2654	3185	3715	4246	4777
3,50	455	728	910	1092	1365	1820	2275	2730	3185	3640	4095
4,00	398	637	796	955	1194	1592	1990	2389	2787	3185	3583
4,50	354	566	708	849	1062	1415	1769	2123	2477	2831	3185
5,00	318	510	637	764	955	1274	1592	1911	2229	2548	2866
5,50	290	463	579	695	869	1158	1448	1737	2027	2316	2606
6,00	265	425	531	637	796	1062	1327	1592	1858	2123	2389
6,50	245	392	490	588	735	980	1225	1470	1715	1960	2205
7,00	227	364	455	546	682	910	1137	1365	1592	1820	2047
8,00	199	318	398	478	597	796	995	1194	1393	1592	1791
9,00	177	283	354	425	531	708	885	1062	1238	1415	1592
10,00	159	255	318	382	478	637	796	955	1115	1274	1433
11,00	145	232	290	347	434	579	724	869	1013	1158	1303
12,00	133	212	265	318	398	531	663	796	929	1062	1194
13,00	122	196	245	294	367	490	612	735	857	980	1102
14,00	114	182	227	273	341	455	569	682	796	910	1024
15,00	106	170	212	255	318	425	531	637	743	849	955
16,00	100	159	199	239	299	398	498	597	697	796	896
17,00	94	150	187	225	281	375	468	562	656	749	843
18,00	88	142	177	212	265	354	442	531	619	708	796
19,00	84	134	168	201	251	335	419	503	587	670	754
20,00	80	127	159	191	239	318	398	478	557	637	717
22,00	72	116	145	174	217	290	362	434	507	579	651
24,00	66	106	133	159	199	265	332	398	464	531	597
25,00	64	102	127	153	191	255	318	382	446	510	573

Alesatori: velocità di taglio V_c (m/min) - velocità di avanzamento f (mm)

Reamers: Cutting speed V_c (m/min) - Feed rate f (mm)

Gruppo Materiali Material group	Refrigerante Cooling medium	◇ V _c (m/min)	Diametro D _c (mm) Diameter D _c (mm)										
			2,00	3,00	4,00	5,00	6,00	8,00	10,00	12,00	14,00	16,00	20,00
			f (mm)										
Alluminio - Leghe d'alluminio - Rame - Leghe di rame - Magnesio Aluminium - Alu-alloys - Copper - Copper alloys - Magnesium													
A 1.1	1	35	0,10	0,12	0,14	0,15	0,18	0,20	0,25	0,28	0,30	0,34	0,38
A 1.2	1	25	0,10	0,12	0,14	0,15	0,18	0,20	0,25	0,28	0,30	0,34	0,38
A 1.3	1	30	0,10	0,12	0,14	0,15	0,18	0,20	0,25	0,28	0,30	0,34	0,38
A 1.4	1	25	0,10	0,12	0,14	0,15	0,18	0,20	0,24	0,26	0,28	0,32	0,35
A 1.5	1	25	0,10	0,12	0,14	0,15	0,18	0,20	0,24	0,26	0,28	0,32	0,35
A 1.6	1	30	0,08	0,10	0,12	0,14	0,16	0,20	0,24	0,26	0,28	0,32	0,35
A 1.7	0	20	0,06	0,08	0,10	0,10	0,12	0,15	0,18	0,20	0,22	0,25	0,28
A 2.1	1	30	0,10	0,12	0,14	0,15	0,18	0,20	0,24	0,26	0,28	0,32	0,35
A 2.2	1	30	0,10	0,12	0,14	0,15	0,18	0,20	0,24	0,26	0,28	0,32	0,35
A 2.3	2	40	0,10	0,12	0,14	0,15	0,18	0,20	0,24	0,26	0,28	0,32	0,35
A 2.4	1	30	0,08	0,10	0,12	0,14	0,16	0,20	0,24	0,26	0,28	0,32	0,35
A 2.5	2	40	0,08	0,10	0,12	0,14	0,16	0,20	0,24	0,26	0,28	0,32	0,35
A 2.6	1	25	0,08	0,10	0,12	0,14	0,16	0,20	0,24	0,26	0,28	0,32	0,35
A 2.7	1	25	0,08	0,10	0,12	0,14	0,16	0,18	0,20	0,24	0,25	0,28	0,32
A 3.1	1	25	0,10	0,12	0,15	0,18	0,20	0,22	0,25	0,28	0,32	0,35	0,40
A 3.2	1	25	0,10	0,12	0,15	0,18	0,20	0,22	0,25	0,28	0,32	0,35	0,40
A 4.1	3	30	0,10	0,10	0,12	0,14	0,16	0,18	0,20	0,22	0,25	0,28	0,32
A 4.2	3	30	0,10	0,10	0,12	0,14	0,16	0,18	0,20	0,22	0,25	0,28	0,32
Plastiche - Plastiche rinforzate con fibre - Materiali non ferrosi Plastics - Reinforced plastic fibers - Non ferrous materials													
B 1.1	0	35	0,20	0,20	0,22	0,22	0,24	0,26	0,28	0,30	0,32	0,35	0,40
B 1.2	0	25	0,16	0,16	0,18	0,18	0,20	0,22	0,25	0,28	0,30	0,32	0,35
B 1.3	0	25	0,16	0,16	0,18	0,18	0,20	0,22	0,25	0,28	0,30	0,32	0,35
B 1.4	0	20	0,08	0,10	0,12	0,14	0,16	0,18	0,20	0,24	0,25	0,28	0,32
B 1.5	0	25	0,16	0,16	0,18	0,18	0,20	0,22	0,25	0,28	0,30	0,32	0,35
Allgemeine Stahlwerkstoffe - Stahllegierungen - gehärtete Stähle General construction steels - Steel alloys - Hardened steels													
C 1.1	1	25	0,15	0,16	0,16	0,18	0,18	0,20	0,22	0,25	0,28	0,32	0,36
C 1.2	1	25	0,15	0,16	0,16	0,18	0,18	0,20	0,22	0,25	0,28	0,32	0,36
C 1.3	1	25	0,14	0,15	0,15	0,16	0,16	0,18	0,20	0,22	0,25	0,28	0,32
C 1.4	1	25	0,14	0,15	0,15	0,16	0,16	0,18	0,20	0,22	0,25	0,28	0,32
C 1.5	1	25	0,14	0,15	0,15	0,16	0,16	0,18	0,20	0,22	0,25	0,28	0,32
C 1.6	2	20	0,12	0,14	0,14	0,15	0,15	0,16	0,18	0,20	0,22	0,25	0,30
C 1.7	0/3	12	0,08	0,08	0,10	0,10	0,10	0,12	0,14	0,15	0,18	0,20	0,25
C 1.8	1	15	0,08	0,08	0,10	0,10	0,10	0,12	0,14	0,15	0,18	0,20	0,25
C 2.1	1	15	0,08	0,08	0,10	0,10	0,10	0,12	0,14	0,15	0,18	0,20	0,25
C 2.2	1	15	0,08	0,08	0,10	0,10	0,10	0,12	0,14	0,15	0,18	0,20	0,25
C 2.3	2	15	0,08	0,08	0,10	0,10	0,10	0,12	0,14	0,15	0,18	0,20	0,25
C 2.4	1	10	0,06	0,06	0,08	0,08	0,10	0,10	0,12	0,14	0,16	0,18	0,22
C 3.1	1	10	0,06	0,06	0,08	0,08	0,10	0,10	0,12	0,14	0,16	0,18	0,22
C 3.2	2	8	0,04	0,04	0,05	0,05	0,06	0,80	0,10	0,12	0,15	0,16	0,20
C 4.1	1	12	0,08	0,08	0,10	0,10	0,10	0,12	0,14	0,15	0,18	0,20	0,25
C 4.2	2	10	0,06	0,06	0,08	0,08	0,10	0,10	0,12	0,14	0,16	0,18	0,22
KRefrigerante 0 = secco 1 = emulsione 2 = olio 3 = aria Cooling medium 0= Dry 1= Emulsion 2= oil 3 = air													

$\diamond$ Valori approssimativi per utensili non rivestiti

$\diamond$ Approx. values for uncoated tools



Alesatori: velocità di taglio V_c (m/min) - velocità di avanzamento f (mm)
Reamers: Cutting speed V_c (m/min) - Feed rate f (mm)

Gruppo Materiali <i>Material group</i>	Refrigerante <i>Cooling medium</i>	◇ V _c (m/min)	Diametro D _c (mm) <i>Diameter D_c (mm)</i>										
			2,00	3,00	4,00	5,00	6,00	8,00	10,00	12,00	14,00	16,00	20,00
			f (mm)										
Acciai resistenti alla corrosione e agli acidi - Acciai inossidabili <i>Stainless steels</i>													
D 1.1	1	15	0,06	0,06	0,06	0,08	0,08	0,10	0,12	0,15	0,18	0,20	0,22
D 1.2	1	15	0,06	0,06	0,06	0,08	0,08	0,10	0,12	0,15	0,18	0,20	0,22
D 1.3	1	12	0,06	0,06	0,06	0,08	0,08	0,10	0,12	0,15	0,18	0,20	0,22
D 1.4	1	15	0,05	0,05	0,06	0,06	0,06	0,08	0,10	0,12	0,14	0,16	0,20
D 1.5	2	10	0,05	0,05	0,06	0,06	0,06	0,08	0,10	0,12	0,14	0,16	0,20
Leghe di nichel/cobalto - Titanio - Leghe di titanio <i>Nickel/Cobalt alloys - Titanium - Titanium alloys</i>													
E 1.1	1	25	0,05	0,05	0,06	0,07	0,08	0,10	0,12	0,15	0,18	0,20	0,22
E 1.2	1	20	0,05	0,05	0,06	0,07	0,08	0,10	0,12	0,15	0,18	0,20	0,20
E 1.3	1	15	0,05	0,05	0,06	0,07	0,08	0,10	0,12	0,14	0,16	0,18	0,20
E 2.1	1	20	0,05	0,05	0,06	0,07	0,08	0,10	0,12	0,15	0,18	0,20	0,20
E 2.2	1	10	0,05	0,05	0,06	0,07	0,08	0,10	0,12	0,15	0,18	0,20	0,20
E 2.3	1	8	0,04	0,04	0,05	0,06	0,06	0,07	0,08	0,10	0,12	0,14	0,16
Ghise <i>Cast irons</i>													
F 1.1	0	12	0,08	0,10	0,14	0,18	0,22	0,25	0,28	0,32	0,35	0,38	0,40
F 1.2	0	12	0,10	0,12	0,14	0,15	0,16	0,18	0,20	0,24	0,28	0,32	0,35
F 1.3	3/0	5	0,04	0,04	0,05	0,06	0,06	0,07	0,08	0,10	0,12	0,14	0,16
F 1.4	0	15	0,08	0,10	0,14	0,18	0,22	0,25	0,28	0,32	0,35	0,38	0,40
F 1.5	0	15	0,10	0,12	0,14	0,15	0,16	0,18	0,20	0,24	0,28	0,32	0,35
F 2.1	3/0	12	0,08	0,10	0,14	0,18	0,22	0,25	0,28	0,32	0,35	0,38	0,40
F 2.2	3/0	10	0,06	0,06	0,06	0,08	0,08	0,10	0,12	0,15	0,18	0,20	0,22
F 2.3	3/0	10	0,10	0,12	0,14	0,15	0,16	0,18	0,20	0,22	0,24	0,26	0,30
F 2.4	3/0	10	0,10	0,12	0,14	0,15	0,16	0,18	0,20	0,22	0,24	0,26	0,30
Grafite - Leghe tungsteno/rame (per elettrodi) <i>Graphite - Tungsten/copper alloys (for electrode manufacturing)</i>													
G 1.1													
G 2.1	1	12	0,10	0,12	0,14	0,15	0,18	0,20	0,24	0,26	0,28	0,32	0,35
Refrigerante 0 = secco 1 = emulsione 2 = olio 3 = aria <i>Cooling medium 0= Dry 1= Emulsion 2= oil 3= air</i>													

Principali tolleranze costruttive - Norma DIN 1420 **Main manufacturing tolerances - DIN 1420**

Ø nominale Ø nominal d₁ in mm		Tolleranza superiore e inferiore del diametro nominale d1 in micron Upper and lower tolerances nominal diameter d1 in micrometers									
da	a	A 9	A 11	B 8	B 9	B 10	B 11	C 8	C 9	C 10	C 11
1	3	+291	+321	+151	+161	+174	+191	+ 71	+ 81	+ 94	+111
		+282	+300	+146	+152	+160	+170	+ 66	+ 72	+ 80	+ 90
3	6	+295	+333	+155	+165	+180	+203	+ 85	+ 95	+110	+133
		+284	+306	+148	+154	+163	+176	+ 78	+ 84	+ 93	+106
6	10	+310	+356	+168	+180	+199	+226	+ 98	+110	+129	+156
		+297	+324	+160	+167	+178	+194	+ 90	+ 97	+108	+124
10	18	+326	+383	+172	+186	+209	+243	+117	+131	+154	+188
		+310	+344	+162	+170	+184	+204	+107	+115	+129	+149
18	30	+344	+410	+188	+204	+231	+270	+138	+154	+181	+220
		+325	+364	+176	+185	+201	+224	+126	+135	+151	+174
30	40	+362	+446	+203	+222	+255	+306	+153	+172	+205	+256
		+340	+390	+189	+200	+220	+250	+139	+150	+170	+200
40	50	+372	+456	+213	+232	+265	+316	+163	+182	+215	+266
		+350	+400	+199	+210	+230	+260	+149	+160	+180	+210
50	65	+402	+501	+229	+252	+292	+351	+179	+202	+242	+301
		+376	+434	+212	+226	+250	+284	+162	+176	+200	+234
65	80	+422	+521	+239	+262	+302	+361	+189	+212	+252	+311
		+396	+454	+222	+236	+260	+294	+172	+186	+210	+244
80	100	+453	+567	+265	+293	+339	+407	+215	+243	+289	+357
		+422	+490	+246	+262	+290	+330	+196	+212	+240	+280
100	120	+483	+597	+285	+313	+359	+427	+225	+253	+299	+367
		+452	+520	+266	+282	+310	+350	+206	+222	+250	+290
120	140	+545	+672	+313	+345	+396	+472	+253	+285	+336	+412
		+510	+584	+290	+310	+340	+384	+230	+250	+280	+324
140	160	+605	+732	+333	+365	+416	+492	+263	+295	+346	+422
		+570	+644	+310	+330	+360	+404	+240	+260	+290	+334
160	180	+665	+792	+363	+395	+446	+522	+283	+315	+366	+442
		+630	+704	+340	+360	+390	+434	+260	+280	+310	+354

04

Ø nominale Ø nomina d₁ in mm		Tolleranza superiore e inferiore del diametro nominale d1 in micron Upper and lower tolerances nominal diameter d1 in micrometers												
da	a	D 8	D 9	D 10	D 11	E 7	E 8	E 9	F 6	F 7	F 8	F 9	G 6	G 7
1	3	+ 31	+ 41	+ 54	+ 71	+ 22	+ 25	+ 35	+ 11	+ 14	+ 17	+ 27	+ 7	+ 10
		+ 26	+ 32	+ 40	+ 50	+ 18	+ 20	+ 26	+ 8	+ 10	+ 12	+ 18	+ 4	+ 6
3	6	+ 45	+ 55	+ 70	+ 93	+ 30	+ 35	+ 45	+ 16	+ 20	+ 25	+ 35	+ 10	+ 14
		+ 38	+ 44	+ 53	+ 66	+ 25	+ 28	+ 34	+ 13	+ 15	+ 18	+ 24	+ 7	+ 9
6	10	+ 58	+ 70	+ 89	+116	+ 37	+ 43	+ 55	+ 20	+ 25	+ 31	+ 43	+ 12	+ 17
		+ 50	+ 57	+ 68	+ 84	+ 31	+ 35	+ 42	+ 16	+ 19	+ 23	+ 30	+ 8	+ 11
10	18	+ 72	+ 86	+109	+143	+ 47	+ 54	+ 68	+ 25	+ 31	+ 38	+ 52	+ 15	+ 21
		+ 62	+ 70	+ 84	+104	+ 40	+ 44	+ 52	+ 21	+ 24	+ 28	+ 36	+ 11	+ 14
18	30	+ 93	+109	+136	+175	+ 57	+ 68	+ 84	+ 31	+ 37	+ 48	+ 64	+ 18	+ 24
		+ 81	+ 90	+106	+129	+49	+ 56	+ 65	+ 26	+ 29	+ 36	+ 45	+ 13	+ 16
30	50	+113	+132	+165	+216	+ 71	+ 83	+102	+ 38	+ 46	+ 58	+ 77	+ 22	+ 30
		+ 99	+110	+130	+160	+ 62	+ 69	+ 80	+ 32	+ 37	+ 44	+ 55	+ 16	+ 21
50	80	+139	+162	+202	+261	+ 85	+ 99	+122	+ 46	+ 55	+ 69	+ 92	+ 26	+ 35
		+122	+136	+160	+194	+ 74	+ 82	+ 96	+ 39	+ 44	+ 52	+ 66	+ 19	+ 24
80	120	+165	+193	+239	+307	+101	+117	+145	+ 54	+ 65	+ 81	+109	+ 30	+ 41
		+146	+162	+190	+230	+ 88	+ 98	+114	+ 46	+ 52	+ 62	+ 78	+ 22	+ 28
120	180	+198	+230	+281	+357	+119	+138	+170	+ 64	+ 77	+ 96	+128	+ 35	+ 48
		+175	+195	+225	+269	+105	+115	+135	+ 55	+ 63	+ 73	+ 93	+ 26	+ 34

Principali tolleranze costruttive - Norma DIN 1420 **Main manufacturing tolerances - DIN 1420**

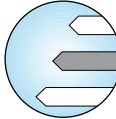
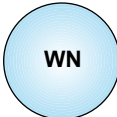
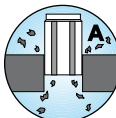
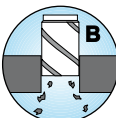
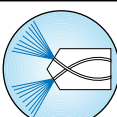
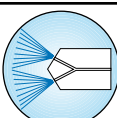
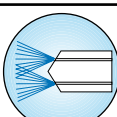
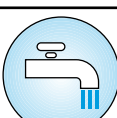
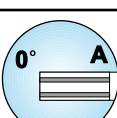
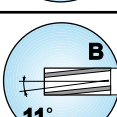
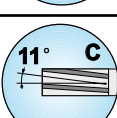
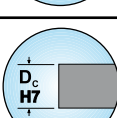
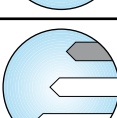
Ø nominale Ø nominal d ₁ in mm		Tolleranza superiore e inferiore del diametro nominale d1 in micron Upper and lower tolerances nominal diameter d1 in micrometers													
da	a	H 6	H 7	H 8	H 9	H 10	H 11	H 12	J 6	J 7	J 8	JS 6	JS 7	JS 8	JS 9
1	3	+ 5 + 2	+ 8 + 4	+ 11 + 6	+ 21 + 12	+ 34 + 20	+ 51 + 30	+ 85 + 50	+ 1 - 2	+ 2 - 2	+ 3 - 2	+ 2 - 1	+ 3 - 1	+ 4 - 1	+ 8 - 1
3	6	+ 6 + 3	+ 10 + 5	+ 15 + 8	+ 25 + 14	+ 40 + 23	+ 63 + 36	+102 +60	+ 3 0	+ 4 - 1	+ 7 0	+ 2 - 1	+ 4 - 1	+ 6 - 1	+ 10 - 1
6	10	+ 7 + 3	+ 12 + 6	+ 18 + 10	+ 30 + 17	+ 49 + 28	+ 76 + 44	+127 +74	+ 3 - 1	+ 5 - 1	+ 8 0	+ 3 - 1	+ 5 - 1	+ 7 - 1	+ 12 - 1
10	18	+ 9 + 5	+ 15 + 8	+ 22 + 12	+ 36 + 20	+ 59 + 34	+ 93 + 54	+153 +90	+ 4 0	+ 7 0	+ 10 0	+ 3 - 1	+ 6 - 1	+ 9 - 1	+ 15 - 1
18	30	+ 11 + 6	+ 17 + 9	+ 28 + 16	+ 44 + 25	+ 71 + 41	+110 + 64	+178 +104	+ 6 + 1	+ 8 0	+ 15 + 3	+ 4 - 1	+ 7 - 1	+ 11 - 1	+ 18 - 1
30	50	+ 13 + 7	+ 21 + 12	+ 33 + 19	+ 52 + 30	+ 85 + 50	+136 + 80	+212 +124	+ 7 + 1	+ 10 + 1	+ 18 + 4	+ 5 - 1	+ 8 - 1	+ 13 - 1	+ 21 - 1
50	80	+ 16 + 9	+ 25 + 14	+ 39 + 22	+ 62 + 36	+102 + 60	+161 + 94	+255 +150	+ 10 + 3	+ 13 + 2	+ 21 + 4	+ 6 - 1	+ 10 - 1	+ 16 - 1	+ 25 - 1
80	120	+ 18 + 10	+ 29 + 16	+ 45 + 26	+ 73 + 42	+119 + 70	+187 +110	+297 +174	+ 12 + 4	+ 16 + 3	+ 25 + 6	+ 7 - 1	+ 12 - 1	+ 18 - 1	+ 30 - 1
120	180	+ 21 + 12	+ 34 + 20	+ 53 + 30	+ 85 + 50	+136 + 80	+212 +124	+340 +200	+ 14 + 5	+ 20 + 6	+ 31 + 8	+ 8 - 1	+ 14 0	+ 22 - 1	+ 35 0

04

Ø nominale Ø nominal d ₁ in mm		Tolleranza superiore e inferiore del diametro nominale d1 in micron Upper and lower tolerances nominal diameter d1 in micrometers													
da	a	K 6	K 7	K 8	M 6	M 7	M 8	N 6	N 7	N 8	N 9	N 10	N 11	P 6	P 7
1	3	- 4 - 1	- 2 - 6	- 3 - 8	- 3 - 6	- 4 - 8	-	- 5 - 8	- 6 - 10	- 7 - 12	- 8 - 17	- 10 - 24	- 13 - 34	- 7 - 10	- 8 - 12
3	6	0 - 3	+ 1 - 4	+ 2 - 5	- 3 - 6	- 2 - 7	- 1 - 8	- 7 - 10	- 6 - 11	- 5 - 12	- 5 - 16	- 8 - 25	- 12 - 39	- 11 - 14	- 10 - 15
6	10	0 - 4	+ 2 - 4	+ 2 - 6	- 5 - 9	- 3 - 9	- 3 - 11	- 9 - 13	- 7 - 13	- 7 - 15	- 6 - 19	- 9 - 30	- 14 - 46	- 14 - 18	- 12 - 18
10	18	0 - 4	+ 3 - 4	+ 3 - 7	- 6 - 10	- 3 - 10	- 3 - 13	- 11 - 15	- 8 - 15	- 8 - 18	- 7 - 23	- 11 - 36	- 17 - 56	- 17 - 21	- 14 - 21
18	30	0 - 5	+ 2 - 6	+ 5 - 7	- 6 - 11	- 4 - 12	- 1 - 13	- 13 - 18	- 11 - 19	- 8 - 20	- 8 - 27	- 13 - 43	- 20 - 66	- 20 - 25	- 18 - 26
30	50	0 - 6	+ 3 - 6	+ 6 - 8	- 7 - 13	- 4 - 13	- 1 - 15	- 15 - 21	- 12 - 21	- 9 - 23	- 10 - 32	- 15 - 50	- 24 - 80	- 24 - 30	- 21 - 30
50	80	+ 1 - 6	+ 4 - 7	+ 7 - 10	- 8 - 15	- 5 - 16	- 2 - 19	- 17 - 24	- 14 - 25	- 11 - 28	- 12 - 38	- 18 - 60	- 29 - 96	- 29 - 36	- 26 - 37
80	120	0 - 8	+ 4 - 9	+ 7 - 12	- 10 - 18	- 6 - 19	- 3 - 22	- 20 - 28	- 16 - 29	- 13 - 32	- 14 - 45	- 21 - 70	- 33 - 110	- 34 - 42	- 30 - 43
120	180	0 - 9	+ 6 - 8	+ 10 - 13	- 12 - 21	- 6 - 20	- 2 - 25	- 24 - 33	- 18 - 32	- 14 - 37	- 15 - 50	- 24 - 80	- 38 - 126	- 40 - 49	- 34 - 48

SPIEGAZIONE PITTOGRAMMI (SIMBOLI)

ICONS DESCRIPTION

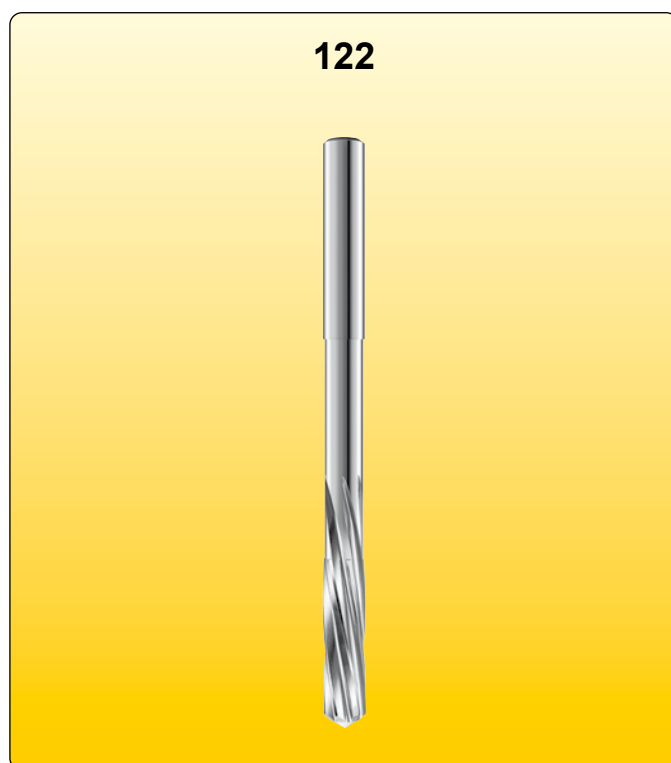
Qualità metallo duro <i>Carbide grade</i>		Lunghezza utensile <i>Tool length</i>	
Esecuzione utensile secondo norma interna <i>Cutting edge design acc. to internal standard</i>		Utensile tipo A <i>Tool length</i>	
Norma interna (WN) lunga <i>Internal standard long</i>		Utensile tipo A <i>Tool type A</i>	
Dimensioni secondo DIN 8093 <i>Dimensions acc. to DIN 8093</i>		Utensile tipo B <i>Tool type B</i>	
Fori di lubrificazione a elica <i>Spiral coolant ducts</i>		Utensile tipo C <i>Tool type C</i>	
Fori di lubrificazione diritti centrale <i>Straight centric coolant duct</i>			
Fori di lubrificazione diritti <i>Straight coolant ducts</i>			
Lavorazione con emulsione d'olio <i>with oil emulsion</i>			
A tagliente diritto <i>straight flute</i>			
Elica sinistra - taglio destro <i>Left hand cut spiral - right hand cut</i>			
Elica destra - taglio destro <i>Right hand cut spiral - right hand cut</i>			
Diametro utensile D _c <i>Tool diameter D_c</i>			
Lunghezza utensile <i>Tool length</i>			

Alesatori ad elica sinistra e taglio destro - tipo B

Tipo di metallo duro K10 - micrograna - DIN 8093 (212) - divisione irregolare - tolleranza H7

Reamers left hand spiral - right hand cut - Type «B»

Tolerance H7 - DIN 8093 (212) - Uneven indexing - K10 - Micrograin carbide



Settori d'impiego / Range of application

A: Leghe Leggere / Light alloys

A1.1-1.7 A2.1-2.7 A3.1-3.2 A4.1-4.2

C: Acciai / Steels

C1.1-1.8 C2.1-2.4 C3.1 C4.1-4.2

D: Acciai inossidabili / Stainless Steel

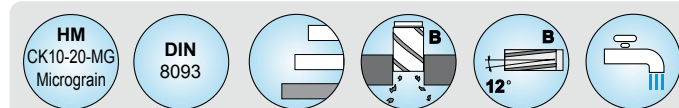
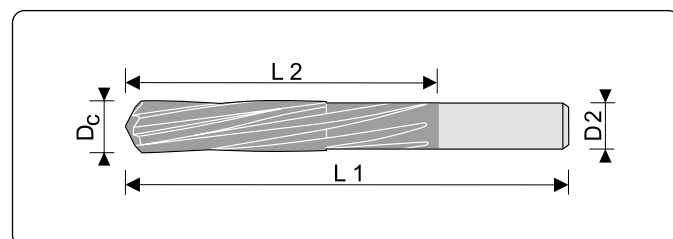
D1.1-1.5

E: Titanio / Titanium

E1.1-1.3 E2.2

F: Ghise / Cast irons

F1.1-1.5 F2.1-2.4



4.
01

D _c mm da-a / from-to Toll. H7	L2	L1	D2	Z	122
					■
					Indicare sempre il Ø mm / Please always indicate Ø mm
1,9 - 2,1	11	49	2	4	122.0190 ÷ 122.0210
2,2 - 2,3	12	53	2,2	4	122.0220 ÷ 122.0230
2,4 - 2,6	14	57	2,5	4	122.0240 ÷ 122.0260
2,7 - 3,1	15	61	3	4	122.0270 ÷ 122.0310
3,2 - 3,7	18	70	3,5	4	122.0320 ÷ 122.0370
3,8 - 4,2	19	75	4	4	122.0380 ÷ 122.0420
4,3 - 4,7	21	75	4,5	4	122.0430 ÷ 122.0470
4,8 - 5,3	23	86	5	4	122.0480 ÷ 122.0530
5,4 - 5,8	26	93	5,6	6	122.0540 ÷ 122.0580
5,9 - 6,2	26	93	5,6	6	122.0590 ÷ 122.0620
6,3 - 6,7	28	101	6,3	6	122.0630 ÷ 122.0670
6,8 - 7,5	31	109	7,1	6	122.0680 ÷ 122.0750
7,6 - 8,5	33	117	8	6	122.0760 ÷ 122.0850
8,6 - 9,5	36	125	9	6	122.0860 ÷ 122.0950
9,6 - 10,6	38	133	10	6	122.0960 ÷ 122.1060
10,7 - 11,8	41	142	10	6	122.1070 ÷ 122.1180
11,9 - 13,2	44	151	10	6	122.1190 ÷ 122.1320

■ Rivestimento su richiesta

■ Coating upon request.

Alesatori ad elica sinistra e taglio destro - tipo B

Tipo di metallo duro K10 - micrograna - DIN 8093 (212) - divisione irregolare - tolleranza H7

Reamers left hand spiral - right hand cut - Type «B»

Tolerance H7 - DIN 8093 (212) - Uneven indexing - K10 - Micrograin carbide

Cent / Cents
0,00

122



Settori d'impiego / Range of application

A: Leghe Leggere / Light alloys

A1.1-1.7 A2.1-2.7 A3.1-3.2 A4.1-4.2

C: Acciai / Steels

C1.1-1.8 C2.1-2.4 C3.1 C4.1-4.2

D: Acciai inossidabili / Stainless Steel

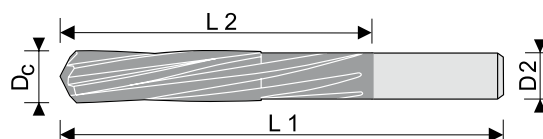
D1.1-1.5

E: Titanio / Titanium

E1.1-1.3 E2.2

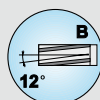
F: Ghise / Cast irons

F1.1-1.5 F2.1-2.4



HM
CK10-20-MG
Micrograin

DIN
8093



D _c mm da-a / from-to H7	L2	L1	D2 h6	Z	122
					■
					Indicare sempre il Ø mm / Please always indicate Ø mm
1,91 - 2,12	11	49	2	4	122.0191 ÷ 122.0212
2,13 - 2,36	12	53	2,2	4	122.0213 ÷ 122.0236
2,37 - 2,65	14	57	2,5	4	122.0237 ÷ 122.0265
2,66 - 3,15	15	61	3	4	122.0266 ÷ 122.0315
3,16 - 3,75	18	70	3,5	4	122.0316 ÷ 122.0375
3,76 - 4,25	19	75	4	4	122.0376 ÷ 122.0425
4,26 - 4,75	21	75	4,5	4	122.0426 ÷ 122.0475
4,76 - 5,30	23	86	5	4	122.0476 ÷ 122.0530
5,31 - 5,80	26	93	5,6	6	122.0531 ÷ 122.0580
5,81 - 6,20	26	93	5,6	6	122.0581 ÷ 122.0620
6,21 - 6,70	28	101	6,3	6	122.0621 ÷ 122.0670
6,71 - 7,50	31	109	7,1	6	122.0671 ÷ 122.0750
7,51 - 8,50	33	117	8	6	122.0751 ÷ 122.0850
8,51 - 9,50	36	125	9	6	122.0851 ÷ 122.0950
9,51 - 10,60	38	133	10	6	122.0951 ÷ 122.1060
10,61 - 11,80	41	142	10	6	122.1061 ÷ 122.1180
11,81 - 13,20	44	151	10	6	122.1181 ÷ 122.1320

■ Rivestimento su richiesta

■ Coating upon request.

Alesatori a tagliente diritto - tipo A

Tipo di metallo duro K10 - micrograna - tolleranza H7 - DIN 8093 (212) - divisione irregolare

Straight flute reamers - Type «A»

Tolerance H7 - K10 - Micrograin carbide - DIN 8093 (212) - Uneven indexing

131



Settori d'impiego / Range of application

A: Leghe Leggere / Light alloys

A1.1-1.7 A2.1-2.7 A3.1-3.2 A4.1-4.2

C: Acciai / Steels

C1.1-1.8 C2.1-2.4 C3.1 C4.1-4.2

D: Acciai inossidabili / Stainless Steel

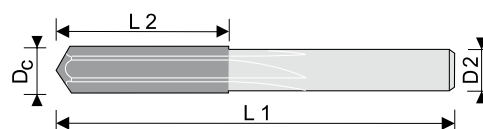
D1.1-1.5

E: Titanio / Titanium

E1.1-1.3 E2.2

F: Ghise / Cast irons

F1.1-1.5 F2.1-2.4



4.
01

D _c H7	L2	L1	D2 h6	Z	131
					■
2	11	49	2	4	131.020
2,5	14	57	2,5	4	131.025
3	15	61	3	4	131.030
3,5	18	70	3,5	4	131.035
4	19	75	4	4	131.040
4,5	21	75	4,5	4	131.045
5	23	86	5	4	131.050
5,5	26	93	5,6	6	131.056
6	26	93	5,6	6	131.056
6,5	28	101	6,3	6	131.063
7	31	109	7,1	6	131.071
8	33	117	8	6	131.080
9	36	125	9	6	131.090
10	38	133	10	6	131.100
11	41	142	10	6	131.110
12	44	151	10	6	131.120

■ Rivestimento su richiesta

■ Coating upon request.

Alesatori ad elica sinistra e taglio destro - tipo B

Tipo di metallo duro K10 - micrograna - tolleranza H7

Reamers left hand spiral - right hand cut - Type «B»

Tolerance H7 - K10 - Micrograin carbide - Internal norm

120



Settori d'impiego / Range of application

A: Leghe Leggere / Light alloys

A1.1-1.7 A2.1-2.7 A3.1-3.2 A4.1-4.2

C: Acciai / Steels

C1.1-1.8 C2.1-2.4 C3.1 C4.1-4.2

D: Acciai inossidabili / Stainless Steel

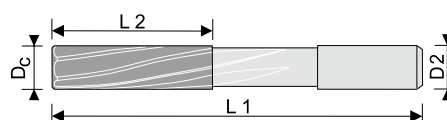
D1.1-1.5

E: Titanio / Titanium

E1.1-1.3 E2.2

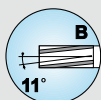
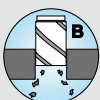
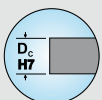
F: Ghise / Cast irons

F1.1-1.5 F2.1-2.4



HM
CK10-20-MG
Micrograin

WN



D _c H7	L2	L1	D2	Z	120
					□
2	12	40	2	4	120.020
2,5	12	40	2,5	4	120.025
3	12	50	3	4	120.030
3,5	15	52	3,5	4	120.035
4	18	55	4	4	120.040
4,5	20	58	4,5	4	120.045
5	22	62	5	4	120.050
5,5	22	62	5,5	4	120.055
6	25	66	6	6	120.060
6,5	25	66	6,5	6	120.065
7	25	75	7	6	120.070
8	28	79	8	6	120.080
9	35	100	9	6	120.090
10	35	100	10	6	120.100
11	35	100	11	6	120.110
12	35	100	12	6	120.120

■ Rivestimento su richiesta

■ Coating upon request.

Alesatori ad elica sinistra e taglio destro - tipo C

Tipo di metallo duro K10 - micrograna - tolleranza H7

Reamers right hand spiral - right hand cut - Type «C»

Tolerance H7 - K10 - Micrograin carbide - Internal norm

125



Settori d'impiego / Range of application

A: Leghe Leggere / Light alloys

A1.1-1.7 A2.1-2.7 A3.1-3.2 A4.1-4.2

C: Acciai / Steels

C1.1-1.8 C2.1-2.4 C3.1 C4.1-4.2

D: Acciai inossidabili / Stainless Steel

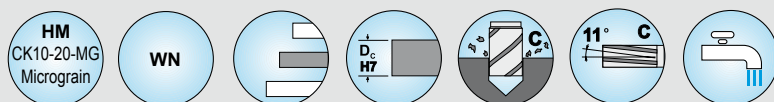
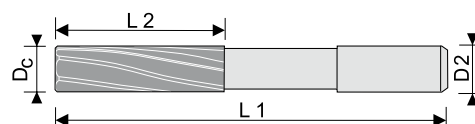
D1.1-1.5

E: Titanio / Titanium

E1.1-1.3 E2.2

F: Ghise / Cast irons

F1.1-1.5 F2.1-2.4



4.
01

D _c H7	L2	L1	D2 h7	Z	125
					■
2	12	40	2	4	125.020
2,5	12	40	2,5	4	125.025
3	12	50	3	4	125.030
3,5	15	52	3,5	4	125.035
4	18	55	4	4	125.040
4,5	20	58	4,5	4	125.045
5	22	62	5	4	125.050
5,5	22	62	5,5	4	125.055
6	25	66	6	6	125.060
6,5	25	66	6,5	6	125.065
7	25	75	7	6	125.070
8	28	79	8	6	125.080
9	35	100	9	6	125.090
10	35	100	10	6	125.100
11	35	100	11	6	125.110
12	35	100	12	6	125.120

■ Rivestimento su richiesta

■ Coating upon request.



Svasatori in metallo duro
Carbide countersinks



Indice

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Velocità di taglio V_c (m/min) - velocità di avanzamento f (mm)
Cutting speed V_c (m/min) - Feed rate f (mm)

Gruppo Materiale	Denominazione Materiale	Resistenza N/mm ²	V_c (m/min)	f (mm)	Raffreddamento
Material Group	Material Description	Strength N/mm ²	V_c (m/min)	f (mm)	Cooling system
A 1	Leghe di alluminio fucinato <i>Wrought Aluminium alloys</i>	< 705	25 - 30	0,08 - 0,3	Emulsione <i>Emulsion</i>
	Leghe di alluminio fuse Si < 12% <i>Cast aluminium alloys</i>	< 400	30 - 35	0,1 - 0,3	Emulsione <i>Emulsion</i>
A 2	Rame - Leghe di rame <i>Copper - Copper alloys</i>	< 400	30 - 35	0,1 - 0,3	Emulsione <i>Emulsion</i>
	Rame - Leghe di rame <i>Copper - Copper alloys</i>	< 850	20 - 25	0,05 - 0,20	Emulsione <i>Emulsion</i>
A 4	Leghe di magnesio <i>Magnesium alloys</i>	< 705	25 - 30	0,05 - 0,25	A secco <i>Dry</i>
B 1	Termoplastiche - Termoindurenti <i>Thermoset - Thermoplastic</i>	< 250	30 - 35	0,08 - 0,35	A secco / con aria <i>Dry / Air</i>
B 2	Materiali non ferrosi <i>Non ferrous materials</i>	< 250	20 - 30	0,08 - 0,15	A secco / con aria <i>Dry / Air</i>
C 1	Acciai - Leghe di acciaio <i>Steel - Steel alloys</i>	< 400	20 - 25	0,1 - 0,3	Emulsione <i>Emulsion</i>
	Acciai - Leghe di acciaio <i>Steel - Steel alloys</i>	< 705	15 - 20	0,05 - 0,25	Emulsione <i>Emulsion</i>
	Acciai - Leghe di acciaio <i>Steel - Steel alloys</i>	< 1125	12 - 18	0,05 - 0,20	Emulsione <i>Emulsion</i>
	Acciai - Leghe di acciaio <i>Steel - Steel alloys</i>	< 1420	10 - 15	0,03 - 0,15	Olio <i>Oil</i>
C 2	Acciai temprati <i>Hardened steels</i>	< 56 HRC	8 - 12	0,02 - 0,01	Olio <i>Oil</i>
C 3	Acciai speciali <i>Special steels</i>	< 1420	10 - 15	0,03 - 0,15	Olio <i>Oil</i>
D 1	Acciai anticorrosione <i>Stainless steels</i>	< 850	10 - 15	0,06 - 0,25	Emulsione <i>Emulsion</i>
	Acciai resistenti agli acidi <i>Stainless steels</i>	< 1420	8 - 12		Olio <i>Oil</i>
E 1	Titanio puro <i>Pure titanium</i>	< 705	20 - 25	0,05 - 0,20	Emulsione <i>Emulsion</i>
	Leghe di titanio <i>Titanium alloys</i>	< 1125	15 - 20	0,05 - 0,20	Emulsione <i>Emulsion</i>
E 2	Leghe nichel-cobalto <i>Nickel-cobalt alloys</i>	< 705	20 - 25	0,05 - 0,20	Emulsione <i>Emulsion</i>
	Leghe nichel-cobalto <i>Nickel-cobalt alloys</i>	< 1420	8 - 12	0,03 - 0,15	Olio <i>Oil</i>
F 1	Ghisa grigia <i>Grey cast irons</i>	< 333 HB	15 - 20	0,05 - 0,3	A secco <i>Dry</i>
	Ghisa dura <i>Hard cast irons</i>	< 418 HB	8 - 12	0,03 - 0,15	A secco / MQL <i>Dry / Min.q.ty lubr.</i>
	Ghisa temperata <i>Malleable cast irons</i>	< 705	15 - 20	0,05 - 0,25	A secco <i>Dry</i>
F 2	Ghisa grafitica nodulare <i>Nodular graphite cast irons</i>	< 400	20 - 25	0,05 - 0,3	A secco / MQL <i>Dry / Min.q.ty lubr.</i>
	Ghisa grafitica nodulare <i>Nodular graphite cast irons</i>	< 1125	15 - 20	0,03 - 0,2	A secco / MQL <i>Dry / Min.q.ty lubr.</i>
	Ghisa grafitica vermicolare <i>Vermicular graphite cast irons</i>	< 333 HB	15 - 20	0,03 - 0,2	A secco / MQL <i>Dry / Min.q.ty lubr.</i>

Svasatori - Formule di calcolo per numero giri n (min^{-1})

Calculation formula for revolution per minute n (min^{-1})

Numero di giri n (min^{-1}) Revolution per minute n (min^{-1})	Velocità di taglio V_c (m/min) Cutting speed V_c (m/min)
$n \text{ (min}^{-1}\text{)} = \frac{V_c \times 1000}{D_w \times 3,14}$	$V_c \text{ (m/min)} = \frac{D_w \times 3,14 \times n \text{ (min}^{-1}\text{)}}{1000}$

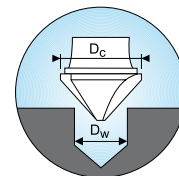


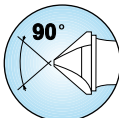
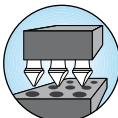
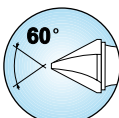
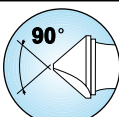
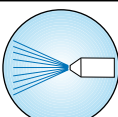
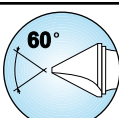
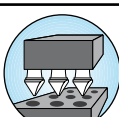
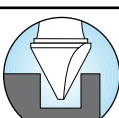
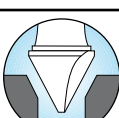
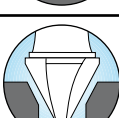
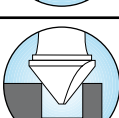
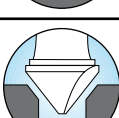
Tabella del numero di giri n (min^{-1})

Survey of revolutions per minute n (min^{-1})

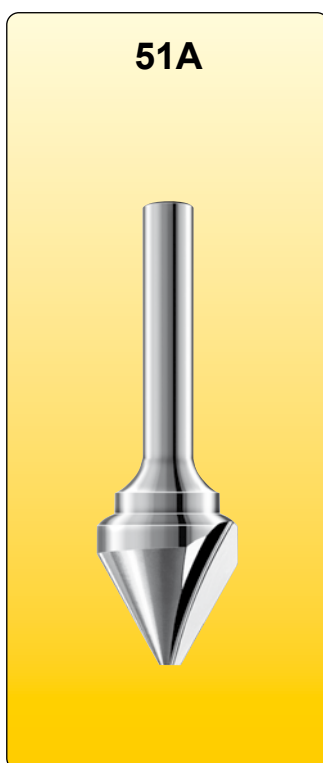
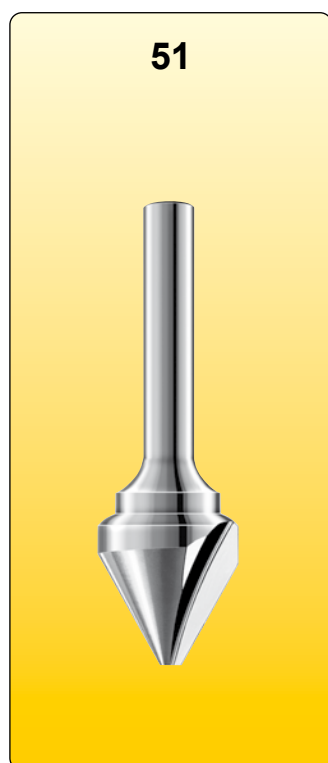
D_w (mm)	V_c (m/min)											
	5	8	10	12	15	18	20	25	30	35	40	50
Numero giri n (min^{-1}) / Revolution or minute (min^{-1})												
2,5	39	63	79	94	118	141	157	196	236	275	314	393
3,0	47	75	94	113	141	170	188	236	283	330	377	471
3,5	55	88	110	132	165	198	220	275	330	385	440	550
4,0	63	100	126	151	188	226	251	314	377	440	502	628
5,0	79	126	157	188	236	283	314	393	471	550	628	785
5,5	86	138	173	207	259	311	345	432	518	604	691	864
6,0	94	151	188	226	283	339	377	471	565	659	754	942
6,5	102	163	204	245	306	367	408	510	612	714	816	1021
7,0	110	176	220	264	330	396	440	550	659	769	879	1099
7,5	118	188	236	283	353	424	471	589	707	824	942	1178
8,0	126	201	251	301	377	452	502	628	754	879	1005	1256
8,5	133	214	267	320	400	480	534	667	801	934	1068	1335
9,0	141	226	283	339	424	509	565	707	848	989	1130	1413
9,5	149	239	299	358	448	538	597	747	896	1045	1194	1493
10,0	157	251	314	377	471	565	628	785	942	1099	1256	1570
11,0	173	276	345	414	518	622	691	864	1036	1209	1382	1727
12,0	188	301	377	452	565	678	754	942	1130	1319	1507	1884
13,0	204	327	408	490	612	735	816	1021	1225	1429	1633	2041
14,0	220	352	440	528	659	791	879	1099	1319	1539	1758	2198
15,0	236	377	471	565	707	848	942	1178	1413	1649	1884	2355
16,0	251	402	502	603	754	904	1005	1256	1507	1758	2010	2512
17,0	267	427	534	641	801	961	1068	1335	1601	1868	2135	2669
18,0	283	452	565	678	848	1017	1130	1413	1696	1978	2261	2826
9,0	141	226	283	339	424	509	565	707	848	989	1130	1413
20,0	314	502	628	754	942	1130	1256	1570	1884	2198	2512	3140
22,0	345	553	691	829	1036	1243	1382	1727	2072	2418	2763	3454
24,0	377	603	754	904	1130	1356	1507	1884	2261	2638	3014	3768
26,0	408	653	816	980	1225	1470	1633	2041	2449	2857	3266	4082
28,0	440	703	879	1055	1319	1583	1758	2198	2638	3077	3517	4396
30,0	471	754	942	1130	1413	1696	1884	2355	2826	3297	3768	4710
31,5	495	791	989	1187	1484	1780	1978	2473	2967	3462	3956	4946

SPIEGAZIONE DEI PITTOGRAMMI (SIMBOLI)

ICONS DESCRIPTION

Qualità metallo duro <i>Carbide grade</i>		Lavorazione di smussatura <i>Face setting application</i>	
Esecuzione utensile secondo norma interna <i>Cutting edge design acc. to internal standard</i>		Lavorazione di svasatura <i>Countersinking application</i>	
Tre taglienti a 90° <i>90° three flute</i>		Lavorazione su plurimandrini <i>Multi-spindle application</i>	
Tre taglienti a 60° <i>60° three flute</i>		Lavorazione con emulsione <i>with emulsion</i>	
Un tagliente 90° <i>90° single flute</i>		Lavorazione con aria compressa <i>with compressed air</i>	
Un tagliente 60° <i>60° single flute</i>			
Lavorazione su plurimandrini <i>Multi-spindle application</i>			
Lavorazione di smussatura <i>Face setting application</i>			
Lavorazione di svasatura <i>Countersinking application</i>			
Lavorazione di smussatura <i>Face setting application</i>			
Lavorazione di svasatura <i>Countersinking application</i>			
Lavorazione di smussatura <i>Face setting application</i>			
Lavorazione di svasatura <i>Countersinking application</i>			

Svasatori 60° a tagliente singolo 60° single flute countersink



Settori d'impiego / Range of application

A: Leghe Leggere / Light alloys

A1.1-1.6 A2.1-2.7 A3.1-3.2 A4.1-4.2

B: Plastiche - Plastiche rinforzate con fibre

B: Plastics - Reinforced plastic fibres

B1.1-1.3 B1.5-1.6 B2.1-2.4

Acciai / Steels

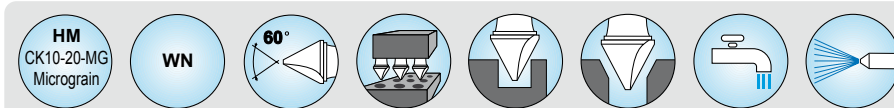
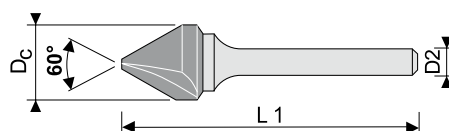
C1.1-1.8 C2.1-2.3 C3.1 C4.1

D: Acciaio inossidabile / Stainless steel

D1.1-1.4

F: Ghise / Cast irons

F1.4-1.5 F2.1-2.4

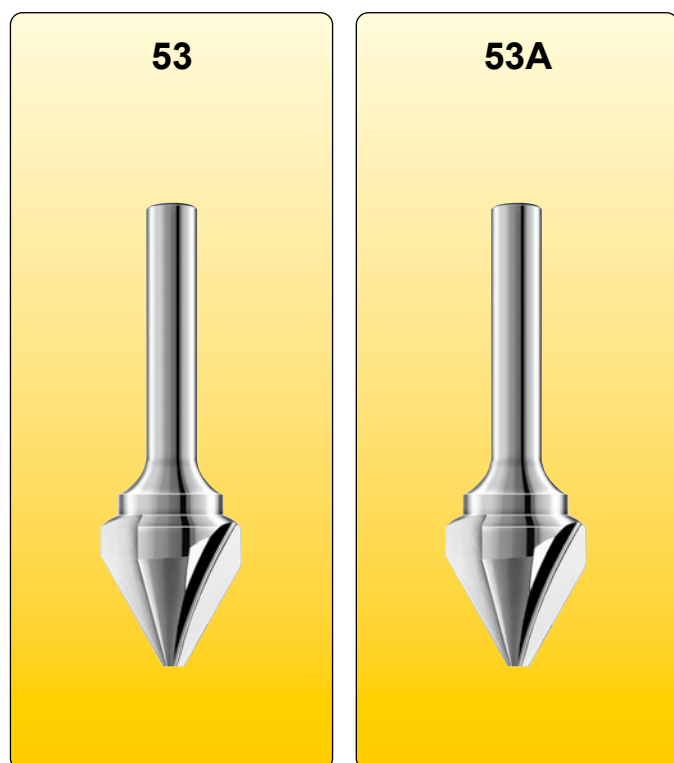


05

D _c	L1	D2 h6	51	51A
				Rivestite / Coated
4,3	50	6	51.0406	51.0406A
6,3	51	6	51.0606	51.0606A
8,3	55	6	51.0806	51.0806A
10,4	56	6	51.1006	51.1006A
12,4	59	6	51.1206	51.1206A
12,4	59	8	51.1208	51.1208A
16,5	63	6	51.1606	51.1606A
16,5	63	8	51.1608	51.1608A
16,5	63	10	51.1610	51.1610A
20,5	67	6	51.2006	51.2006A
20,5	67	8	51.2008	51.2008A
20,5	67	10	51.2010	51.2010A
25,5	73	8	51.2508	51.2508A
25,5	73	10	51.2510	51.2510A
31,5	79	10	51.3110	51.3110A

Svasatori 60° a 3 taglienti

60° three flute countersink



Settori d'impiego / Range of application

A: Legierungen / Light alloys

A1.1-1.6 A2.1-2.7 A3.1-3.2 A4.1-4.2

B: Plastiche - Plastiche rinforzate con fibre

B: Plastics - Reinforced plastic fibres

B1.1-1.3 B1.5-1.6 B2.1-2.4

C: Acciai / Steels

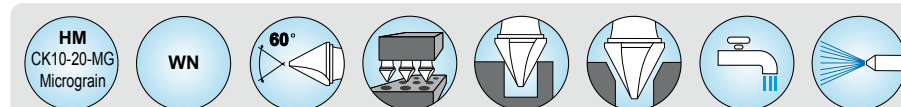
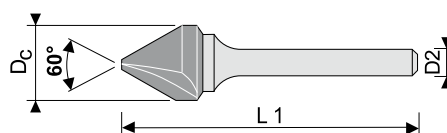
C1.1-1.8 C2.1-2.3 C3.1 C4.1

D: Acciaio inossidabile / Stainless steel

D1.1-1.4

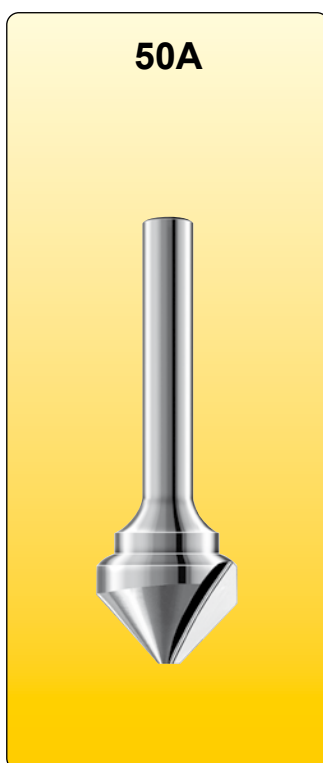
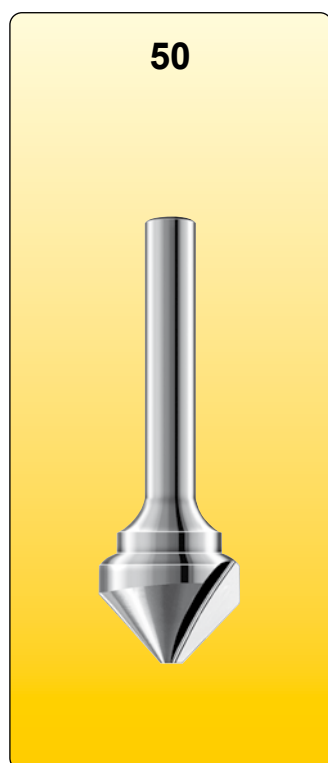
F: Ghise / Cast irons

F1.4-1.5 F2.1-2.4



D _c	L1	D2 h6	53	53A
				Rivestite / Coated
4,3	50	6	53.0406	53.0406A
6,3	51	6	53.0606	53.0606A
8,3	55	6	53.0806	53.0806A
10,4	56	6	53.1006	53.1006A
12,4	59	6	53.1206	53.1206A
12,4	59	8	53.1208	53.1208A
16,5	63	6	53.1606	53.1606A
16,5	63	8	53.1608	53.1608A
16,5	63	10	53.1610	53.1610A
20,5	67	6	53.2006	53.2006A
20,5	67	8	53.2008	53.2008A
20,5	67	10	53.2010	53.2010A
25,5	73	8	53.2508	53.2508A
25,5	73	10	53.2510	53.2510A
31,5	79	10	53.3110	53.3110A

Svasatori 90° a tagliente singolo 90° single flute countersink



Settori d'impiego / Range of application

A: Leghe Leggere / Light alloys

A1.1-1.6 A2.1-2.7 A3.1-3.2 A4.1-4.2

B: Plastiche - Plastiche rinforzate con fibre

B: Plastics - Reinforced plastic fibres

B1.1-1.3 B1.5-1.6 B2.1-2.4

C: Acciai / Steels

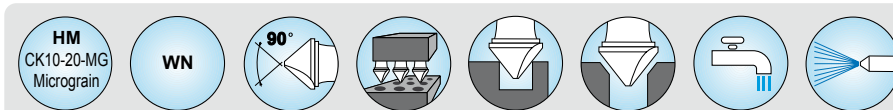
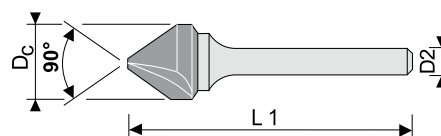
C1.1-1.8 C2.1-2.3 C3.1 C4.1

D: Acciaio inossidabile / Stainless steel

D1.1-1.4

F: Ghise / Cast irons

F1.4-1.5 F2.1-2.4



05

D _c	L1	D2 h6	50	50A
				Rivestite / Coated
4,3	50	6	50.0406	50.0406A
6,3	51	6	50.0606	50.0606A
8,3	52	6	50.0806	50.0806A
10,4	53	6	50.1006	50.1006A
12,4	55	6	50.1206	50.1206A
12,4	55	8	50.1208	50.1208A
16,5	58	6	50.1606	50.1606A
16,5	58	8	50.1608	50.1608A
16,5	58	10	50.1610	50.1610A
20,5	61	6	50.2006	50.2006A
20,5	61	8	50.2008	50.2008A
20,5	61	10	50.2010	50.2010A
25,5	64	8	50.2508	50.2508A
25,5	64	10	50.2510	50.2510A
31,5	68	10	50.3110	50.3110A

Svasatori 90° a 3 taglienti

90° three flute countersink

52



52A



Settori d'impiego / Range of application

A: Leghe Leggere / *Light alloys*

A1.1-1.6 A2.1-2.7 A3.1-3.2 A4.1-4.2

B: Plastiche - Plastiche rinforzate con fibre

B: *Plastics - Reinforced plastic fibres*

B1.1-1.3 B1.5-1.6 B2.1-2.4

C: Acciai / *Steels*

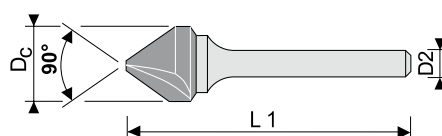
C1.1-1.8 C2.1-2.3 C3.1 C4.1

D: Acciaio inossidabile / *Stainless steel*

D1.1-1.4

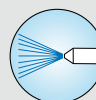
F: Ghise / *Cast irons*

F1.4-1.5 F2.1-2.4



HM
CK10-20-MG
Micrograin

WN



D _c	L1	D2 h6	52	52A
				Rivestite / Coated
4,3	50	6	52.0406	52.0406A
6,3	51	6	52.0606	52.0606A
8,3	52	6	52.0806	52.0806A
10,4	53	6	52.1006	52.1006A
12,4	55	6	52.1206	52.1206A
12,4	55	8	52.1208	52.1208A
16,5	58	6	52.1606	52.1606A
16,5	58	8	52.1608	52.1608A
16,5	58	10	52.1610	52.1610A
20,5	61	6	52.2006	52.2006A
20,5	61	8	52.2008	52.2008A
20,5	61	10	52.2010	52.2010A
25,5	64	8	52.2508	52.2508A
25,5	64	10	52.2510	52.2510A
31,5	68	10	52.3110	52.3110A

05









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45°33'53.28" N - 10°45'58.14" E