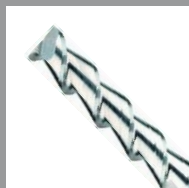
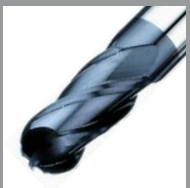




Fresas frontales / *End mills*



C O R T E

Fresas frontales de Metal duro integral. Índice de referencias

Solid Carbide end mills. Index of references



Cortes / Cuts	 Z2	 Z2	 Z3	 Z4	 Z2	 Z4	 Z2	 Z4
Aplicación / Application								
Referencia M&T / M&T Reference	F MINI-Z2	F-Z2	F-Z3	F-Z4	F CL-Z2	F CL-Z4	F ML-Z2	F ML-Z4
- / -	PLANA MINIATURA SQUARE TYPE	PLANA SQUARE TYPE	PLANA SQUARE TYPE	PLANA SQUARE TYPE	PLANA SQUARE TYPE	PLANA SQUARE TYPE	PLANA SQUARE TYPE	PLANA SQUARE TYPE
Recubrimiento / Coating	TiALN	TiALN	TiALN	TiALN	TiALN	TiALN	TiALN	TiALN
Ranura λ / λ Flute	λ s35°		λ s45°	λ s35°				
Material / Material	MDI Solid carbide							
Dureza material / Material hardness	<50HRC					<55HRC		
Tamaño grano / Grain Size	ϕ <0,6 μ m							
Gama / Range	ϕ 0,4...3	ϕ 1...20	ϕ 3...20	ϕ 1...20	ϕ 2...12	ϕ 2...20	ϕ 6...12	ϕ 3...16
								
Página / Page	1	2	3	4	5	6	7	7

Cortes / Cuts	 Z6	 Z3	 Z4	 Z2	 Z2	 Z2	 Z2	 Z4
Aplicación / Application								
Referencia M&T / M&T Reference	F HRC ML	DF-Z3	DF-Z4	TP-Z2	TP CL-Z2	B MINI-Z2	B-Z2	B-Z4
- / -	PLANA SQUARE TYPE	SEMI-DESBASTE FINE PITCH ROUGHING CUTTER	SEMI-DESBASTE FINE PITCH ROUGHING CUTTER	CÓNICAS TAPERED TYPE	CÓNICAS TAPERED TYPE	ESFÉRICA MINIATURA BALL TYPE	ESFÉRICA BALL TYPE	ESFÉRICA BALL TYPE
Recubrimiento / Coating	TiALN	TiALN	TiALN	TiALN	TiALN	TiALN	TiALN	TiALN
Ranura λ / λ Flute	λs45°		λs35°			λs30°		
Material / Material	MDI Solid carbide							
Dureza material / Material hardness	<55HRC		<50HRC			<55HRC		
Tamaño grano / Grain Size	Ø<0,6 μm							
Gama / Range	Ø6...20	Ø6...20	Ø6...20	Ø0,5...10	Ø1...6	Ø0,4...4	Ø4,5...20	Ø1...12
								
Página / Page	8	9	9	10,11	12	13	14	15

Cortes / Cuts	 Z2	 Z2	 Z4	 Z4	 Z2	 Z2	 Z4	 Z4
Aplicación / Application								
Referencia M&T / M&T Reference	B ML-Z2	TN-Z2	TN-Z4	TN ML-Z4	FUMG-MINI-Z2	F UMG-Z2	F UMG-Z4	FV UMG-Z4
- / -	ESFÉRICA BALL TYPE	TÓRICAS CORNER RADIUS	TÓRICAS CORNER RADIUS	TÓRICAS CORNER RADIUS	PLANA SQUARE TYPE	PLANA SQUARE TYPE	PLANA SQUARE TYPE	PLANA SQUARE TYPE
Recubrimiento / Coating	TiALN	TiALN	TiALN	TiALN	AlTiN	AlTiN	AlTiN	G300
Ranura λ / λ Flute	λs30°		λs35°		λs35°			λs35-38°
Material / Material	MDI Solid carbide				UMG-MDI Solid carbide	UMG-MDI Solid carbide		
Dureza material / Material hardness	<55HRC				<60HRC			
Tamaño grano / Grain Size	Ø<0,6 μm				Ø<0,4 μm			
Gama / Range	Ø1...20	Ø3...12	Ø3...12	Ø6...12	Ø0,2...3	Ø4...20	Ø1...20	Ø3...20
								
Página / Page	16	17	18	19	20	21	22	23

Cortes / Cuts	 Z4	 Z6	 Z2	 Z2	 Z2	 Z4	 Z2	 Z2
Aplicación / Application								
Referencia M&T / M&T Reference	F UMG CL-Z4	F UMG HRC	F UMG CUL-Z2	B UMG MINI-Z2	B UMG-Z2	B UMG-Z4	B UMG ML-Z2	B UMG CUL-Z2
- / -	PLANA SQUARE TYPE	PLANA SQUARE TYPE	PLANA SQUARE TYPE	ESFÉRICA BALL TYPE	ESFÉRICA BALL TYPE	ESFÉRICA BALL TYPE	ESFÉRICA BALL TYPE	ESFÉRICA BALL TYPE
Recubrimiento / Coating	AlTiN	AlTiN	Aldura	AlTiN	AlTiN	AlTiN	AlTiN	AlTiN
Ranura λ / λ Flute	λ s35°	λ s45°	λ s35°	λ s30°				
Material / Material	UMG-MDI Solid carbide							QMG-MDI
Dureza material / Material hardness	<60HRC		<65HRC	<60HRC			<65HRC	
Tamaño grano / Grain Size	ϕ <0,4 μ m			ϕ <0,4 μ m				ϕ <0,2 μ m
Gama / Range	ϕ 4...12	ϕ 6...16	ϕ 0,5...3	ϕ 0,3...3	ϕ 4...16	ϕ 1...16	ϕ 1...20	ϕ 0,5...4
								
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Cortes / Cuts	Z2	Z4	Z2	Z3	Z3	Z2	Z4	Z4
Aplicación / Application	H P K	H P K	N	N	N	N	P K M S	M S
Referencia M&T / M&T Reference	TN UMG-Z2	TN UMG-Z4	F AL-Z2	F AL-Z3	F AL CL-Z3	B AL-Z2	FI-Z4	FIV UMG-Z4
- / -	TÓRICAS CORNER RADIUS	TÓRICAS CORNER RADIUS	PLANA SQUARE TYPE	PLANA SQUARE TYPE	PLANA SQUARE TYPE	ESFÉRICA BALL TYPE	PLANA SQUARE TYPE	PLANA SQUARE TYPE
Recubrimiento / Coating	AlTiN	AlTiN					TiALN	G300
Ranura λ / λ Flute	$\lambda_s 35^\circ$		$\lambda_s 55^\circ$			$\lambda_s 25^\circ$	$\lambda_s 45^\circ$	$\lambda_s 40-43^\circ$
Material / Material	UMG-MDI <i>Solid carbide</i>		MDI <i>Solid carbide</i>					UMG-MDI <i>Solid carbide</i>
Dureza material / Material hardness	<60HRC		<40HRC			<45HRC	<50HRC	<60HRC
Tamaño grano / Grain Size	$\phi < 0,4 \mu m$		$\phi < 0,6 \mu m$					$\phi < 0,4 \mu m$
Gama / Range	$\phi 3...12$	$\phi 1,5...12$	$\phi 1...16$	$\phi 3...20$	$\phi 2...20$	$\phi 1...12$	$\phi 3...16$	$\phi 3...20$
Página / Page	32	33	34	35	35	36	37	38



Cortes / Cuts	 Z2	 Z2	 Z2	 Z2	 Z4	 Z2	 Z2
Aplicación / Application	S	S	S	S	S	N	N
Referencia M&T / M&T Reference	B DT CUL Zr	BD DT CUL Ti	F DT CUL Ti	TN DT CUL Z2	TN DT CUL Z4	B DT CUL Comp	B DT CUL WAX
- / -	ESFÉRICA BALL TYPE	ESFÉRICA BALL TYPE	PLANA SQUARE TYPE	TÓRICAS CORNER RA- DIUS	TÓRICAS CORNER RA- DIUS	ESFÉRICA BALL TYPE	ESFÉRICA BALL TYPE
Recubrimiento / Coating	Diamond	G300	G300	G300	G300	Diamond	
Ranura λ / λ Flute	$\lambda_s 30^\circ$		$\lambda_s 35^\circ$	$\lambda_s 30^\circ$			
Material / Material	GMG-MDI <i>Solid carbide</i>	TMG-MDI <i>Solid carbide</i>				GMG-MDI <i>Solid carbide</i>	TMG-MDI <i>Solid carbide</i>
Dureza material / Material hardness	<60HRC						
Tamaño grano / Grain Size	$\varnothing < 0,4 \mu m$						
Gama / Range	$\varnothing 0,6...3$	$\varnothing 0,8...3$	$\varnothing 0,5...2,5$	$\varnothing 1...2,5$	$\varnothing 2...4$	$\varnothing 0,8...3$	$\varnothing 0,8...3$
							
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Fresas frontales de Metal duro integral / Solid Carbide end mills

Condiciones de corte recomendadas / Recommended cutting conditions

ISO Colour CODE	Grupo materiales Materials groups	Subgrupos materiales Application materials sub-groups	Resist. Tensil Tensile strength (N/mm²)	Ejemplos Examples	Mecani- zado Machining	Desbaste Roughing cutter		Acabado Finishing		
										
P	GR1 Aceros no aleados Non alloy steels	1	Aceros de construcción y automáticos General structural and free cutting steels	≤ 500	ST44-2 / ST52-3		1xd	0,06xd	1xd	0,03xd
				≤ 800	95MnPb 36 / 10SPb 20		0,04xd	0,12xd	0,03xd	0,85xd
				≤ 850	C22 / CK22 / C25 / CK38 / CK40 / C45		0,02xd	0,05xd	0,01xd	0,02xd
M	GR2 Aceros aleados Alloy steels	1	Aceros de construcción o fundidos General structural steels R<55HRC	≤ 1150	20MnRc5 / 15CrMo5		1xd	0,04xd	1xd	0,02xd
				≤ 1450	42CrMo4 / 41Cr4		0,03xd	0,82xd	0,02xd	0,65xd
				≤ 1000	X42Cr13 / 56-5-2		0,02xd	0,03xd	0,01xd	0,02xd
	2	Aceros de construcción o fundidos General structural steels R>55HRC	> 55 HRC			1xd	0,03xd	1xd	0,01xd	
						0,03xd	0,75xd	0,01xd	0,45xd	
						0,02xd	0,02xd	0,01xd	0,01xd	
GR3 Aceros inoxidables Stainless steels	1	Aceros inoxidables austeníticos y ferríticos Austenitic and ferritic stainless steels	≤ 700	X6CrAl13 / X8Cr30		1xd	0,04xd	1xd	0,01xd	
			≤ 850	X5CrNi18-10 / X8CrNiMo17-12-2		0,02xd	0,83xd	0,01xd	0,85xd	
						0,02xd	0,03xd	0,01xd	0,02xd	
K	GR4 Fundiciones Cast iron	1	Fundición gris GG GG Grey cast iron	≤ 820	GG15 / GG20 / GG25 / GG40		1xd	0,04xd	1xd	0,02xd
							0,02xd	0,85xd	0,01xd	0,64xd
		2	Fundición nodular GGG GGG Nodular cast iron	≤ 960	GGG40 / GGG50 / GGG70		1xd	0,22xd	1xd	0,03xd
							0,18xd	0,65xd	0,06xd	0,45xd
N	GR5 Cobre Copper	1	Cobre puro / Pure copper	≤ 210	E-Cu / SE-Cu / Cobre Ellectrolitic		1xd	0,09xd	1xd	0,03xd
				≤ 400	G-CuSn5ZnPb		0,15xd	1,05xd	0,04xd	0,75xd
							0,08xd	0,15xd	0,03xd	0,05xd
	GR6 Aluminio Aluminium	1	Aluminio y aleaciones de aluminio Aluminium and aluminium alloys	≤ 100	Al99.98 / Al99Cu / Al99.5ti		1xd	0,12xd	1xd	0,05xd
				≤ 270	AlMgSi0,5 / AlMgSiPb / AlCuBiPb		0,25xd	1,25xd	0,05xd	0,82xd
				≤ 330	GAlSi6Cu / GD-AlSi9Cu3 / GAlSi12		0,25xd	0,35xd	0,04xd	0,05xd
GR7 Magnesio Magnesium	1	Magnesio / Magnesium	≤ 275	GDMgAl6 / GDMgAl6Zn1 / GDMgAl8Zn1		1xd	0,12xd	1xd	0,05xd	
			≤ 365	MgMn2 / MgAl6Zn / MgAl8Zn		0,25xd	1,25xd	0,05xd	0,82xd	
						0,25xd	0,35xd	0,04xd	0,05xd	
S	GR8 Níquel Nickel	1	Níquel y aleaciones de níquel Nickel and nickel alloys	≤ 500	RNi24 / RNi12 / RNi8		1xd	0,03xd	1xd	0,01xd
				≤ 900	Monel ® 400 / Inconel 625 / Invar		0,02xd	0,52xd	0,01xd	0,35xd
				≤ 1400	Nimonic 80 / Inconel 718 / Hastelloy C4		0,02xd	0,02xd	0,01xd	0,01xd
	GR9 Titanio Titanium	1	Titanio y aleaciones de titanio Titanium and titanium alloys	≤ 850	Ti99,5 / Ti99,7 / Ti99,4 Ti99,2		1xd	0,03xd	1xd	0,01xd
≤ 1200				Ti4Al4Mn / Ti6Al4V / Ti7Al4Mo		0,02xd	0,75xd	0,01xd	0,43xd	
						0,02xd	0,03xd	0,01xd	0,02xd	
N	GR10 Zinc / Zinc	1	Zinc / Zinc	≤ 300	ZnCuPb1		1xd	0,12xd	1xd	0,05xd
				≤ 328	GD-ZnAl4 / GD-ZnAl4Cu3 / GK-ZnAlCu1		0,25xd	1,25xd	0,05xd	0,82xd
							0,25xd	0,35xd	0,04xd	0,05xd
	GR11 Materiales sintéticos Synthetic materials	1	Termoplásticos / Thermoplastics	≤ 80	Makrolon / Plexiglas / Hostalen		1xd	0,12xd	1xd	0,03xd
							0,08xd	0,95xd	0,04xd	0,63xd
							0,06xd	0,07xd	0,03xd	0,04xd
2	Termoestables Thermosetting plastics	≤ 110	Bakelite / Resopal / Pertinax		1xd	0,06xd	1xd	0,02xd		
					0,02xd	0,45xd	0,01xd	0,32xd		
					0,02xd	0,03xd	0,01xd	0,02xd		

Códigos de colores ISO

ISO Colour code

P Aceros 500 - 1.300 N/mm² / Steel 500 - 1.300 N/mm²

M Aceros Inoxidables / Stainless Steels

K Fundiciones / Cast Iron

N Aluminios, aleaciones de Cu, materiales no ferricos / Aluminum, Cu alloys, non ferreous materials

S Aleaciones de titanio o níquel resistentes al calor / Titanium or nickel alloys heat resistant

H Aceros Templados ≤62 HRC / Temperate Steels ≤62 HRC

$$\pi = 3,14159$$

D = Diámetro / Diameter (mm.)

N = Velocidad de rotación (rev/min.)
Rotating speed (rev/min.)

Vc = Velocidad de corte (m/min.)
Cutting speed (m/min.)

Z = Número de dientes
Number of teeth

F = Avance (mm/min.)
Feed (mm/min.)

Fz = Avance por diente
Feed of teeth

Tc = Tiempo de trabajo
Working time

L = Longitud de trabajo
Working length

		Desbaste / Roughing cutter					Acabados / Finishing						
		Velocidad Speed Vc=m/min.	Fz = mm./Z					Velocidad Speed Vc=m/min.	Fz = mm./Z				
			Ø 2~3 mm.	Ø 4~6 mm.	Ø 8~10 mm.	Ø 12~16 mm.	Ø 20~25 mm.		Ø 2~3 mm.	Ø 4~6 mm.	Ø 8~10 mm.	Ø 12~16 mm.	Ø 20~25 mm.
P	1	155	0,014	0,028	0,057	0,084	0,114	225	0,016	0,032	0,065	0,095	0,130
		255	0,022	0,044	0,088	0,132	0,176	345	0,025	0,050	0,100	0,150	0,200
		310	0,025	0,048	0,097	0,145	0,194	410	0,028	0,055	0,100	0,165	0,220
	1	145	0,013	0,026	0,053	0,079	0,105	175	0,014	0,029	0,059	0,088	0,117
		240	0,020	0,040	0,081	0,122	0,163	295	0,022	0,045	0,090	0,135	0,180
		285	0,022	0,045	0,089	0,134	0,178	325	0,024	0,050	0,099	0,149	0,198
M	2	75	0,011	0,021	0,045	0,069	0,098	35	0,012	0,023	0,049	0,075	0,107
		125	0,016	0,032	0,069	0,106	0,152	140	0,018	0,035	0,075	0,115	0,165
		150	0,017	0,034	0,074	0,113	0,163	150	0,019	0,037	0,080	0,123	0,177
	1	80	0,010	0,021	0,042	0,063	0,104	105	0,013	0,025	0,051	0,075	0,216
		135	0,017	0,035	0,070	0,104	0,174	175	0,021	0,042	0,085	0,125	0,210
		160	0,018	0,037	0,075	0,111	0,183	205	0,022	0,045	0,090	0,133	0,223
K	1	135	0,013	0,027	0,055	0,080	0,108	155	0,015	0,031	0,062	0,091	0,123
		230	0,020	0,041	0,084	0,123	0,167	255	0,023	0,047	0,095	0,140	0,190
		275	0,022	0,046	0,092	0,136	0,184	295	0,025	0,052	0,105	0,154	0,209
	2	600	0,016	0,032	0,068	0,203	0,126	600	0,024	0,049	0,104	0,141	0,191
		600	0,020	0,041	0,086	0,117	0,158	600	0,016	0,032	0,068	0,203	0,126
		800	0,022	0,044	0,094	0,127	0,172	600	0,020	0,041	0,086	0,117	0,158
N	1	400	0,014	0,027	0,054	0,081	0,135	400	0,018	0,036	0,076	0,225	0,140
		400	0,018	0,036	0,072	0,108	0,180	400	0,022	0,045	0,095	0,130	0,175
		600	0,020	0,040	0,080	0,120	0,200	600	0,024	0,049	0,104	0,141	0,191
	1	1910	0,022	0,043	0,086	0,122	0,180	1910	0,024	0,048	0,096	0,136	0,200
		1910	0,027	0,054	0,108	0,153	0,225	1910	0,030	0,060	0,120	0,170	0,250
		1910	0,031	0,060	0,112	0,171	0,252	1910	0,034	0,067	0,134	0,190	0,280
S	1	1910	0,022	0,043	0,086	0,122	0,180	1910	0,024	0,048	0,096	0,136	0,200
		1910	0,027	0,054	0,108	0,153	0,225	1910	0,030	0,060	0,120	0,170	0,250
		1910	0,031	0,060	0,112	0,171	0,252	1910	0,034	0,067	0,134	0,190	0,280
	1	25	0,009	0,018	0,034	0,054	0,090	30	0,011	0,021	0,039	0,063	0,105
		40	0,015	0,030	0,056	0,090	0,151	50	0,018	0,035	0,065	0,105	0,175
		50	0,016	0,032	0,058	0,095	0,158	55	0,019	0,037	0,068	0,110	0,184
N	1	80	0,011	0,022	0,044	0,065	0,108	90	0,012	0,024	0,048	0,072	0,120
		135	0,018	0,036	0,073	0,108	0,181	155	0,020	0,040	0,080	0,120	0,200
		160	0,019	0,039	0,077	0,114	0,192	180	0,021	0,043	0,086	0,128	0,214
	2	1910	0,022	0,043	0,086	0,122	0,180	1910	0,024	0,048	0,096	0,136	0,200
		1910	0,027	0,054	0,108	0,153	0,225	1910	0,030	0,060	0,120	0,170	0,250
		1910	0,031	0,060	0,112	0,171	0,252	1910	0,034	0,067	0,134	0,190	0,280
N	1	280	0,015	0,031	0,057	0,085	0,139	335	0,017	0,034	0,064	0,094	0,154
		360	0,020	0,041	0,077	0,113	0,185	420	0,022	0,045	0,085	0,125	0,205
		380	0,022	0,045	0,085	0,124	0,203	500	0,024	0,050	0,094	0,138	0,226
	2	120	0,012	0,025	0,049	0,071	0,122	160	0,013	0,027	0,053	0,077	0,133
		175	0,017	0,035	0,069	0,101	0,175	230	0,019	0,038	0,075	0,110	0,190
		190	0,019	0,038	0,075	0,109	0,189	270	0,021	0,041	0,081	0,119	0,205

* Estos valores recomendados dependen de las siguientes condiciones: máquina, sistema de fijación, refrigerante, etc. Es posible que tengan que ser adaptados.
 * These recommended values depend on the following conditions: machine locking system, coolant, etc. You may have to be adapted.

Formulas de cálculo para fresado / End mill working condition calculation method					Mecanizado / Machining
Velocidad de corte Cutting speed: $Vc = \frac{\pi \times D \times N}{1000}$	Velocidad de rotación Rotation speed: $N = \frac{1000 \times Vc}{\pi \times D}$	Avance / Feed: $F = N \times Z \times Fz$	Avance por diente Feed of teeth: $Fz = \frac{F}{N \times Z}$	Tiempo de trabajo Working time: $Tc = \frac{L}{F}$	Ranura / Slotting Lateral / Side cutting Radio / Radius



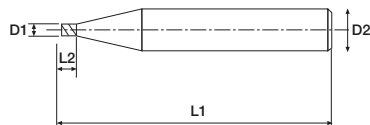
Fresas frontales de Metal duro integral. Micro Grano.

Solid Carbide end mills. Micro Grain.

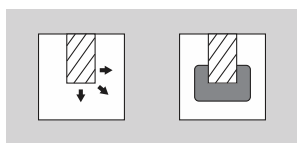
F MINI-Z2	 Z2	$\lambda_s 35^\circ$	<55HRC	MDI Solid carbide	Co 10% Wc 90%	HV30	grain $\varnothing < 0,6 \mu m$	3750 N/mm ²
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PLANA MINIATURA
MINIATURE
SQUARE TYPE

TiALN



D1 mm.	L2 mm.	L1 mm.	D2 h6mm.	stock	Cod.
0,2	0,4	50	4	○	1080100134100212
0,3	0,6	50	4	○	1080100134100312
0,4	0,8	50	4	●	1080100134100412
0,5	1	50	4	●	1080100134100512
0,6	1,2	50	4	●	1080100134100612
0,7	1,4	50	4	●	1080100134100712
0,8	1,6	50	4	●	1080100134100812
0,9	1,8	50	4	●	1080100134100912
1	3	50	4	●	1080100134101012
1,1	3	50	4	○	1080100134101212
1,2	3	50	4	●	1080100134101312
1,3	3	50	4	○	1080100134101412
1,4	3	50	4	●	1080100134101512
1,5	4	50	4	●	1080100134101612
1,6	4	50	4	●	1080100134101812
1,7	4	50	4	○	1080100134101912
1,8	4	50	4	●	1080100134102012
1,9	4	50	4	○	1080100134102112
2	6	50	4	●	1080100134102312
2,1	6	50	4	○	1080100134102512
2,3	6	50	4	○	1080100134102712
2,4	6	50	4	○	1080100134102812
2,5	8	50	4	●	1080100134103012
2,6	8	50	4	○	1080100134103212
2,7	8	50	4	○	1080100134103312
2,8	8	50	4	○	1080100134103412
2,9	8	50	4	○	1080100134103512
3	8	50	4	●	1080100134103712



● Tarifa en stock / Price list from stock
○ Bajo demanda / On request

Fresas frontales de Metal duro integral. Micro Grano.

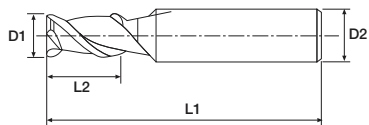
Solid Carbide end mills. Micro Grain.



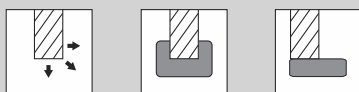
F-Z2	 Z2	$\lambda_s 35^\circ$	<55HRC	MDI Solid carbide	Co 10% Wc 90%	HV30	grain $\varnothing < 0,6 \mu m$	3750 N/mm ²
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PLANA
SQUARE TYPE

TiALN



D1 mm.	L2 mm.	L1 mm.	D2 h6mm.	stock	Cod.
3	8	50	3	○	1080100234103612
3,5	10	50	4	○	1080100234103912
4	11	50	4	●	1080100234104112
1	3	50	6	○	1080100234101112
1,5	4	50	6	○	1080100234101712
2	6	50	6	○	1080100234102412
2,2	6	50	4	○	1080100234102612
2,5	8	50	6	○	1080100234103112
3	8	50	6	○	1080100234103812
3,5	10	50	6	○	1080100234104012
4	11	50	6	●	1080100234104212
4,5	11	50	6	○	1080100234104312
5	13	50	6	●	1080100234104512
5,5	13	50	6	○	1080100234104612
6	16	50	6	●	1080100234104712
6,5	16	60	8	○	1080100234104812
7	16	60	8	○	1080100234104912
7,5	19	60	8	○	1080100234105012
8	20	60	8	●	1080100234105112
8,5	20	75	10	○	1080100234105212
9	20	75	10	○	1080100234105312
9,5	25	75	10	○	1080100234105412
10	25	75	10	●	1080100234105512
10,5	25	75	12	○	1080100234105612
11	25	75	12	○	1080100234105712
11,5	30	75	12	○	1080100234105812
12	30	75	12	●	1080100234105912
13	40	100	16	○	1080100234106012
14	40	100	14	●	1080100234106112
15	40	100	16	○	1080100234106312
16	40	100	16	●	1080100234106412
18	40	100	20	●	1080100234106612
20	45	100	20	●	1080100234106812



● Tarifa en stock / Price list from stock
○ Bajo demanda / On request



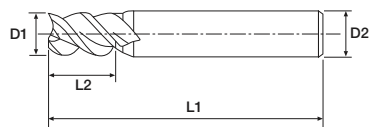
Fresas frontales de Metal duro integral. Micro Grano.

Solid Carbide end mills. Micro Grain.

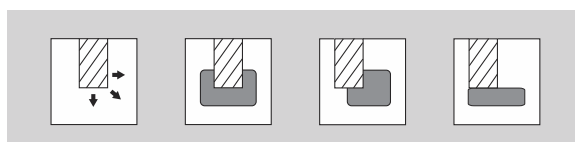
F-Z3	Z3	$\lambda_s 45^\circ$	<55HRC	MDI Solid carbide	Co 10% Wc 90%	HV30	grain $\varnothing < 0,6 \mu m$	3750 N/mm ²
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PLANA
SQUARE TYPE

TiALN



D1 mm.	L2 mm.	L1 mm.	D2 h6mm.	stock	Cod.
1	3	50	4	○	1080100634101012
1,5	4	50	4	○	1080100634101612
2	6	50	4	○	1080100634102312
2,5	8	50	4	○	1080100634103012
3	8	50	3	○	1080100634103612
3	8	50	4	●	1080100634103712
3,5	10	50	4	○	1080100634103912
4	11	50	4	●	1080100634104112
1	3	50	6	○	1080100634101112
1,5	4	50	6	○	1080100634101712
2	6	50	6	○	1080100634102412
2,5	8	50	6	○	1080100634103112
3	8	50	6	○	1080100634103812
3,5	10	50	6	○	1080100634104012
4	11	50	6	○	1080100634104212
4,5	11	50	6	○	1080100634104312
5	13	50	6	●	1080100634104512
5,5	13	50	6	○	1080100634104612
6	16	50	6	●	1080100634104712
6,5	16	60	8	○	1080100634104812
7	16	60	8	○	1080100634104912
7,5	19	60	8	○	1080100634105012
8	20	60	8	●	1080100634105112
8,5	20	75	10	○	1080100634105212
9	20	75	10	○	1080100634105312
9,5	25	75	10	○	1080100634105412
10	25	75	10	●	1080100634105512
10,5	25	75	12	○	1080100634105612
11	25	75	12	○	1080100634105712
11,5	30	75	12	○	1080100634105812
12	30	75	12	●	1080100634105912
14	40	100	16	○	1080100634106112
16	40	100	16	●	1080100634106412
18	40	100	20	○	1080100634106612
20	45	100	20	●	1080100634106812



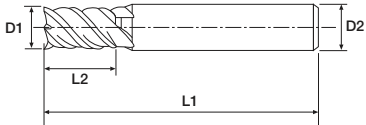
● Tarifa en stock / Price list from stock
○ Bajo demanda / On request



Fresas frontales de Metal duro integral. Micro Grano.

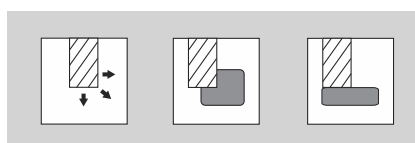
Solid Carbide end mills. Micro Grain.



F-Z4	 Z4	λ_{s35°	<55HRC	MDI Solid carbide	Co 10% Wc 90%	HV30	grain $\varnothing < 0,6 \mu m$	3750 N/mm ²
PLANA SQUARE TYPE								
TiALN								



D1 mm.	L2 mm.	L1 mm.	D2 h6mm.	stock	Cod.
1	3	50	4	●	1080100734101012
1,5	4	50	4	●	1080100734101612
2	6	50	2	●	1080100734102412
2,5	8	50	4	●	1080100734103012
3	8	50	3	●	1080100734103612
3	8	50	4	●	1080100734103712
3,5	10	50	4	○	1080100734103912
4	11	50	4	●	1080100734104112
1	3	50	6	○	1080100734101112
1,5	4	50	6	○	1080100734101712
2	6	50	4	●	1080100734102312
2,5	8	50	6	○	1080100734103112
3	8	50	6	○	1080100734103812
3,5	10	50	6	○	1080100734104012
4	11	50	6	○	1080100734104212
4,5	11	50	6	○	1080100734104312
5	13	50	5	●	1080100734104412
5	13	50	6	●	1080100734104512
6	16	50	6	●	1080100734104712
6,5	16	60	8	○	1080100734104812
7	18	60	7	●	1080100734104912
7,5	19	60	8	○	1080100734105012
8	20	60	8	●	1080100734105112
8,5	20	75	10	○	1080100734105212
9	20	75	10	○	1080100734105312
9,5	25	75	10	○	1080100734105412
10	25	75	10	●	1080100734105512
10,5	25	75	12	○	1080100734105612
11	25	75	12	○	1080100734105712
11,5	30	75	12	○	1080100734105812
12	30	75	12	●	1080100734105912
13	40	100	16	○	1080100734106012
14	40	100	14	●	1080100734106112
15	40	100	16	○	1080100734106312
16	40	100	16	●	1080100734106412
18	40	100	20	●	1080100734106612
20	45	100	20	●	1080100734106812

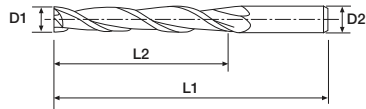


● Tarifa en stock / Price list from stock
○ Bajo demanda / On request



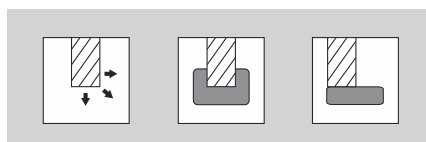
Fresas frontales de Metal duro integral. Micro Grano. Canal largo.

Solid Carbide end mills. Micro Grain. Long flute.

F CL-Z2		$\lambda_s 35^\circ$	<55HRC	MDI Solid carbide	Co 10% Wc 90%	HV30	grain $\varnothing < 0,6 \mu m$	3750 N/mm ²
PLANA SQUARE TYPE								
TiALN								



D1 mm.	L2 mm.	L1 mm.	D2 h6mm.	stock	Cod.
1	7	50	4	○	1080100434101012
1,5	9	50	4	○	1080100434101612
2	12	50	4	●	1080100434102812
2,5	12	50	4	○	1080100434103012
3	20	50	4	●	1080100434103812
3,5	15	60	6	○	1080100434104012
4	25	75	4	●	1080100434104212
4,5	20	75	6	○	1080100434104312
5	30	75	6	●	1080100434104512
5,5	25	75	6	○	1080100434104612
6	30	75	6	●	1080100434104712
7	30	100	8	○	1080100434104912
8	40	100	8	●	1080100434105112
9	40	100	10	○	1080100434105312
10	40	100	10	●	1080100434105512
11	40	100	12	○	1080100434105712
12	45	100	12	●	1080100434105912
14	50	150	16	○	1080100434106112
16	60	150	16	○	1080100434106412
20	90	200	20	○	1080100434106812

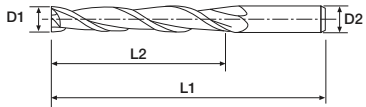


● Tarifa en stock / Price list from stock
○ Bajo demanda / On request

Fresas frontales de Metal duro integral. Micro Grano. Canal largo.

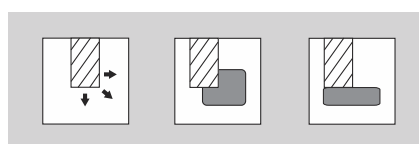
Solid Carbide end mills. Micro Grain. Long flute.



F CL-Z4		$\lambda_s 35^\circ$	<55HRC	MDI Solid carbide	Co 10% Wc 90%	HV30	grain $\varnothing < 0,6 \mu m$	3750 N/mm ²
PLANA SQUARE TYPE								
TiALN								



D1 mm.	L2 mm.	L1 mm.	D2 h6mm.	stock	Cod.
1	6	50	4	○	1080100934101012
1,5	9	50	4	○	1080100934101612
2	15	50	4	●	1080100934102312
2,5	12	50	4	○	1080100934103012
3	20	50	4	●	1080100934103812
3,5	15	60	6	○	1080100934104012
4	25	75	4	●	1080100934104212
4,5	20	75	6	○	1080100934104312
5	30	60	5	○	1080100934104412
5	30	75	6	●	1080100934104512
5,5	25	75	6	○	1080100934104612
6	24	65	6	○	1080100934107112
6	30	75	6	●	1080100934104712
7	30	100	8	○	1080100934104912
8	40	100	8	●	1080100934105112
9	40	100	10	○	1080100934105312
10	40	100	10	●	1080100934105512
11	40	100	12	○	1080100934105712
12	45	100	12	●	1080100934105912
14	50	150	16	○	1080100934106112
16	60	150	16	●	1080100934106412
20	60	150	20	●	1080100934106812



● Tarifa en stock / Price list from stock
○ Bajo demanda / On request



Fresas frontales de Metal duro integral. Micro Grano. Mango largo. Solid Carbide end mills. Micro Grain. Long shank.

F ML-Z2

PLANA
SQUARE TYPE

TiALN

Z2	$\lambda_s 35^\circ$	<55HRC	MDI Solid carbide	Co 10% Wc 90%	HV30	grain $\varnothing < 0,6 \mu m$	3750 N/mm ²
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D1 mm.	L2 mm.	L1 mm.	D2 h6mm.	stock	Cod.
6	15	75	6	●	1080100550101612
6	15	100	6	●	1080100550101712
8	20	75	8	○	1080100550101912
8	20	100	8	●	1080100550102012
10	25	100	10	●	1080100550102212
10	25	150	10	●	1080100550102312
12	30	100	12	●	1080100550102512
12	30	150	12	●	1080100550102612

P

K

● Tarifa en stock / Price list from stock
○ Bajo demanda / On request

F ML-Z4

PLANA
SQUARE TYPE

TiALN

Z4	$\lambda_s 35^\circ$	<55HRC	MDI Solid carbide	Co 10% Wc 90%	HV30	grain $\varnothing < 0,6 \mu m$	3750 N/mm ²
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D1 mm.	L2 mm.	L1 mm.	D2 h6mm.	stock	Cod.
3	8	75	3	●	1080103150100912
4	11	75	4	●	1080103050101212
6	15	75	6	●	1080103150101712
6	15	100	6	●	1080103150101612
8	20	75	8	○	1080103150102012
8	20	100	8	●	1080103150101912
10	25	100	10	●	1080103150102212
10	25	150	10	●	1080103150102312
12	30	100	12	●	1080103150102512
12	30	150	12	●	1080103150102612
16	40	150	16	●	1080103150102812

P

K

● Tarifa en stock / Price list from stock
○ Bajo demanda / On request

Fresas frontales de Metal duro integral / Solid Carbide end mills.

Ultra Micro Grano fino. Altas velocidades y aceros templados. Canal largo.

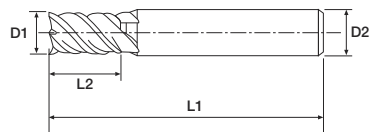
Ultra fine Micro Grain. High speed and tempered steels. Long flute.



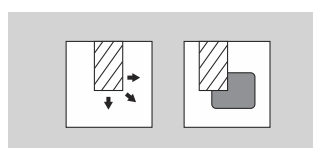
F HRC ML	Z6	$\lambda_s 45^\circ$	<55HRC	MDI Solid carbide	Co 10% Wc 90%	HRA 92,3	grain $\varnothing < 0,6 \mu m$	3800 N/mm ²
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PLANA
SQUARE TYPE

TiALN



D1 mm.	L2 mm.	L1 mm.	D2 mm.	stock	Cod.
6	24	75	6	●	1080103350101612
8	32	75	8	●	1080103350101912
10	40	100	10	●	1080103350102212
12	45	100	12	●	1080103350102512
16	64	150	16	●	1080103350102812
20	75	150	20	●	1080103350103412



● Tarifa en stock / Price list from stock
○ Bajo demanda / On request



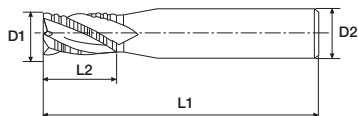
Fresas frontales de Metal duro integral. Micro Grano.

Solid Carbide end mills. Micro Grain.

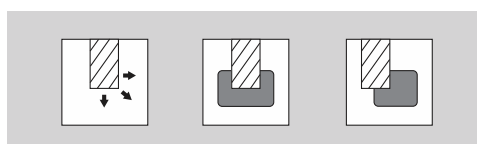
DF-Z3		$\lambda_s 45^\circ$		<55HRC	MDI Solid carbide	Co 10% Wc 90%	HV30	grain $\varnothing < 0,6 \mu m$	3750 N/mm ²
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SEMI-DESABASTE
FINE PITCH
ROUGHING CUTTER

TiALN



D1 mm.	L2 mm.	L1 mm.	D2 h6mm.	stock	Cod.
4	8	50	6	○	1080102634104212
5	13	50	6	○	1080102634104512
6	16	50	6	●	1080102634104712
7	16	60	8	○	1080102634104912
8	19	60	8	●	1080102634105112
9	25	75	10	○	1080102634105312
10	25	75	10	●	1080102634105512
11	30	75	12	○	1080102634105712
12	30	75	12	●	1080102634105912
16	35	100	16	●	1080102634106412
20	40	100	20	●	1080102634106812



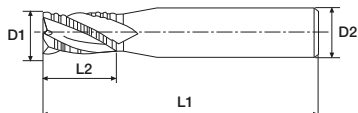
● Tarifa en stock / Price list from stock
○ Bajo demanda / On request



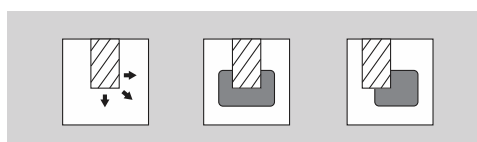
DF-Z4		$\lambda_s 35^\circ$		<55HRC	MDI Solid carbide	Co 10% Wc 90%	HV30	grain $\varnothing < 0,6 \mu m$	3750 N/mm ²
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SEMI-DESABASTE
FINE PITCH
ROUGHING CUTTER

TiALN



D1 mm.	L2 mm.	L1 mm.	D2 h6mm.	stock	Cod.
5	13	50	6	○	1080102734104512
6	16	50	6	●	1080102734104712
7	16	60	8	○	1080102734104912
8	19	60	8	●	1080102734105112
9	25	75	10	○	1080102734105312
10	25	75	10	●	1080102734105512
11	30	75	12	○	1080102734105712
12	30	75	12	●	1080102734105912
16	35	100	16	●	1080102734106412
20	40	100	20	●	1080102734106812



● Tarifa en stock / Price list from stock
○ Bajo demanda / On request



Fresas frontales de Metal duro integral. Micro Grano. Cónica.

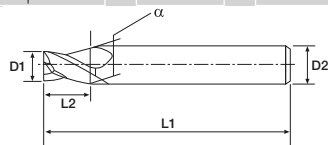
Solid Carbide end mills. Micro Grain. Taper.



TP-Z2		λ_{s35°	<55HRC	MDI Solid carbide	Co 10% Wc 90%	HV30	grain $\varnothing < 0,6 \mu m$	3750 N/mm ²
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CÓNICAS
TAPERED TYPE

TiALN



D1 mm.	α	L2 mm.	L1 mm.	$\varnothing$ max.	D2 h6mm.	stock	Cod.
0,5	30"	2	50	0,53	4	●	1080104048100112
0,5	1°	2	50	0,57	4	●	1080104048100212
0,5	1°30"	2	50	0,6	4	●	1080104048100312
0,5	2°	2	50	0,64	4	●	1080104048100412
0,5	2°30"	2	50	0,67	4	●	1080104048100512
0,5	3°	2	50	0,71	4	●	1080104048100612
0,5	5°	2	50	0,85	4	●	1080104048100712
0,5	7°	2	50	0,99	4	●	1080104048100812
0,5	10°	2	50	1,21	4	●	1080104048100912
1	30"	4	50	1,07	4	●	1080104048101012
1	1°	4	50	1,14	4	●	1080104048101112
1	1°30"	4	50	1,21	4	●	1080104048101212
1	2°	4	50	1,28	4	●	1080104048101312
1	2°30"	4	50	1,35	4	●	1080104048101412
1	3°	4	50	1,42	4	●	1080104048101512
1	5°	4	50	1,7	4	●	1080104048101612
1	7°	4	50	1,98	4	●	1080104048101712
1	10°	4	50	2,41	4	●	1080104048101812
1,5	30"	5	50	1,59	4	●	1080104048101912
1,5	1°	5	50	1,67	4	●	1080104048102012
1,5	1°30"	5	50	1,76	4	●	1080104048102112
1,5	2°	5	50	1,85	4	●	1080104048102212
1,5	2°30"	5	50	1,93	4	●	1080104048102312
1,5	3°	5	50	2,02	4	●	1080104048102412
1,5	5°	5	50	2,37	4	●	1080104048102512
1,5	7°	5	50	2,73	4	●	1080104048102612
1,5	10°	5	50	3,26	4	●	1080104048102712
2	30"	6	50	2,1	4	●	1080104048102812
2	1°	6	50	2,21	4	●	1080104048102912
2	1°30"	6	50	2,31	4	●	1080104048103012
2	2°	6	50	2,41	4	●	1080104048103112
2	2°30"	6	50	2,52	4	●	1080104048103212
2	3°	6	50	2,62	4	●	1080104048103312
2	5°	6	50	3,05	4	●	1080104048103412
2	7°	6	50	3,47	4	●	1080104048103512
2	10°	6	50	4,11	6	●	1080104048103612
2,5	30"	8	50	2,64	4	●	1080104048103712
2,5	1°	8	50	2,78	4	●	1080104048103812
2,5	1°30"	8	50	2,91	4	●	1080104048103912
2,5	2°	8	50	3,05	4	●	1080104048104012
2,5	2°30"	8	50	3,2	4	●	1080104048104112
2,5	3°	8	50	3,33	4	●	1080104048104212
2,5	5°	8	50	3,9	4	●	1080104048104312
2,5	7°	8	50	4,46	6	●	1080104048104412
2,5	10°	8	50	5,32	6	●	1080104048104512
3	30"	10	50	3,17	6	●	1080104048104612
3	1°	10	50	3,35	6	●	1080104048104712
3	1°30"	10	50	3,52	6	●	1080104048104812





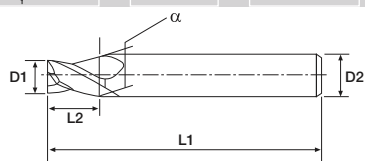
Fresas frontales de Metal duro integral. Micro Grano. Cónica.

Solid Carbide end mills. Micro Grain. Taper.

TP-Z2	Z2	$\lambda_s 35^\circ$	<55HRC	MDI Solid carbide	Co 10% Wc 90%	HV30	grain $\varnothing < 0,6 \mu m$	3750 N/mm ²
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CÓNICAS
TAPERED TYPE

TiALN



D1 mm.	α	L2 mm.	L1 mm.	$\varnothing$ max.	D2 h6mm.	stock	Cod.
3	2°	10	50	3,69	6	●	1080104048104912
3	2°30'	10	50	3,87	6	●	1080104048105012
3	3°	10	50	4,05	6	●	1080104048105112
3	5°	10	50	4,75	6	●	1080104048105212
3	7°	10	50	5,46	6	●	1080104048105312
3	10°	10	50	6,53	8	●	1080104048105412
4	30'	15	50	4,26	6	●	1080104048105512
4	1°	15	50	4,52	6	●	1080104048105612
4	1°30'	15	50	4,79	6	●	1080104048105712
4	2°	15	50	5,04	6	●	1080104048105812
4	2°30'	15	50	5,31	6	●	1080104048105912
4	3°	15	50	5,57	6	●	1080104048106012
4	5°	15	60	6,62	8	●	1080104048106112
4	7°	15	60	7,68	8	●	1080104048106212
5	30'	20	60	5,34	6	●	1080104048106312
5	1°	20	60	5,7	6	●	1080104048106412
5	1°30'	20	60	6,04	6	●	1080104048106512
5	2°	20	60	6,39	8	●	1080104048106612
5	2°30'	20	60	6,74	8	●	1080104048106712
5	3°	20	60	7,1	8	●	1080104048106812
5	5°	20	60	8,5	10	●	1080104048106912
5	7°	20	75	9,91	10	●	1080104048107012
6	30'	20	60	6,35	8	●	1080104048107112
6	1°	20	60	6,7	8	●	1080104048107212
6	1°30'	20	60	7,05	8	●	1080104048107312
6	2°	20	60	7,4	8	●	1080104048107412
6	2°30'	20	60	7,75	8	●	1080104048107512
6	3°	20	60	8,1	8	●	1080104048107612
6	5°	20	75	9,5	8	●	1080104048107712
8	30'	25	75	8,44	10	●	1080104048107812
8	1°	25	75	8,87	10	●	1080104048107912
8	1°30'	25	75	9,31	10	●	1080104048108012
8	2°	25	75	9,74	10	●	1080104048108112
8	2°30'	25	75	10,18	10	●	1080104048108212
8	3°	25	75	10,62	10	●	1080104048108312
8	5°	25	100	12,37	12	●	1080104048108412
10	30'	35	100	10,61	12	●	1080104048108512
10	1°	35	100	11,22	12	●	1080104048108612
10	1°30'	35	100	11,83	12	●	1080104048108712
10	2°	35	100	12,44	12	●	1080104048108812
10	2°30'	35	100	13,06	16	●	1080104048108912
10	3°	35	100	13,67	16	●	1080104048109012
10	5°	35	100	16,12	16	●	1080104048109112



● Tarifa en stock / Price list from stock
○ Bajo demanda / On request

Fresas frontales de Metal duro integral. Micro Grano. Canal largo.Cónica

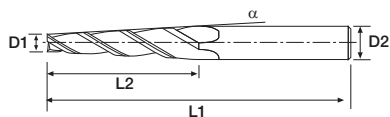
Solid Carbide end mills. Micro Grain. Long flute. Taper.



TP CL-Z2		$\lambda_s 35^\circ$	<55HRC	MDI Solid carbide	Co 10% Wc 90%	HV30	grain $\varnothing < 0,6 \mu m$	3750 N/mm ²
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CÓNICAS
TAPERED TYPE

TiALN



D1 mm.	α	L2 mm.	L1 mm.	$\varnothing$ max.	D2 h6mm.	stock	Cod.
1	30"	10	50	1,17	4	●	1080103948101012
1	1°	10	50	1,35	4	●	1080103948101112
1	1°30"	10	50	1,52	4	●	1080103948101212
1	2°	10	50	1,7	4	●	1080103948101312
1	2°30"	10	50	1,87	4	●	1080103948101412
1	3°	10	50	2,05	4	●	1080103948101512
1	5°	10	50	2,74	4	●	1080103948101612
1	7°	10	50	3,44	4	●	1080103948101712
1,5	30"	10	50	1,67	4	●	1080103948101912
1,5	1°	10	50	1,85	4	●	1080103948102012
1,5	1°30"	10	50	2,02	4	●	1080103948102112
1,5	2°	10	50	2,2	4	●	1080103948102212
1,5	2°30"	10	50	2,37	4	●	1080103948102312
1,5	3°	10	50	2,55	4	●	1080103948102412
1,5	5°	10	50	3,24	4	○	1080103948102512
1,5	7°	10	50	3,94	4	○	1080103948102612
2	30"	13	50	2,22	4	●	1080103948102812
2	1°	13	50	2,45	4	●	1080103948102912
2	1°30"	13	50	2,68	4	●	1080103948103012
2	2°	13	50	2,9	4	●	1080103948103112
2	2°30"	13	50	3,13	4	●	1080103948103212
2	3°	13	50	3,36	4	●	1080103948103312
2	5°	13	50	4,27	6	●	1080103948103412
2	7°	13	50	5,17	6	○	1080103948103512
2,5	30"	15	50	2,76	4	●	1080103948103712
2,5	1°	15	50	3,03	4	●	1080103948103812
2,5	1°30"	15	50	3,29	4	●	1080103948103912
2,5	2°	15	50	3,56	4	●	1080103948104012
2,5	2°30"	15	50	3,81	4	●	1080103948104112
2,5	3°	15	50	4,07	6	●	1080103948104212
2,5	5°	15	50	5,13	6	●	1080103948104312
3	30"	20	60	3,35	6	●	1080103948104512
3	1°	20	60	3,7	6	●	1080103948104712
3	1°30"	20	60	4,05	6	●	1080103948104812
3	2°	20	60	4,39	6	●	1080103948104912
3	2°30"	20	60	4,65	6	●	1080103948105012
3	3°	20	60	5,1	6	●	1080103948105112
3	5°	20	60	6,5	6	●	1080103948105212
4	30"	25	60	4,44	6	●	1080103948105512
4	1°	25	60	4,88	6	●	1080103948105612
4	1°30"	25	60	5,13	6	●	1080103948105712
4	2°	25	60	5,75	6	●	1080103948105812
4	2°30"	25	60	6,19	8	●	1080103948105912
4	3°	25	60	6,62	8	●	1080103948106012
4	5°	25	75	8,38	8	●	1080103948106112

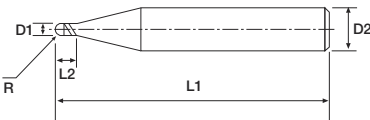


● Tarifa en stock / Price list from stock
○ Bajo demanda / On request



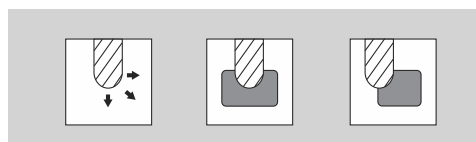
Fresas frontales de Metal duro integral. Micro Grano.

Solid Carbide end mills. Micro Grain.

B MINI-Z2		$\lambda_s 30^\circ$	<55HRC	MDI Solid carbide	Co 10% Wc 90%	HV30	grain $\varnothing < 0,6 \mu m$	3750 N/mm ²
ESFÉRICA MINIATURA MINIATURE BALL TYPE								
TiALN								



D1 mm.	L2 mm.	L1 mm.	D2 h6mm.	R	stock	Cod.
0,3	0,6	50	4	0,15	○	1080101034100312
0,4	0,8	50	4	0,20	●	1080101034100412
0,5	1	50	4	0,25	●	1080101034100512
0,6	1,2	50	4	0,30	●	1080101034100612
0,7	1,4	50	4	0,35	●	1080101034100712
0,8	1,6	50	4	0,40	●	1080101034100812
0,9	1,8	50	4	0,45	●	1080101034100912
1	2	50	4	0,50	●	1080101034101012
1,1	2,2	50	4	0,55	○	1080101034101212
1,2	2,4	50	4	0,60	●	1080101034101312
1,3	2,6	50	4	0,65	○	1080101034101412
1,4	2,8	50	4	0,70	●	1080101034101512
1,5	3	50	4	0,75	●	1080101034101612
1,6	3,2	50	4	0,80	●	1080101034101812
1,7	3,4	50	4	0,85	○	1080101034101912
1,8	3,6	50	4	0,90	●	1080101034102012
1,9	3,8	50	4	0,95	○	1080101034102112
2	4	50	2	1,00	●	1080101034102212
2	4	50	4	1,00	●	1080101034102312
2,1	4,2	50	4	1,05	○	1080101034102512
2,2	4,4	50	4	1,10	○	1080101034102612
2,3	4,6	50	4	1,15	○	1080101034102712
2,4	4,8	50	4	1,20	○	1080101034102812
2,5	5	50	4	1,25	●	1080101034103012
2,6	5,2	50	4	1,30	○	1080101034103212
2,7	5,4	50	4	1,35	○	1080101034103312
2,8	5,6	50	4	1,40	○	1080101034103412
2,9	5,8	50	4	1,45	○	1080101034103512
3	6	50	4	1,50	●	1080101034103712
3,5	7	50	4	1,75	●	1080101034103912
4	8	50	4	2,00	●	1080101034104112



● Tarifa en stock / Price list from stock
○ Bajo demanda / On request



Fresas frontales de Metal duro integral. Micro Grano.

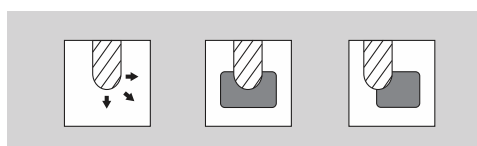
Solid Carbide end mills. Micro Grain.



B-Z2		$\lambda_s 30^\circ$	<55HRC	MDI Solid carbide	Co 10% Wc 90%	HV30	grain $\varnothing < 0,6 \mu m$	3750 N/mm ²
ESFÉRICA BALL TYPE								
TiALN								



D1 mm.	L2 mm.	L1 mm.	D2 h6mm.	R	stock	Cod.
1	2	50	6	0,50	○	1080101134101112
1	3	50	4	0,50	○	1080101134101012
1,5	3	50	6	0,75	○	1080101134101712
1,5	4	50	4	0,75	○	1080101134101612
2	4	50	6	1,00	○	1080101134102412
2	6	50	4	1,00	○	1080101134102312
2,5	5	50	6	1,25	○	1080101134103112
3	6	50	3	1,50	○	1080101134103612
3	6	50	6	1,50	○	1080101134103812
3,5	7	50	6	1,75	○	1080101134104012
4	8	50	4	2,00	○	1080101134104112
4	8	50	6	2,00	○	1080101134104212
4,5	9	50	6	2,25	●	1080101134104312
5	10	50	5	2,50	●	1080101134104412
5	10	50	6	2,50	●	1080101134104512
5,5	11	50	6	2,75	●	1080101134104612
6	12	50	6	3,00	●	1080101134104712
7	14	60	7	3,50	●	1080101134107212
7	14	60	8	3,50	●	1080101134104912
8	16	60	8	4,00	●	1080101134105112
9	18	75	10	4,50	●	1080101134105312
10	20	75	10	5,00	●	1080101134105512
11	22	75	12	5,50	○	1080101134105712
12	24	75	12	6,00	●	1080101134105912
14	28	100	16	7,00	○	1080101134106112
16	32	100	16	8,00	●	1080101134106412
18	36	100	20	9,00	●	1080101134106612
20	40	100	20	10,00	●	1080101134106812



● Tarifa en stock / Price list from stock
○ Bajo demanda / On request



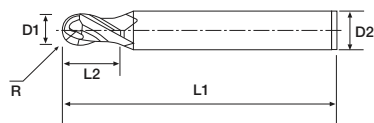


Fresas frontales de Metal duro integral. Micro Grano.

Solid Carbide end mills. Micro Grain.

B-Z4		$\lambda_s 30^\circ$	<55HRC	MDI Solid carbide	Co 10% Wc 90%	HV30	grain $\varnothing < 0,6 \mu m$	3750 N/mm ²
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ESFÉRICA
BALL TYPE
TiALN



D1 mm.	L2 mm.	L1 mm.	D2 h6mm.	R	stock	Cod.
1	2	50	3	0,50	●	1080101434101112
1	2	50	4	0,50	●	1080101434101012
1,5	3	50	3	0,75	●	1080101434101712
1,5	3	50	4	0,75	●	1080101434101612
2	4	50	3	1,00	●	1080101434102912
2	4	50	4	1,00	●	1080101434102312
2,5	5	50	3	1,25	●	1080101434103112
2,5	5	50	4	1,25	●	1080101434103012
3	6	50	3	1,50	○	1080101434103612
3	6	50	4	1,50	●	1080101434103712
3,5	7	50	4	1,75	○	1080101434103912
4	8	50	4	2,00	●	1080101434104112
5	10	50	6	2,50	●	1080101434104512
6	12	50	6	3,00	●	1080101434104712
7	14	60	8	3,50	○	1080101434104912
8	16	60	8	4,00	●	1080101434105112
9	18	75	10	4,50	○	1080101434105312
10	20	75	10	5,00	●	1080101434105512
12	24	75	12	6,00	●	1080101434105912
14	28	100	16	7,00	○	1080101434106212
16	32	100	16	8,00	○	1080101434106412
18	36	100	20	9,00	○	1080101434106612
20	40	100	20	10,00	○	1080101434106812



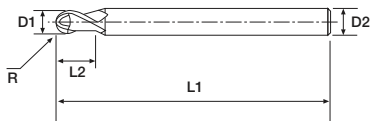
● Tarifa en stock / Price list from stock
○ Bajo demanda / On request



Fresas frontales de Metal duro integral. Micro Grano. Mango largo.

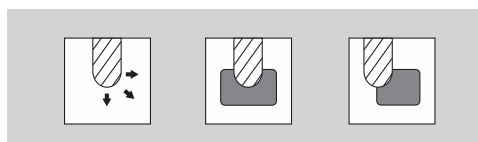
Solid Carbide end mills. Micro Grain. Long shank.



B ML-Z2		$\lambda_s 30^\circ$	<55HRC	MDI Solid carbide	Co 10% Wc 90%	HV30	grain $\varnothing < 0,6 \mu m$	3750 N/mm ²
ESFÉRICA BALL TYPE								
TiALN								



D1 mm.	L2 mm.	L1 mm.	D2 h6mm.	R	stock	Cod.
1	2	75	4	0,50	●	1080101350103712
1	2	75	6	0,50	●	1080101350100112
1	2	100	6	0,50	○	1080101350100212
1,5	3	75	4	0,75	●	1080101350103812
1,5	3	75	6	0,75	●	1080101350100312
1,5	3	100	6	0,75	○	1080101350100412
2	4	75	6	1,00	●	1080101350100612
2	4	100	6	1,00	●	1080101350100512
2,5	5	75	6	1,25	●	1080101350100812
2,5	5	100	6	1,25	○	1080101350100712
3	6	75	3	1,50	●	1080101350104012
3	6	100	3	1,50	●	1080101350101012
3	6	75	6	1,50	●	1080101350103912
3	6	100	6	1,50	●	1080101350100912
3,5	7	100	6	1,75	○	1080101350101112
4	8	75	4	2,00	●	1080101350104112
4	8	100	4	2,00	●	1080101350104212
4	8	75	6	2,00	●	1080101350101212
4	8	100	6	2,00	●	1080101350101312
5	10	75	6	2,50	●	1080101350101412
5	10	100	6	2,50	○	1080101350101512
6	12	75	6	3,00	●	1080101350101612
6	12	100	6	3,00	●	1080101350101712
6	12	150	6	3,00	●	1080101350101812
8	16	75	6	4,00	●	1080101350101912
8	16	100	8	4,00	●	1080101350102012
8	16	150	8	4,00	●	1080101350102112
10	20	100	10	5,00	●	1080101350102212
10	20	150	10	5,00	●	1080101350102312
10	20	200	10	5,00	○	1080101350102412
12	24	100	12	6,00	●	1080101350102512
12	24	150	12	6,00	●	1080101350102612
12	24	200	12	6,00	○	1080101350102712
16	32	150	16	8,00	●	1080101350102812
20	40	150	20	10,00	●	1080101350103412



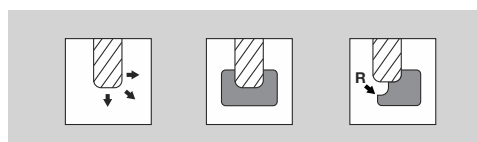
● Tarifa en stock / Price list from stock
○ Bajo demanda / On request



TN-Z2		$\lambda_s 35^\circ$	<55HRC	MDI Solid carbide	Co 10% Wc 90%	HV30	grain $\varnothing < 0,6 \mu m$	3750 N/mm ²
TÓRICAS CORNER RADIUS								
TiALN								



D1 mm.	R esquina	L2 mm.	L1 mm.	D2	stock	Cod.
3	0,2	6	50	3	●	1080101532101012
3	0,3	8	50	3	○	1080101532101112
3	0,5	6	50	3	●	1080101532101212
3	1	8	50	3	○	1080101532101412
3	0,2	8	50	4	○	1080101532105112
3	0,3	8	50	4	○	1080101532105212
3	0,5	8	50	4	○	1080101532101312
3	1	8	50	4	○	1080101532105312
4	0,2	8	50	4	●	1080101532101512
4	0,3	10	50	4	○	1080101532101612
4	0,5	8	50	4	●	1080101532101712
4	1	8	50	4	●	1080101532101812
4	1,5	10	50	4	○	1080101532101912
5	0,2	13	50	6	○	1080101532102012
5	0,3	13	50	6	○	1080101532102112
5	0,5	13	50	6	○	1080101532102212
5	1	13	50	6	○	1080101532102312
6	0,2	12	50	6	●	1080101532102412
6	0,3	12	50	6	○	1080101532102512
6	0,5	12	50	6	●	1080101532102612
6	1	12	50	6	●	1080101532102712
6	1,5	12	50	6	●	1080101532102812
6	2	12	50	6	●	1080101532102912
8	0,3	16	60	8	●	1080101532103012
8	0,5	16	60	8	●	1080101532103112
8	1	16	60	8	●	1080101532103212
8	1,5	16	60	8	●	1080101532103312
8	2	16	60	8	●	1080101532103412
8	2,5	20	60	8	○	1080101532103512
8	3	20	60	8	○	1080101532103612
10	0,3	25	75	10	○	1080101532103712
10	0,5	20	75	10	●	1080101532103812
10	1	20	75	10	●	1080101532103912
10	1,5	20	75	10	●	1080101532104012
10	2	20	75	10	●	1080101532104112
10	2,5	25	75	10	○	1080101532104212
10	3	20	75	10	●	1080101532104312
12	0,3	30	75	12	○	1080101532104412
12	0,5	24	75	12	●	1080101532104512
12	1	24	75	12	●	1080101532104612
12	1,5	24	75	12	●	1080101532104712
12	2	24	75	12	●	1080101532104812
12	2,5	30	75	12	○	1080101532104912
12	3	24	75	12	●	1080101532105012



● Tarifa en stock / Price list from stock
○ Bajo demanda / On request

Fresas frontales de Metal duro integral. Micro Grano.

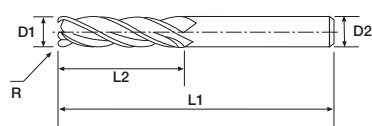
Solid Carbide end mills. Micro Grain.



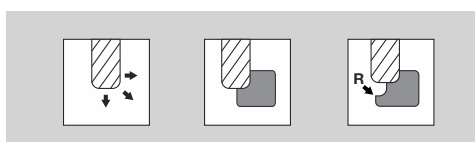
TN-Z4		$\lambda_s 35^\circ$	<55HRC	MDI Solid carbide	Co 10% Wc 90%	HV30	grain $\varnothing < 0,6 \mu m$	3750 N/mm ²
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TÓRICAS
CORNER RADIUS

TiALN



D1 mm.	R esquina	L2 mm.	L1 mm.	D2	stock	Cod.
3	0,2	6	50	3	●	1080101732101012
3	0,3	6	50	3	○	1080101732101112
3	0,5	6	50	3	●	1080101732101212
3	1	6	50	3	●	1080101732101412
3	0,2	6	50	4	●	1080101732105112
3	0,3	6	50	4	○	1080101732105212
3	0,5	6	50	4	●	1080101732101312
3	1	6	50	4	●	1080101732105312
4	0,2	8	50	4	●	1080101732101512
4	0,3	8	50	4	○	1080101732101612
4	0,5	8	50	4	●	1080101732101712
4	1	8	50	4	●	1080101732101812
4	1,5	10	50	4	○	1080101732101912
5	0,3	13	50	6	○	1080101732102112
5	0,5	13	50	6	○	1080101732102212
5	1	13	50	6	○	1080101732102312
6	0,2	12	50	6	●	1080101732102412
6	0,3	15	50	6	○	1080101732102512
6	0,5	12	50	6	●	1080101732102612
6	1	12	50	6	●	1080101732102712
6	1,5	12	50	6	●	1080101732102812
6	2	12	50	6	●	1080101732102912
8	0,3	16	60	8	●	1080101732103012
8	0,5	16	60	8	●	1080101732103112
8	1	16	60	8	●	1080101732103212
8	1,5	16	60	8	●	1080101732103312
8	2	16	60	8	●	1080101732103412
8	2,5	20	60	8	○	1080101732103512
8	3	20	60	8	○	1080101732103612
10	0,3	20	75	10	○	1080101732103712
10	0,5	20	75	10	●	1080101732103812
10	1	20	75	10	●	1080101732103912
10	1,5	20	75	10	●	1080101732104012
10	2	20	75	10	●	1080101732104112
10	2,5	25	75	10	○	1080101732104212
10	3	20	75	10	●	1080101732104312
12	0,3	30	75	12	○	1080101732104412
12	0,5	24	75	12	●	1080101732104512
12	1	24	75	12	●	1080101732104612
12	1,5	24	75	12	●	1080101732104712
12	2	24	75	12	●	1080101732104812
12	2,5	30	75	12	○	1080101732104912
12	3	24	75	12	●	1080101732105012



● Tarifa en stock / Price list from stock
○ Bajo demanda / On request



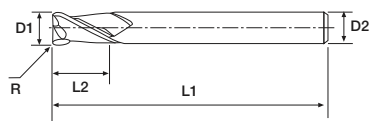


Fresas frontales de Metal duro integral. Micro Grano. Mango largo. Solid Carbide end mills. Micro Grain. Long shank.

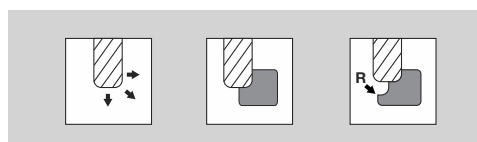
TN ML-Z4		$\lambda_s 35^\circ$	<55HRC	MDI Solid carbide	Co 10% Wc 90%	HV30	grain $\varnothing < 0,6 \mu m$	3750 N/mm ²
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TÓRICAS
CORNER RADIUS

TiALN



D1 mm.	R esquina	L2 mm.	L1 mm.	D2	stock	Cod.
6	0,5	15	100	6	●	1080104332102610
6	1	15	100	6	●	1080104332102710
8	0,5	20	100	8	●	1080104332103110
8	1	20	100	8	●	1080104332103210
10	0,5	25	100	10	●	1080104332103810
10	1	25	100	10	●	1080104332103910
10	2	25	100	10	●	1080104332104110
12	0,5	30	100	12	●	1080104332104510
12	1	30	100	12	●	1080104332104610
12	2	30	100	12	●	1080104332104810



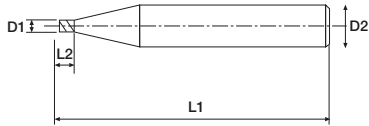
● Tarifa en stock / Price list from stock
○ Bajo demanda / On request



Fresas frontales de Metal duro integral. Ultra Micro Grano fino.

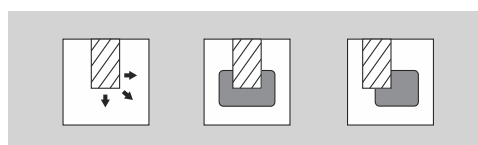
Solid Carbide end mills. Ultra fine Micro Grain.



F UMG MINI-Z2	 Z2	$\lambda_s 35^\circ$	<60HRC	UMG-MDI Solid carbide	Co 12% Wc 88%	HRA 92,5	grain $\varnothing < 0,4 \mu m$	>4.000 N/mm ²
PLANA MINIATURA MINIATURE SQUARE TYPE								
AlTiN								



D1 mm.	L2 mm.	L1 mm.	D2 mm.	stock	Cod.
0,2	0,4	50	4	●	1080103434100212
0,3	0,6	50	4	●	1080103434100312
0,4	0,8	50	4	●	1080103434100412
0,5	1	50	4	●	1080103434100512
0,6	1,2	50	4	●	1080103434100612
0,7	1,4	50	4	●	1080103434100712
0,8	1,6	50	4	●	1080103434100812
0,9	1,8	50	4	●	1080103434100912
1	3	50	4	●	1080103434101012
1,1	3	50	4	○	1080103434101212
1,2	3	50	4	●	1080103434101312
1,3	3	50	4	○	1080103434101412
1,4	3	50	4	●	1080103434101512
1,5	4	50	4	●	1080103434101612
1,6	4	50	4	●	1080103434101812
1,7	4	50	4	○	1080103434101912
1,8	5	50	4	●	1080103434102012
1,9	4	50	4	○	1080103434102112
2	6	50	4	●	1080103434102312
2,1	6	50	4	○	1080103434102512
2,2	6	50	4	○	1080103434102612
2,3	6	50	4	○	1080103434102712
2,4	6	50	4	○	1080103434102812
2,5	8	50	4	○	1080103434103012
2,6	8	50	4	○	1080103434103212
2,7	8	50	4	○	1080103434103312
2,8	8	50	4	○	1080103434103412
2,9	8	50	4	○	1080103434103512
3	8	50	6	●	1080103434103712

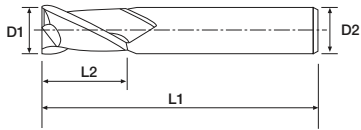


● Tarifa en stock / Price list from stock
○ Bajo demanda / On request



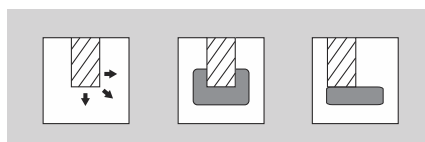
Fresas frontales de Metal duro integral. Ultra Micro Grano fino.

Solid Carbide end mills. Ultra fine Micro Grain.

F UMG-Z2		Z2	$\lambda_s 35^\circ$	<60HRC	UMG-MDI Solid carbide	Co 12% Wc 88%	HRA 92,5	grain $\varnothing < 0,4 \mu m$	>4.000 N/mm ²
PLANA SQUARE TYPE									
AlTiN									



D1 mm.	L2 mm.	L1 mm.	D2 mm.	stock	Cod.
3,5	10	50	6	○	1080103534104012
4	11	50	6	●	1080103534104212
4,5	11	50	6	○	1080103534104312
5	13	50	6	●	1080103534104512
5,5	13	50	6	○	1080103534104612
6	16	50	6	●	1080103534104712
6,5	19	60	8	○	1080103534104812
7	19	60	8	●	1080103534104912
7,5	19	60	8	○	1080103534105012
8	20	60	8	●	1080103534105112
8,5	20	75	10	○	1080103534105212
9	20	75	10	○	1080103534105312
9,5	25	75	10	○	1080103534105412
10	25	75	10	●	1080103534105512
10,5	25	75	12	○	1080103534105612
11	25	75	12	○	1080103534105712
12	30	75	12	●	1080103534105912
14	40	100	14	○	1080103534106112
16	40	100	16	●	1080103534106412
20	45	100	20	●	1080103534106812



● Tarifa en stock / Price list from stock
○ Bajo demanda / On request



Fresas frontales de Metal duro integral. Ultra Micro Grano fino.

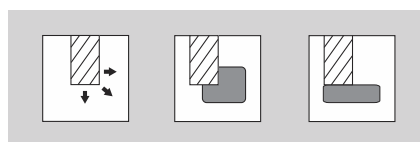
Solid Carbide end mills. Ultra fine Micro Grain.



F UMG-Z4	Z4	$\lambda_s 35^\circ$	<60HRC	UMG-MDI Solid carbide	Co 12% Wc 88%	HRA 92,5	grain $\varnothing < 0,4 \mu m$	>4.000 N/mm ²
PLANA SQUARE TYPE								
AlTiN								



D1 mm.	L2 mm.	L1 mm.	D2 mm.	stock	Cod.
1	3	50	4	●	1080103634101012
1	3	50	6	●	1080103634101112
1,5	4	50	4	●	1080103634101612
1,5	4	50	6	●	1080103634101712
2	6	50	4	●	1080103634102312
2	6	50	6	●	1080103634102412
2,5	8	50	4	●	1080103634103012
2,5	8	50	6	●	1080103634103112
3	8	50	3	●	1080103634103612
3	8	50	4	●	1080103634103712
3	8	50	6	●	1080103634103812
3,5	10	50	6	○	1080103634104012
4	11	50	4	●	1080103634104112
4	11	50	6	●	1080103634104212
4,5	11	50	6	○	1080103634104312
5	13	50	5	●	1080103634104412
5	13	50	6	●	1080103634104512
5,5	13	50	6	○	1080103634104612
6	16	50	6	●	1080103634104712
6,5	19	60	8	○	1080103634104812
7	19	60	8	○	1080103634104912
7,5	19	60	8	○	1080103634105012
8	20	60	8	●	1080103634105112
8,5	20	75	10	○	1080103634105212
9	20	75	10	○	1080103634105312
9,5	25	75	10	○	1080103634105412
10	25	75	10	●	1080103634105512
11	25	75	12	○	1080103634105712
12	30	75	12	●	1080103634105912
14	35	100	14	●	1080103634106112
16	40	100	16	●	1080103634106412
18	45	100	18	●	1080103634106612
20	45	100	20	●	1080103634106812



- Tarifa en stock / Price list from stock
- Bajo demanda / On request



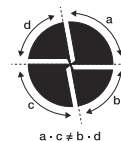
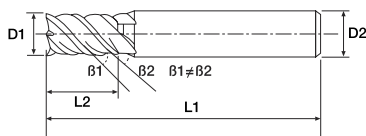


Fresas frontales de Metal duro integral. Ultra Micro Grano fino. Ángulo hélice variable.

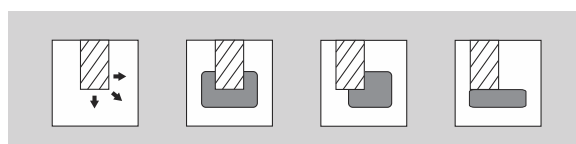
Solid Carbide end mills. Ultra fine Micro Grain. Variable helix angle.

FV UMG-Z4	Z4	$\lambda_{s35^\circ/38^\circ}$	<60HRC	UMG-MDI Solid carbide	Co 12% Wc 88%	HRA 92,5	grain Ø<0,4 µm	>4.000 N/mm ²
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PLANA
SQUARE TYPE
G300



D1 mm.	L2 mm.	L1 mm.	D2 mm.	stock	Cod.
3	8	50	6	●	1080104534103812
4	11	50	6	●	1080104534104212
5	13	50	6	●	1080104534104512
6	16	50	6	●	1080104534104712
8	20	60	8	●	1080104534105112
10	25	75	10	●	1080104534105512
12	30	75	10	●	1080104534105912
16	40	100	16	●	1080104534106412
20	45	100	20	●	1080104534106812



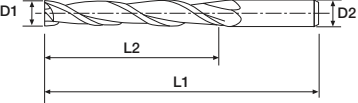
● Tarifa en stock / Price list from stock
○ Bajo demanda / On request



Material Material	Aceros al carbono • Aceros aleados Carbon steels • Alloy steels S45C, FC, FCD, SCM, S50C, SKS...		Aceros aleados • Aceros herramientas Alloy steels • Tool steels SCr, SNCM, SKD11, SKD61, NAK80...		Aceros templados Hardened steels SKD11	
Dureza Hardness	~HRC30		~HRC50		~HRC60	
Ø	vc/cs Velocidad/Speed (mim ⁻¹)	F Avance/Feed mm / min	vc/cs Velocidad/Speed (mim ⁻¹)	F Avance/Feed mm / min	vc/cs Velocidad/Speed (mim ⁻¹)	F Avance/Feed mm / min
3	22000	1800	16000	1300	10000	800
4	15000	1400	12000	1250	7000	700
5	13000	1600	10000	1400	6000	650
6	11500	1650	8500	1300	5000	800
8	8000	1800	6500	1350	3500	700
10	7000	1800	5000	1400	2800	750
12	6000	1700	4000	1300	2300	650
16	3560	1500	3000	1250	1800	700
20	3000	1450	2500	1250	1500	780

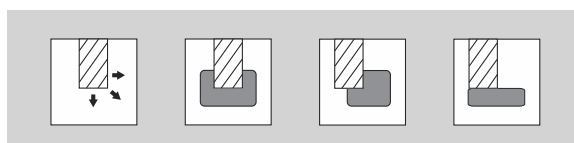
Fresas frontales de Metal duro integral. Ultra Micro Grano fino. Canal largo.
Solid Carbide end mills. Ultra fine Micro Grain. Long flute.



F UMG CL-Z4	 Z4	$\lambda_s 35^\circ$	<60HRC	UMG-MDI Solid carbide	Co 12% Wc 88%	HRA 92,5	grain $\varnothing < 0,4 \mu m$	>4.000 N/mm ²
PLANA SQUARE TYPE								
ALTiN								



D1 mm.	L2 mm.	L1 mm.	D2	stock	Cod.
1	5	50	4	○	1080103234101012
1,5	6	50	4	○	1080103234101612
2	9	50	4	○	1080103234102312
2,5	10	50	4	○	1080103234103012
3	12	50	6	○	1080103234103812
3,5	14	50	6	○	1080103234104012
4	25	75	4	●	1080103234104212
4,5	18	60	6	○	1080103234104312
5	30	75	6	●	1080103234104512
6	30	75	6	●	1080103234104712
7	30	75	8	○	1080103234104912
8	40	100	8	●	1080103234105112
10	40	100	10	●	1080103234105512
12	45	100	12	●	1080103234105912
14	45	100	14	○	1080103234106112
16	65	150	16	○	1080103234106412
20	75	150	20	○	1080103234106812



● Tarifa en stock / Price list from stock
○ Bajo demanda / On request





Fresas frontales de Metal duro integral / Solid Carbide end mills.

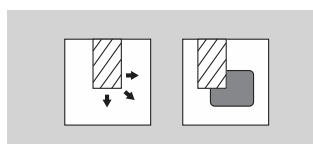
Ultra Micro Grano fino. Altas velocidades y aceros templados.

Ultra fine Micro Grain. High speed and tempered steels.

F UMG HRC	Z6	$\lambda_s 45^\circ$	<60HRC	UMG-MDI Solid carbide	Co 12% Wc 88%	HRA 92,5	grain $\varnothing < 0,4 \mu\text{m}$	>4.000 N/mm ²
PLANA SQUARE TYPE								
AlTiN								



D1 mm.	L2 mm.	L1 mm.	D2 mm.	stock	Cod.
2	4	50	4	○	1080103334102312
3	6	50	6	○	1080103334103812
4	8	50	6	○	1080103334104212
5	10	50	6	○	1080103334104512
6	16	50	6	●	1080103334104712
8	20	60	8	●	1080103334105112
10	25	75	10	●	1080103334105512
12	30	75	12	●	1080103334105912
16	40	100	16	●	1080103334106412
20	45	100	20	●	1080103334106812



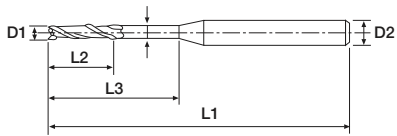
● Tarifa en stock / Price list from stock
○ Bajo demanda / On request



Fresas frontales de Metal duro integral. Ultra Micro Grano. Cuello largo.

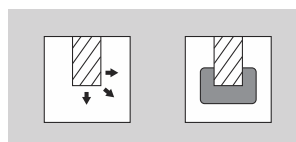
Solid Carbide end mills. Ultra Micro Grain. Long neck.



F UMG CUL-Z2		$\lambda_s 35^\circ$	<65HRC	UMG-MDI Solid carbide	Co 9% Wc 91%	HRA 93,9	grain $\varnothing < 0,2 \mu m$	>4.000 N/mm ²
PLANA SQUARE TYPE								
Aldura								



D1 mm.	L2 mm.	L3 mm.	L1 mm.	D2 h6mm.	stock	Cod.
0,5	1	4	50	4	●	1080100349100312
0,5	1	6	50	4	●	1080100349100212
0,6	1,2	4	50	4	●	1080100349100512
0,6	1,2	6	50	4	●	1080100349100612
0,8	1,2	4	50	4	●	1080100349101012
0,8	1,2	6	50	4	●	1080100349100912
0,8	1,2	8	50	4	●	1080100349101112
1	1,5	6	50	4	●	1080100349101712
1	1,5	8	50	4	●	1080100349101812
1	1,5	10	50	4	●	1080100349101512
1	1,5	12	50	4	●	1080100349101612
1,2	2	8	50	4	●	1080100349102312
1,2	2	12	50	4	●	1080100349102112
1,5	2	8	50	4	●	1080100349102812
1,5	2	10	50	4	●	1080100349102912
1,5	2	12	50	4	●	1080100349103012
1,5	2	16	50	4	●	1080100349103212
1,6	2,5	8	50	4	●	1080100349103612
1,6	2,5	12	50	4	●	1080100349103812
1,6	2,5	16	50	4	●	1080100349104012
2	3	8	50	4	●	1080100349104712
2	3	10	50	4	●	1080100349104812
2	3	12	50	4	●	1080100349104912
2	3	16	50	4	●	1080100349105112
2	3	20	50	4	●	1080100349105312
2,5	3	10	50	4	●	1080100349105512
2,5	3	12	50	4	●	1080100349105612
2,5	3	16	50	4	●	1080100349105812
2,5	3	20	50	4	●	1080100349105912
3	4	10	50	6	●	1080100349106112
3	4	12	50	6	●	1080100349106212
3	4	16	60	6	●	1080100349106312
3	4	20	60	6	●	1080100349106412
3	4	25	75	6	●	1080100349106512



● Tarifa en stock / Price list from stock
○ Bajo demanda / On request





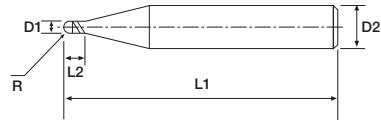
Fresas frontales de Metal duro integral. Ultra Micro Grano fino.

Solid Carbide end mills. Ultra fine Micro Grain.

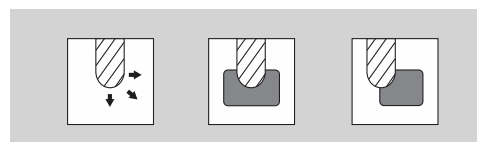
B UMG MINI-Z2	Z2	$\lambda_s 30^\circ$	<60HRC	UMG-MDI Solid carbide	Co 12% Wc 88%	HRA 92,5	grain $\varnothing < 0,4 \mu m$	>4.000 N/mm ²
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ESFÉRICA MINIATURA
MINIATURE
BALL TYPE

AlTiN



D1 mm.	L2 mm.	L1 mm.	D2 mm.	R	stock	Cod.
0,2	0,4	50	4	0,10	●	1080102234100212
0,3	0,6	50	4	0,15	●	1080102234100312
0,4	0,8	50	4	0,20	●	1080102234100412
0,5	1	50	4	0,25	●	1080102234100512
0,6	1,2	50	4	0,30	●	1080102234100612
0,7	1,4	50	4	0,35	●	1080102234100712
0,8	1,6	50	4	0,40	●	1080102234100812
0,9	1,8	50	4	0,45	○	1080102234100912
1	2	50	4	0,50	○	1080102234101012
1	2	50	6	0,50	●	1080102234101112
1,1	2,2	50	4	0,55	○	1080102234101212
1,2	2,4	50	4	0,60	●	1080102234101312
1,3	2,6	50	4	0,65	○	1080102234101412
1,4	2,8	50	4	0,70	●	1080102234101512
1,5	3	50	4	0,75	○	1080102234101612
1,5	3	50	6	0,75	●	1080102234101712
1,6	3,2	50	4	0,80	●	1080102234101812
1,7	3,4	50	4	0,85	○	1080102234101912
1,8	3,6	50	4	0,90	●	1080102234102012
1,9	3,8	50	4	0,95	○	1080102234102112
2	4	50	4	1,00	●	1080102234102312
2	4	50	6	1,00	●	1080102234102412
2,1	4,2	50	4	1,05	○	1080102234102512
2,2	4,4	50	4	1,10	○	1080102234102612
2,3	4,6	50	4	1,15	○	1080102234102712
2,4	4,8	50	4	1,20	○	1080102234102812
2,5	5	50	4	1,25	●	1080102234103012
2,5	5	50	6	1,25	●	1080102234103112
2,6	5,2	50	4	1,30	○	1080102234103212
2,7	5,4	50	4	1,35	○	1080102234103312
2,8	5,6	50	4	1,40	○	1080102234103412
2,9	5,8	50	4	1,45	○	1080102234103512
3	6	50	3	1,50	●	1080102234103712
3	6	50	4	1,50	●	1080102234103612
3	6	50	6	1,50	●	1080102234103812

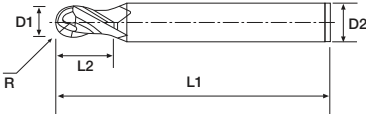


● Tarifa en stock / Price list from stock
○ Bajo demanda / On request

Fresas frontales de Metal duro integral. Ultra Micro Grano fino.

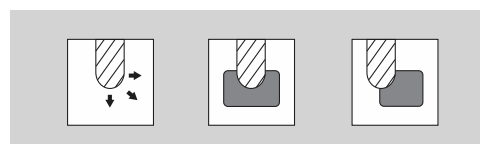
Solid Carbide end mills. Ultra fine Micro Grain.



B UMG-Z2		$\lambda_s 30^\circ$	<60HRC	UMG-MDI Solid carbide	Co 12% Wc 88%	HRA 92,5	grain $\varnothing < 0,4 \mu m$	>4.000 N/mm ²
ESFÉRICA BALL TYPE								
AlTiN								



D1 mm.	L2 mm.	L1 mm.	D2 mm.	R	stock	Cod.
3,5	7	50	4	1,75	○	1080102434103912
4	8	50	4	2,00	●	1080102434104112
4	8	50	6	2,00	●	1080102434104212
4,5	9	50	6	2,25	○	1080102434104312
5	10	50	5	2,50	●	1080102434104412
5	10	50	6	2,50	●	1080102434104512
5,5	11	50	6	2,75	○	1080102434104612
6	12	50	6	3,00	●	1080102434104712
7	14	60	8	3,50	○	1080102434104912
8	16	60	8	4,00	●	1080102434105112
9	18	75	10	4,50	○	1080102434105312
10	20	75	10	5,00	●	1080102434105512
12	24	75	12	6,00	●	1080102434105912
16	32	100	16	8,00	●	1080102434106412
20	40	100	20	10,00	●	1080102434106812



- Tarifa en stock / Price list from stock
- Bajo demanda / On request

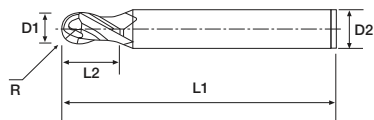




Fresas frontales de Metal duro integral. Ultra Micro Grano fino. Solid Carbide end mills. Ultra fine Micro Grain.

B UMG-Z4		$\lambda_s 30^\circ$	<60HRC	UMG-MDI Solid carbide	Co 12% Wc 88%	HRA 92,5	grain $\varnothing < 0,4 \mu m$	>4.000 N/mm ²
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ESFÉRICA
BALL TYPE
AlTiN



D1 mm.	L2 mm.	L1 mm.	D2 mm.	R	stock	Cod.
1	2	50	4	0,50	●	1080102534101012
1,5	3	50	4	0,75	●	1080102534101612
2	4	50	4	1,00	●	1080102534102312
2,5	5	50	4	1,25	●	1080102534103012
3	6	50	4	1,50	●	1080102534103712
3,5	7	50	4	1,75	○	1080102534103912
4	8	50	4	2,00	●	1080102534104112
4,5	9	50	6	2,25	○	1080102534104312
5	10	50	6	2,50	●	1080102534104512
5,5	11	50	6	2,75	○	1080102534104612
6	12	50	6	3,00	●	1080102534104712
7	14	60	8	3,50	○	1080102534104912
8	16	60	8	4,00	●	1080102534105112
9	18	75	10	4,50	○	1080102534105312
10	20	75	10	5,00	●	1080102534105512
12	24	75	12	6,00	●	1080102534105912
16	32	100	16	8,00	●	1080102534106412



● Tarifa en stock / Price list from stock
○ Bajo demanda / On request



Fresas frontales de Metal duro integral. Ultra Micro Grano fino. Mango largo.
Solid Carbide end mills. Ultra fine Micro Grain. Long shank.



B UMG ML-Z2	 Z2	$\lambda_s 30^\circ$	<60HRC	UMG-MDI Solid carbide	Co 12% Wc 88%	HRA 92,5	grain $\varnothing < 0,4 \mu m$	>4.000 N/mm ²
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ESFÉRICA
BALL TYPE
AlTiN



D1 mm.	L2 mm.	L1 mm.	D2 mm.	R	stock	Cod.
1	2	75	4	0,50	●	1080104150103712
1	2	75	6	0,50	●	1080104150100112
1,5	3	75	4	0,75	●	1080104150103812
1,5	3	75	6	0,75	●	1080104150100312
2	4	75	6	1,00	●	1080104150100612
2	4	100	6	1,00	●	1080104150100512
2,5	5	75	6	1,25	●	1080104150100712
3	6	75	3	1,50	●	1080104150101012
3	6	75	6	1,50	●	1080104150103912
3	6	100	6	1,50	●	1080104150100912
3,5	7	75	6	1,50	●	1080104150103012
4	8	75	4	2,00	●	1080104150101312
4	8	75	6	2,00	●	1080104150104112
4	8	100	6	2,00	●	1080104150101212
4,5	9	75	6	2,00	●	1080104150103112
5	10	75	6	2,50	●	1080104150101412
5,5	11	75	6	2,75	●	1080104150103212
6	12	75	6	3,00	●	1080104150101712
6	12	100	6	3,00	●	1080104150101812
6	12	150	6	3,00	●	1080104150101612
7	14	75	8	3,00	●	1080104150103612
8	16	75	8	4,00	●	1080104150102012
8	16	100	8	4,00	●	1080104150102112
8	16	150	8	4,00	●	1080104150101912
9	18	100	10	4,50	○	1080104150103312
10	20	100	10	5,00	●	1080104150102212
10	20	150	10	5,00	●	1080104150102312
12	24	100	12	6,00	●	1080104150102512
12	24	150	12	6,00	●	1080104150102612
14	28	100	14	7,00	○	1080104150103512
16	32	150	16	8,00	●	1080104150102912
16	30	200	16	8,00	○	1080104150102812
20	40	150	20	10,00	●	1080104150103412



H P K

● Tarifa en stock / Price list from stock
○ Bajo demanda / On request



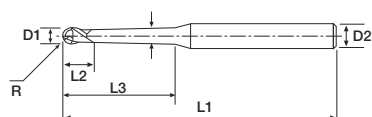
Fresas frontales de Metal duro integral. Ultra Micro Grano. Cuello largo.

Solid Carbide end mills. Ultra Micro Grain. Long neck.

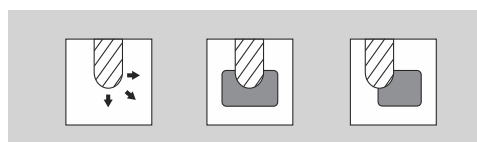
B UMG CUL-Z2	Z2	$\lambda_s 30^\circ$	<65HRC	QMG-MDI Solid carbide	Co 9% Wc 91%	HRA93.9	grain $\varnothing < 0,5 \mu m$	>4.000 N/mm ²
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ESFÉRICA
BALL TYPE

AlTiN



D1 mm.	L2 mm.	L efectiva	L1 mm.	D2 mm.	R	stock	Cod.
0,5	0,50	4	50	4	0,25	●	1080101249100212
0,5	0,50	6	50	4	0,25	●	1080101249100312
0,6	0,60	4	50	4	0,30	●	1080101249100512
0,6	0,60	6	50	4	0,30	●	1080101249100612
0,8	0,80	6	50	4	0,40	●	1080101249101012
0,8	0,80	8	50	4	0,40	●	1080101249101112
1	1,50	6	50	4	0,50	●	1080101249101712
1	1,50	8	50	4	0,50	●	1080101249101812
1	1,50	10	50	4	0,50	●	1080101249101512
1	1,50	12	50	4	0,50	●	1080101249101612
1,2	2,00	8	50	4	0,60	●	1080101249102112
1,2	2,00	12	50	4	0,60	●	1080101249102312
1,5	2,00	8	50	4	0,75	●	1080101249102812
1,5	2,00	12	50	4	0,75	●	1080101249103012
1,5	2,00	16	50	4	0,75	●	1080101249103212
1,5	2,00	20	50	4	0,75	●	1080101249103412
1,6	2,50	8	50	4	0,80	●	1080101249102812
1,6	2,50	12	50	4	0,80	●	1080101249103812
1,6	2,50	16	50	4	0,80	●	1080101249104012
2	3,00	8	50	4	1,00	●	1080101249103612
2	3,00	12	50	4	1,00	●	1080101249104912
2	3,00	16	50	4	1,00	●	1080101249105112
2	3,00	20	50	4	1,00	●	1080101249105312
3	4	8	50	6	1,50	●	1080101249106012
3	4,5	10	50	6	1,50	●	1080101249106112
3	4	16	60	6	1,50	●	1080101249106312
3	4	20	75	6	1,50	●	1080101249106412
3	4	25	75	6	1,50	●	1080101249106512
4	5	10	75	6	2,00	●	1080101249107112
4	5	15	75	6	2,00	●	1080101249107212
4	5	20	75	6	2,00	●	1080101249107312
4	5	25	75	6	2,00	●	1080101249107412
4	5	30	75	6	2,00	●	1080101249107512



● Tarifa en stock / Price list from stock
○ Bajo demanda / On request

Fresas frontales de Metal duro integral. Ultra Micro Grano fino.

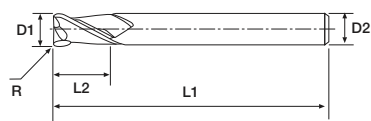
Solid Carbide end mills. Ultra fine Micro Grain.



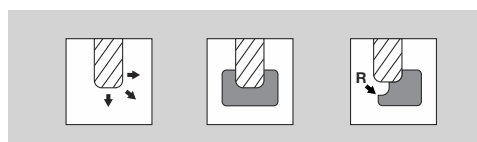
TN UMG-Z2		$\lambda_s 35^\circ$	<60HRC	UMG-MDI Solid carbide	Co 12% Wc 88%	HRA 92,5	grain $\phi < 0,4 \mu m$	>4.000 N/mm ²
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TÓRICAS
CORNER RADIUS

AlTiN



D1 mm.	R esquina	L2 mm.	L1 mm.	D2	stock	Cod.
1	0,2	2	50	4	○	1080104232100212
1	0,3	2	50	4	○	1080104232100312
1	0,1	2	50	6	○	1080104232100112
1,5	0,2	3	50	4	○	1080104232100412
1,5	0,3	3	50	4	○	1080104232100512
2	0,2	5	50	4	○	1080104232100612
2	0,5	5	50	4	○	1080104232100812
3	0,2	6	50	4	●	1080104232101012
3	0,3	8	50	4	○	1080104232101212
3	0,5	6	50	4	●	1080104232101112
3	1	8	50	4	○	1080104232101412
4	0,2	8	50	4	●	1080104232101612
4	0,3	10	50	4	○	1080104232101512
4	0,5	8	50	4	●	1080104232101712
4	1	8	50	4	●	1080104232101812
6	0,2	12	50	6	●	1080104232102512
6	0,5	12	50	6	●	1080104232102612
6	1	12	50	6	●	1080104232102712
6	1,5	12	50	6	●	1080104232102812
6	2	12	50	6	●	1080104232102912
8	0,3	16	60	8	●	1080104232103012
8	0,5	16	60	8	●	1080104232103112
8	1	16	60	8	●	1080104232103212
8	1,5	16	60	8	●	1080104232103312
8	2	16	60	8	●	1080104232103412
10	0,3	20	75	10	●	1080104232103712
10	0,5	20	75	10	●	1080104232103812
10	1	20	75	10	●	1080104232103912
10	1,5	20	75	10	●	1080104232104012
10	2	20	75	10	●	1080104232104112
10	3	20	75	10	●	1080104232104312
12	0,5	24	75	12	●	1080104232104512
12	1	24	75	12	●	1080104232104612
12	1,5	24	75	12	●	1080104232104712
12	2	24	75	12	●	1080104232104812
12	3	24	75	12	●	1080104232104912



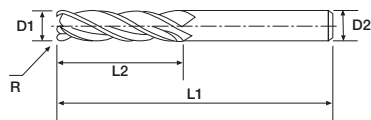
● Tarifa en stock / Price list from stock
○ Bajo demanda / On request



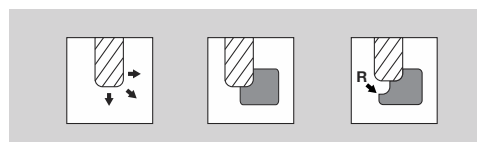
Fresas frontales de Metal duro integral. Ultra Micro Grano fino. Solid Carbide end mills. Ultra fine Micro Grain.

TN UMG-Z4	 Z4	$\lambda_s 35^\circ$	<60HRC	UMG-MDI Solid carbide	Co 12% Wc 88%	HRA 92,5	grain $\varnothing < 0,4 \mu m$	>4.000 N/mm ²
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TÓRICAS
CORNER RADIUS
AlTiN



D1 mm.	R esquina	L2 mm.	L1 mm.	D2	stock	Cod.
1,5	0,2	3	50	4	●	1080103832100412
2	0,2	4	50	4	●	1080103832100612
2	0,5	4	50	4	●	1080103832100812
3	0,2	6	50	3	●	1080103832101012
3	0,2	6	50	4	●	1080103832101212
3	0,3	6	50	4	●	1080103832105112
3	0,5	6	50	3	●	1080103832101112
3	0,5	6	50	4	●	1080103832101312
3	1	6	50	4	●	1080103832101412
4	0,2	8	50	4	●	1080103832101512
4	0,5	8	50	4	●	1080103832101712
4	1	8	50	4	●	1080103832101812
5	1	13	50	6	●	1080103832102312
6	0,2	12	50	6	●	1080103832102912
6	0,3	12	50	6	●	1080103832102412
6	0,5	12	50	6	●	1080103832102512
6	1	12	50	6	●	1080103832102612
6	1,5	12	75	6	●	1080103832102712
6	2	12	50	6	●	1080103832102812
8	0,3	16	60	8	●	1080103832103012
8	0,5	16	60	8	●	1080103832103112
8	1	16	60	8	●	1080103832103212
8	1,5	16	60	8	●	1080103832103312
8	2	16	60	8	●	1080103832103412
10	0,3	20	75	10	●	1080103832103712
10	0,5	20	75	10	●	1080103832103812
10	1	20	75	10	●	1080103832103912
10	1,5	20	75	10	●	1080103832104012
10	2	20	75	10	●	1080103832104112
10	3	20	75	10	●	1080103832104312
12	0,5	24	75	12	●	1080103832104512
12	1	24	75	12	●	1080103832104612
12	1,5	24	75	12	●	1080103832104712
12	2	24	75	12	●	1080103832104812
12	3	24	75	12	●	1080103832105012



● Tarifa en stock / Price list from stock
○ Bajo demanda / On request

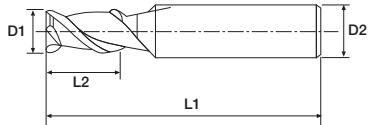
H P K

Fresas frontales de Metal duro integral. Micro Grano. Para Aluminio.
Solid Carbide end mills. Micro Grain. For Aluminium.

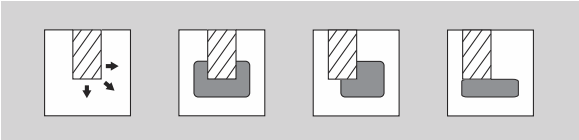


F AL-Z2		$\lambda_s 55^\circ$	<40HRC	MDI Solid carbide	Co 10% Wc 90%	HV30	grain $\varnothing < 0,6 \mu m$	3750 N/mm ²
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PLANA
SQUARE TYPE



D1 mm.	L2 mm.	L1 mm.	D2 h6mm.	stock	Cod.
1	3	50	6	●	1080101834101112
2	6	50	6	●	1080101834102412
3	9	50	6	●	1080101834103812
4	12	50	6	●	1080101834104212
5	15	50	6	●	1080101834104512
6	18	50	6	●	1080101834104712
8	20	60	8	●	1080101834105112
10	30	75	10	●	1080101834105512
12	30	75	12	●	1080101834105912
16	45	100	16	●	1080101834106412
20	45	100	20	○	1080101834106812

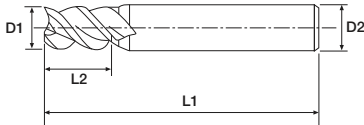


- Tarifa en stock / Price list from stock
- Bajo demanda / On request

N

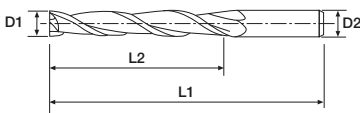


Fresas frontales de Metal duro integral. Micro Grano. Para Aluminio. Solid Carbide end mills. Micro Grain. For Aluminium.

F AL-Z3	 Z3	λ_s55°	<40HRC	MDI Solid carbide	Co 10% Wc 90%	HV30	grain $\varnothing<0,6\ \mu\text{m}$	3750 N/mm ²
PLANA SQUARE TYPE								
	D1 mm.	L2 mm.	L1 mm.	D2 h6mm.	stock	Cod.		
	2	6	50	6	●	1080101934102412		
	3	9	50	6	●	1080101934103812		
	4	12	50	6	●	1080101934104212		
	5	15	50	6	●	1080101934104512		
	6	18	50	6	●	1080101934104712		
	8	20	60	8	●	1080101934105112		
	10	30	75	10	●	1080101934105512		
	12	30	75	12	●	1080101934105912		
	16	45	100	16	●	1080101934106412		
	20	45	100	20	●	1080101934106812		
								
	● Tarifa en stock / Price list from stock ○ Bajo demanda / On request							

N

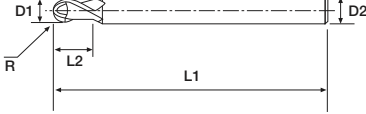
Fresas frontales de Metal duro integral. Micro Grano. Para Aluminio. Canal largo. Solid Carbide end mills. Micro Grain. For Aluminium. Long flute.

F AL CL-Z3	 Z3	$\lambda_s 55^\circ$	<40HRC	MDI Solid carbide	Co 10% Wc 90%	HV30	grain $\varnothing < 0,6 \mu m$	3750 N/mm ²
PLANA SQUARE TYPE								
	D1 mm.	L2 mm.	L1 mm.	D2 h6mm.	stock	Cod.		
	2	9	75	6	●	1080102034102412		
	3	12	75	6	●	1080102034103812		
	4	16	75	6	●	1080102034104212		
	5	20	75	6	●	1080102034104512		
	6	25	75	6	●	1080102034104712		
	8	32	75	8	●	1080102034105112		
	10	50	100	10	●	1080102034105512		
	12	50	100	12	●	1080102034105912		
	16	65	150	16	●	1080102034106412		
	20	75	150	20	●	1080102034106812		
								
	● Tarifa en stock / Price list from stock ○ Bajo demanda / On request							

N

Fresas frontales de Metal duro integral. Micro Grano. Para aluminio.
Solid Carbide end mills. Micro Grain. For aluminium.



B AL-Z2		$\lambda_s 45^\circ$	<40HRC	MDI Solid carbide	Co 10% Wc 90%	HV30	grain $\varnothing < 0,6 \mu m$	3750 N/mm ²
ESFÉRICA BALL TYPE								



D1 mm.	L2 mm.	L1 mm.	D2 mm.	R	stock	Cod.
1	3	50	4	0,50	●	1080102134101012
1,5	4	50	4	0,75	●	1080102134101612
2	6	50	4	1,00	●	1080102134102312
2,5	5	50	4	1,25	○	1080102134103012
3	6	50	3	1,50	●	1080102134103712
3,5	7	50	4	1,75	○	1080102134103912
4	8	50	4	2,00	○	1080102134104112
4,5	9	50	6	2,25	●	1080102134104312
5	10	50	6	2,50	○	1080102134104512
5,5	11	50	6	2,75	○	1080102134104612
6	12	50	6	3,00	●	1080102134104712
8	16	60	8	4,00	●	1080102134105112
10	20	75	10	5,00	●	1080102134105512
12	24	75	12	6,00	●	1080102134105912



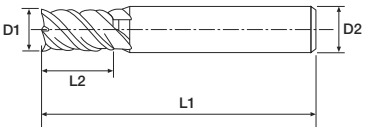
● Tarifa en stock / Price list from stock
○ Bajo demanda / On request





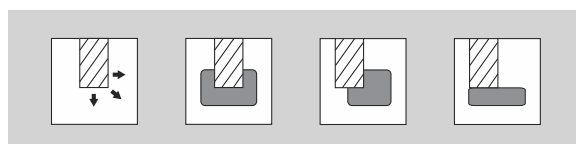
Fresas frontales de Metal duro integral. Micro Grano, para Inox.

Solid Carbide end mills. Micro Grain, for steel.

FI-Z4	 Z4	$\lambda_s 45^\circ$	INOX	MDI Solid carbide	Co 10% Wc 90%	HV30	grain $\varnothing < 0,6 \mu\text{m}$	3750 N/mm ²
PLANA SQUARE TYPE								
TiALN								



D1 mm.	L2 mm.	L1 mm.	D2 h6mm.	stock	Cod.
3	8	50	4	●	1080104434103712
4	11	50	4	●	1080104434104212
5	13	50	6	●	1080104434104512
6	16	50	6	●	1080104434104712
8	20	60	8	●	1080104434105112
10	25	75	10	●	1080104434105512
12	30	75	12	●	1080104434105912
16	40	100	16	●	1080104434106412



● Tarifa en stock / Price list from stock
○ Bajo demanda / On request



Fresas frontales de Metal duro integral. Ultra Micro Grano fino. Para Inox. Ángulo de hélice variable.
Solid Carbide end mills. Ultra fine Micro Grain. For Steel. Variable helix angle.



FIV UMG-Z4		$\lambda_s 40^\circ/43^\circ$	INOX	UMG-MDI Solid carbide	Co 12% Wc 88%	HRA 92,5	grain $\varnothing < 0,4 \mu m$	$> 4.000 \text{ N/mm}^2$
PLANA SQUARE TYPE								
G300								



D1 mm.	L2 mm.	L1 mm.	D2 mm.	stock	Cod.
3	8	50	6	●	1080104634103812
4	11	50	6	●	1080104634104212
5	13	50	6	●	1080104634104512
6	16	50	6	●	1080104634104712
8	20	60	8	●	1080104634105112
10	25	75	10	●	1080104634105512
12	30	75	10	●	1080104634105912
16	40	100	16	●	1080104634106412
20	45	100	20	●	1080104634106812



- Tarifa en stock / Price list from stock
- Bajo demanda / On request



Fresado lateral / Side Milling

Material	Aceros inoxidables Stainless steels		Aleaciones de titanio Titanium alloy		Inconel 718	
Profundidad de corte Depth of cut	$a_p=1D1$	$a_e=0.05D1$	$a_p=1D1$	$a_e=0.05D1$	$a_p=1D1$	$a_e=0.05D1$
$\varnothing$	Velocidad/Speed (mim ⁻¹)	Avance/Feed mm / min	Velocidad/Speed (mim ⁻¹)	Avance/Feed mm / min	Velocidad/Speed (mim ⁻¹)	Avance/Feed mm / min
6	4600	590	4600	4600	2600	230
8	3500	560	3500	3500	2000	220
10	2700	535	2700	2700	1600	200
12	2400	520	2400	2400	1400	170
16	1700	450	1700	1700	1000	130
20	1400	450	1400	1400	800	100

Ranurado / Slotting

Material	Aceros inoxidables Stainless steels		Aleaciones de titanio Titanium alloy		Inconel 718	
Profundidad de corte Depth of cut	$a_e=0.05D1$	$a_p=1D1$	$a_e=0.05D1$	$a_p=1D1$	$a_e=0.05D1$	$a_p=1D1$
$\varnothing$	Velocidad/Speed (mim ⁻¹)	Avance/Feed mm / min	Velocidad/Speed (mim ⁻¹)	Avance/Feed mm / min	Velocidad/Speed (mim ⁻¹)	Avance/Feed mm / min
6	3000	375	2600	335	1200	105
8	2200	360	2000	320	900	90
10	1800	335	1600	310	750	80
12	1500	330	1300	300	600	70
16	1100	290	1000	250	450	50
20	900	290	800	250	360	40



Fresas frontales de Metal duro integral. Ultra Micro Grano fino. Para ZrO₂ Solid Carbide end mills. Ultra fine Micro Grain. For ZrO₂

B DT CUL-Zr	Z2	$\lambda_s 30^\circ$	<60HRC	GMG-MDI Solid carbide	Co 6% Wc 94%	HRA 93,6	grain $\varnothing < 0,65 \mu m$	3900 N/mm ²
ESFÉRICA BALL TYPE								
Diamond								



D1 mm.	L2 mm.	L3 efectiva	L1 mm.	D2 mm.	R	stock	Cod.
0,6	2,5	10	50	3	0,30	●	1080104749100612
0,6	2,5	10	50	4	0,30	●	1080104749100512
0,6	2,5	10	50	6	0,30	●	1080104749100412
0,8	3	10	50	3	0,40	●	1080104749101112
0,8	3	12	50	3	0,40	●	1080104749101012
1	4	16	50	3	0,50	●	1080104749101912
1	4	16	50	6	0,50	●	1080104749101812
1	4	18	50	3	0,50	●	1080104749101612
1	4	18	50	4	0,50	●	1080104749101712
1	4	18	50	6	0,50	●	1080104749101512
1,5	4	18	50	3	0,75	●	1080104749103312
1,5	4	18	50	6	0,75	●	1080104749102712
2	4,5	20	50	3	1	●	1080104749105312
2	4,5	20	50	4	1	●	1080104749105112
2	4,5	20	50	6	1	●	1080104749104912
2	4,5	25	50	3	1	●	1080104749105212
2	4,5	25	50	6	1	●	1080104749105012
2,5	4,5	22	50	3	1,25	●	1080104749105812
2,5	4,5	22	50	4	1,25	●	1080104749105712
2,5	4,5	22	50	6	1,25	●	1080104749105512
2,5	4,5	25	50	3	1,25	●	1080104749109112
2,5	4,5	25	50	6	1,25	●	1080104749105612
3	6	25	50	3	1,50	●	1080104749106512
3	6	25	50	6	1,50	●	1080104749106412



- Tarifa en stock / Price list from stock
- Bajo demanda / On request

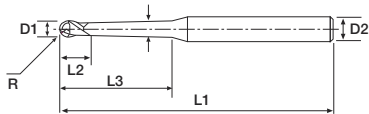


Fresas frontales de Metal duro integral. Ultra Micro Grano fino. Para Titanio/CoCr
Solid Carbide end mills. Ultra fine Micro Grain. For Titanium/CoCr



BD DT CUL Ti	Z2	$\lambda_s 30^\circ$	<60HRC	TMG-MDI Solid carbide	Co 10% Wc 90%	HRA 93	grain $\varnothing < 0,5 \mu m$	4000 N/mm ²
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ESFÉRICA
BALL TYPE
G300



dental



D1 mm.	L2 mm.	L3 efectiva	L1 mm.	D2 mm.	R	stock	Cod.
0,8	3,5	10	50	4	0,40	●	1080104849100912
0,8	3,5	8	50	6	0,40	●	1080104849101012
1	3,5	10	50	6	0,50	●	1080104849101712
1	3,5	12	50	6	0,50	●	1080104849101812
1	3,5	8	50	6	0,50	●	1080104849101612
1	4	12	50	4	0,50	●	1080104849101512
1,5	4	12	50	6	0,75	●	1080104849102912
1,5	4	14	50	4	0,75	●	1080104849102812
1,5	4	16	50	6	0,75	●	1080104849103212
2	4	12	50	6	1	●	1080104849104912
2	4	16	50	4	1	●	1080104849105112
2	4	16	50	6	1	●	1080104849105212
2,5	4,5	14	50	6	1,25	●	1080104849105812
2,5	4,5	18	50	4	1,25	●	1080104849105712
2,5	4,5	18	50	6	1,25	●	1080104849105912
3	5,5	15	50	6	1,50	●	1080104849106212
3	5,5	17	50	6	1,50	●	1080104849106412
3	5,5	22	50	4	1,50	●	1080104849106312
3	5,5	22	50	6	1,50	●	1080104849106512

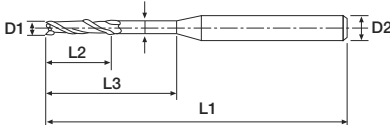


- Tarifa en stock / Price list from stock
- Bajo demanda / On request



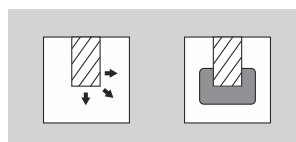


Fresas frontales de Metal duro integral. Ultra Micro Grano fino. Para Titanio/CoCr
Solid Carbide end mills. Ultra fine Micro Grain. For Titanium/CoCr

F DT CUL Ti	 Z2	$\lambda_s 35^\circ$	<60HRC	TMG-MDI Solid carbide	Co 10% Wc 90%	HRA 93	grain $\varnothing < 0,5 \mu m$	4000 N/mm ²
PLANA SQUARE TYPE								
G300	 dental							



D1 mm.	L2 mm.	L3 efectiva	L1 mm.	D2 mm.	R	stock	Cod.
0,5	1	5	50	4	0,25	●	1080104949100212
0,8	1,2	8	50	4	0,40	●	1080104949101112
0,9	1,2	10	50	4	0,45	●	1080104949101412
1	1,5	15	50	4	0,50	●	1080104949101912
1,2	1,5	15	50	4	0,60	●	1080104949102312
1,5	2	16	50	4	0,75	●	1080104949103212
1,6	2,5	16	50	4	0,80	●	1080104949104012
1,8	2,5	16	50	4	0,90	●	1080104949104412
2	3	16	50	4	1	●	1080104949105112
2,5	3	18	50	4	1,25	●	1080104949105912



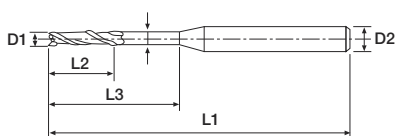
- Tarifa en stock / Price list from stock
○ Bajo demanda / On request



Fresas frontales de Metal duro integral. Ultra Micro Grano fino. Para Titanio/CoCr
Solid Carbide end mills. Ultra fine Micro Grain. For Titanium/CoCr



TN DT CUL	Z2	$\lambda_s 30^\circ$	<60HRC	TMG-MDI Solid carbide	Co 10% Wc 90%	HRA 93	grain $\varnothing < 0,5 \mu m$	4000 N/mm ²
TÓRICAS CORNER RADIUS								
G300								





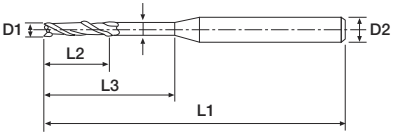

D1 mm.	L2 mm.	L3 efectiva	L1 mm.	D2 mm.	R	stock	Cod.
1	1,5	15	50	4	0,50	●	1080105032100112
1,2	1,5	15	50	4	0,60	●	1080105032105412
1,5	2	16	50	4	0,75	●	1080105032100412
1,8	2,5	16	50	4	0,90	●	1080105032105512
2	3	16	50	4	1	●	1080105032100612
2,5	3	18	50	4	1,25	●	1080105032100912



- Tarifa en stock / Price list from stock
- Bajo demanda / On request

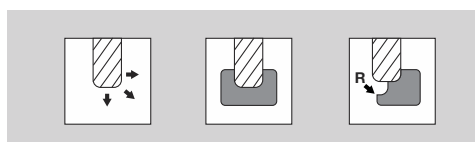
S

TN DT CUL	Z4	$\lambda_s 30^\circ$	<60HRC	TMG-MDI Solid carbide	Co 10% Wc 90%	HRA 93	grain $\varnothing < 0,5 \mu m$	4000 N/mm ²
TÓRICAS CORNER RADIUS								
G300								






D1 mm.	L2 mm.	L3 efectiva	L1 mm.	D2 mm.	R	stock	Cod.
2	4	12	50	6	1	●	1080105132100612
3	5	14	50	6	1,50	●	1080105132101112
3	5	18	50	6	1,50	●	1080105032105612
4	6	16	50	6	2	●	1080105032105712



- Tarifa en stock / Price list from stock
- Bajo demanda / On request

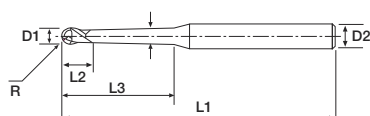
S



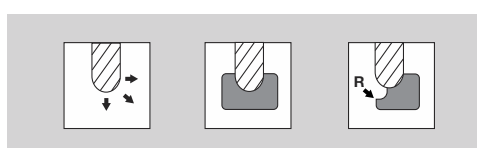
Fresas frontales de Metal duro integral. Ultra Micro Grano fino. Para Composite.
Solid Carbide end mills. Ultra fine Micro Grain. For Composite.

B DT CUL	 Z2	$\lambda_s 30^\circ$	COMPOSITE	GMG-MDI Solid carbide	Co 6% Wc 94%	HRA 93,6	grain $\varnothing < 0,65 \mu m$	3900 N/mm ²
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COMP
ESFÉRICA BALL TYPE
Diamond



D1 mm.	L2 mm.	L3 efectiva	L1 mm.	D2 mm.	R	stock	Cod.
0,8	3,5	12	50	6	0,40	●	1080105249101012
1	3,5	14	50	6	0,50	●	1080105249101912
1,5	4	16	50	6	0,75	●	1080105249103212
2	4	18	50	6	0,80	●	1080105249105212
2,5	4,5	20	50	6	0,90	●	1080105249105912
3	5,5	25	50	6	1	●	1080105249106512



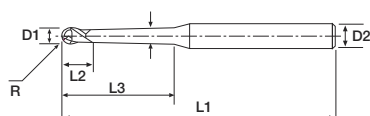
- Tarifa en stock / Price list from stock
- Bajo demanda / On request

N

Fresas frontales de Metal duro integral. Ultra Micro Grano fino. Para Cera/PMMA.
Solid Carbide end mills. Ultra fine Micro Grain. For WAX/PMMA.

B DT CUL	 Z2	$\lambda_s 30^\circ$	CERA/WAX PMMA	TMG-MDI Solid carbide	Co 10% Wc 90%	HRA 93	grain $\varnothing < 0,5 \mu m$	4000 N/mm ²
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WAX
ESFÉRICA BALL TYPE



D1 mm.	L2 mm.	L3 efectiva	L1 mm.	D2 mm.	R	stock	Cod.
0,8	3,5	12	50	4	0,40	●	1080105349100912
1	3,5	16	50	4	0,50	●	1080105349101912
1,5	4	18	50	4	0,75	●	1080105349103312
2	4	20	50	4	1	●	1080105349105312
2,5	4,5	25	50	4	1,25	●	1080105349105912
3	5,5	25	50	4	1,50	●	1080105349106512



- Tarifa en stock / Price list from stock
- Bajo demanda / On request

N



Tabla de conversión de durezas / *Hardness conversion table*

Tratamientos térmicos / *Recommended cutting conditions*



Resistencia Tracción <i>Tensile Strength</i>	Vickers <i>Vickers</i>	Brinell <i>Brinell</i>	Dureza Rockwell		Resistencia Tracción <i>Tensile Strength</i>	Vickers <i>Vickers</i>	Brinell <i>Brinell</i>	Dureza Rockwell		Resistencia Tracción <i>Tensile Strength</i>	Vickers <i>Vickers</i>	Brinell <i>Brinell</i>	Dureza Rockwell	
N/mm ²	HV	HB	HRB	HRC	N/mm ²	HV	HB	HRB	HRC	N/mm ²	HV	HB	HRB	HRC
200	63	60			850	265	252			1560	481	(457)		
210	65	62			860	268	255		25	1570	484	(460)		48
220	69	66			865	270	257			1580	486	(462)		
225	70	67			870	272	258		26	1585	489	(465)		
230	72	68			880	275	261			1590	490	(466)		
240	75	71			890	278	264			1600	491	(467)		
250	79	75			900	280	266		27	1610	494	(470)		
255	80	76			910	283	269			1620	497	(472)		49
260	82	78			915	285	271			1630	500	(475)		
270	85	81	41		920	287	273		28	1640	503	(478)		
280	88	84	45		930	290	276			1650	506	(481)		
285	90	86	48		940	293	278		29	1660	509	(483)		
290	91	87	49		950	295	280			1665	510	(485)		
300	94	89	51		960	299	284			1670	511	(486)		
305	95	90	52		965	300	285			1680	514	(488)		50
310	97	92	54		970	302	287		30	1690	517	(491)		
320	100	95	56		980	305	290			1700	520	(494)		
330	103	98	58		980	308	293			1710	522	(496)		
335	105	100	59		995	310	295		31	1720	525	(499)		
340	107	102	60		1000	311	296			1730	527	(501)		51
350	110	105	62		1010	314	299			1740	530	(504)		
360	113	107	63,5		1020	317	301		32	1750	533	(506)		
370	115	109	64,5		1030	320	304			1760	536	(509)		
380	119	113	66		1040	323	307			1770	539	(512)		
385	120	114	67		1050	327	311		33	1775	540	(513)		
390	122	116	67,5		1060	330	314			1780	541	(514)		
400	125	119	69		1070	333	316			1790	544	(517)		52
410	128	122	70		1080	336	319		34	1800	547	(520)		
415	130	124	71		1090	339	322			1810	550	(523)		
420	132	125	72		1095	340	323			1820	553	(525)		
430	135	128	73		1100	342	325			1830	556	(528)		
440	138	131	74		1110	345	328		35	1840	559	(531)		
450	140	133	75		1120	349	332			1845	560	(532)		53
460	143	136	76,5		1125	350	333			1850	561	(533)		
465	145	138	77		1130	352	334			1860	564	(536)		
470	147	140	77,5		1140	355	337		36	1870	567	(539)		
480	150	143	78,5		1150	358	340			1880	570	(542)		
490	153	145	79,5		1155	360	342			1890	572	(543)		
495	155	147	80		1160	361	342			1900	575	(546)		
500	157	149	81		1170	364	346		37	1910	578	(549)		54
510	160	152	81,5		1180	367	349			1920	580	(551)		
520	163	155	82,5		1190	370	352			1930	583	(554)		
530	165	157	83		1200	373	354		38	1940	586	(557)		
540	168	160	84,5		1210	376	357			1950	589	(560)		
545	170	162	85		1220	380	361			1955	590	(561)		
550	172	163	85,5		1230	382	363		39	1960	591	(562)		
560	175	166	86		1240	385	366			1970	594	(564)		
570	178	169	86,5		1250	388	369			1980	596	(567)		55
575	180	171	87		1255	390	371			1990	599	(569)		
580	181	172			1260	392	372		40	1995	600	(570)		
590	184	175	88		1270	394	374			2000	602	(572)		
595	185	176			1280	397	377			2010	605	(575)		
600	187	178	89		1290	400	380			2020	607	(577)		
610	190	181	89,5		1300	403	383		41	2030	610	(580)		
620	193	184	90		1310	407	387			2040	613	(582)		
625	195	185			1320	410	390			2050	615	(584)		56
630	197	187	91		1330	413	393		42	2060	618	(587)		
640	200	190	91,5		1340	417	396			2070	620	(589)		
650	203	193	92		1350	420	399			2080	623	(592)		
660	205	195	92,5		1360	423	402		43	2090	626	(595)		
670	208	198	93		1370	426	405			2100	629	(598)		
675	210	199	93,5		1380	429	408			2105	630	(599)		
680	212	201			1385	430	409			2110	631	(600)		
690	215	204	94		1390	431	410			2120	634	(602)		
700	219	208			1400	434	413		44	2130	636	(604)		
705	220	209	95		1410	437	415			2140	639	(607)		57
710	222	211	95,5		1420	440	418			2145	640	(608)		
720	225	214	96		1430	443	421			2150	641	(609)		
730	228	216			1440	446	424		45	2160	644	(612)		
740	230	219	96,5		1450	449	427			2170	647	(615)		
750	233	221	97		1455	450	428			2180	650	(618)		
755	235	223			1460	452	429			2190	653	(620)		
760	237	225	97,5		1470	455	432			2200	655	(622)		58
770	240	228	98		1480	458	435		46		675			59
780	243	231		21	1485	460	437				698			60
785	245	233			1490	461	438				720			61
790	247	235	99		1500	464	441				745			62
800	250	238	99,5	22	1510	467	444				773			63
810	253	240			1520	470	447				800			64
820	255	242		23	1530	473	449		47		829			65
830	258	245			1540	476	452				864			66
835	260	247		24	1550	479	455				900			67
840	262	249			1555	480	(456)				940			68

* Esta tabla de conversión de durezas está basada en la Norma DIN 50150 (diciembre de 1976).

* This hardness conversion table is based on the standard DIN 50150 (December 1976).

Equivalencias⁽¹⁾ aprox. para material tipo acero rápido
Equivalences⁽¹⁾ approx. for speed steel type material

Dureza /Hardness HRC	Dureza /Hardness HV ₅
63	820
64	850
65	885
66	920
67	955

⁽¹⁾ Tabla no sujeta a Norma

⁽¹⁾ Table not subject to any standard

Tolerancias / Tolerances

Planas Square		Esféricas Ball Nose		Tónicas Corner Radius		Mango Shank	
mm		mm		mm		mm	
Ø	Ø Tolerancia Ø Tolerance	Ø	R.Tolerancia R. Tolerance	Ø	R.Tolerancia R. Tolerance	Ø (h6) Ø (h6)	Tolerancia Tolerance
1,0	0~-0,015	R0,5	±0,01	1,0	±0,01	Ø 3	0~-0,008
1,5	0~-0,015	R1	±0,01	2,0	±0,01	Ø 4	0~-0,008
2,0	0~-0,015	R1,5	±0,01	3,0	±0,01	Ø 6	0~-0,008
2,5	0~-0,015	R2	±0,01	4,0	±0,01	Ø 8	0~-0,009
3,0	0~-0,015	R2,5	±0,01	6,0	±0,01	Ø 10	0~-0,009
4,0	0~-0,015	R3	±0,01	8,0	±0,01	Ø 12	0~-0,011
5,0	0~-0,015	R4	±0,01	10,0	±0,01	Ø 16	0~-0,011
6,0	0~-0,015	R5	±0,01	12,0	±0,01	Ø 20	0~-0,013
8,0	0~-0,020	R6	±0,01	16,0	±0,015		
10,0	0~-0,020	R8	±0,02				
12,0	0~-0,020	R10	±0,02				
16,0	0~-0,020						
20,0	0~-0,020						

Propiedades del recubrimiento / Hard coating properties

Tipo Type	Color simbolo Symbol color	Microdureza (GPa) Nanohamess (GPa)	Espesor (µm) Thickness (µm)	Coefficiente de fricción Friction coefficient	Temperatura uso Max (°C) Max usage Temp (°C)	Temp. recubrimiento (°C) Coating Temp (°C)
TiALN	Violeta / Violet	30	1 - 4	0,4	800	450 ↑
AlTiN	Violeta oscuro Violet grey	38	1 - 4	0,6	900	450 ↑
G300	Dorado / Gold	35	1 - 4	0,4	800	
Aldura	Azul oscuro Blue grey	32	1 - 4	0,35	1100	
Diamond	Gris oscuro Black grey	90	7	0,3 - 0,5	950	450

MDI Standard		
ISO - Clasificación ISO - Classification		K40-K50
Ø	mm.	1,2-42,2
Co	(%)	10,0
W/C+cr ₃ C ₂ +vc	(%)	90,0
Densidad / Density	(g/cm ³)	14,5
HV ₃₀	(Kg/mm ²)	1610
HRA	(ISO3738)	92,3
K _{IC}	(MNm ^{-3/2})	10,5
TRS	(N/mm ²)	> 4000
A		≤ 02
Porosidad / Porosity		B
C		00
WC-medida grano / grain size (µm)		0,6
		Co% 10
		WC incl. Doping (%) 90
		Tungsten Carbideα Ø0,6µm

UMG-MDI Solid carbide		
ISO - Clasificación ISO - Classification		K40-K50
Ø	mm.	1,2-42,2
Co	(%)	12,0
W/C+cr ₃ C ₂ +vc	(%)	88,0
Densidad / Density	(g/cm ³)	14,05
HV ₃₀	(Kg/mm ²)	1680
HRA	(ISO3738)	92,5
K _{IC}	(MNm ^{-3/2})	10,0
TRS	(N/mm ²)	> 4000
A		≤ 02
Porosidad / Porosity		B
C		00
WC-medida grano / grain size (µm)		0,5
		Co% 12
		WC incl. Doping (%) 88
		Tungsten Carbideα Ø0,4µm

GMG-MDI Solid carbide		
ISO - Clasificación ISO - Classification		K05-K10
Ø	mm.	1,2-42,2
Co	(%)	6,0
W/C+cr ₃ C ₂ +vc	(%)	94,0
Densidad / Density	(g/cm ³)	14,8
HV ₃₀	(Kg/mm ²)	1870
HRA	(ISO3738)	93,6
K _{IC}	(MNm ^{-3/2})	9,3
TRS	(N/mm ²)	> 3900
A		≤ 02
Porosidad / Porosity		B
C		00
WC-medida grano / grain size (µm)		0,65
		Co% 6
		WC incl. Doping (%) 94
		Tungsten Carbideα Ø0,65µm

TMG-MDI Solid carbide		
ISO - Clasificación ISO - Classification		K10-K520
Ø	mm.	1,2-42,2
Co	(%)	10,0
W/C+cr ₃ C ₂ +vc	(%)	90,0
Densidad / Density	(g/cm ³)	14,35
HV ₃₀	(Kg/mm ²)	1770
HRA	(ISO3738)	93,0
K _{IC}	(MNm ^{-3/2})	9,8
TRS	(N/mm ²)	> 4000
A		≤ 02
Porosidad / Porosity		B
C		00
WC-medida grano / grain size (µm)		0,5
		Co% 10
		WC incl. Doping (%) 90
		Tungsten Carbideα Ø0,5µm

QMG-MDI Solid carbide		
ISO - Clasificación ISO - Classification		K10-K30
Ø	mm.	1,2-32,2
Co	(%)	9,0
W/C+cr ₃ C ₂ +vc	(%)	91,0
Densidad / Density	(g/cm ³)	14,40
HV ₃₀	(Kg/mm ²)	1920
HRA	(ISO3738)	93,9
K _{IC}	(MNm ^{-3/2})	9,3
TRS	(N/mm ²)	> 4000
A		≤ 02
Porosidad / Porosity		B
C		00
WC-medida grano / grain size (µm)		0,2-0,5
		Co% 9
		WC incl. Doping (%) 89,83
		Tungsten Carbideα Ø0,2µm

	DF Desbaste fino <i>Fine pitch</i>		F Plana frontal <i>Square type</i>		ML Mango largo <i>Long shank</i>		CUL Cuello largo <i>Long neck</i>		B Esférica <i>Ball type</i>		UMG Ultra micro grano <i>Ultra micro grain</i>
	D Desbaste <i>Roughing cutter</i>		CL Canal recto <i>Straight flute</i>		AL Para aluminio <i>For aluminium</i>		TP Cónica <i>Taper</i>		TN Tórica <i>Corner radius</i>		HRC Para templado <i>For tempered</i>
	INOX Para INOX <i>For STAINLESS</i>		VARIABLE Ángulo hélice variable <i>Variable helix angle</i>		COMP Para Composite <i>For Composite</i>		DT Dental <i>Dental</i>		Zr Para óxido de zirconio <i>For zirconium oxide ZrO2</i>		Ti Para Titanio/CoCr <i>For Titanium/CoCr</i>

Cortes Flutes	Plana / Square type			Esférica / Ball type		Tórica / Corner radius		Multicorte	Ángulo de hélice Helix angle 25°, 35°, 40°, 45°, 55°

			
Ranurado <i>Slotting</i>	Corte lateral <i>Side cutting</i>	Planeado <i>Planing</i>	Direc. avance <i>Feed direction</i>
			
Ranurado <i>Slotting</i>	Corte lateral <i>Side cutting</i>	Direc. avance <i>Feed direction</i>	
			
Ranurado <i>Slotting</i>	Corte lateral <i>Side cutting</i>	Direc. avance <i>Feed direction</i>	
			
Ranurado <i>Slotting</i>	Corte lateral <i>Side cutting</i>		





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