UNION TOOL

Tungsten Carbide End Mills
UNIMAX Series

NEW
Published April 2023

DLCCOAT 2 Flutes End Mills for Copper Electrode Milling

DLCLB
Long Neck Ball End Mills

new
DLCLS
Long Neck Square End Mills

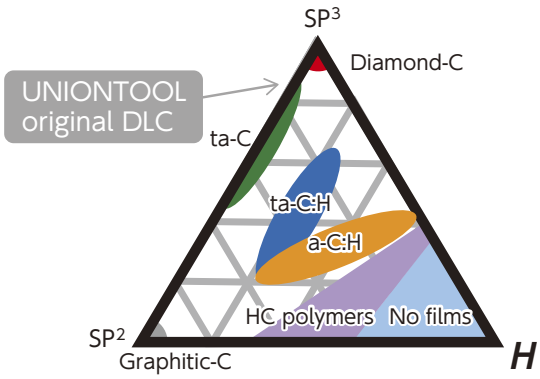
new
DLCLRS
Long Neck Radius End Mills

UNION TOOL CO.

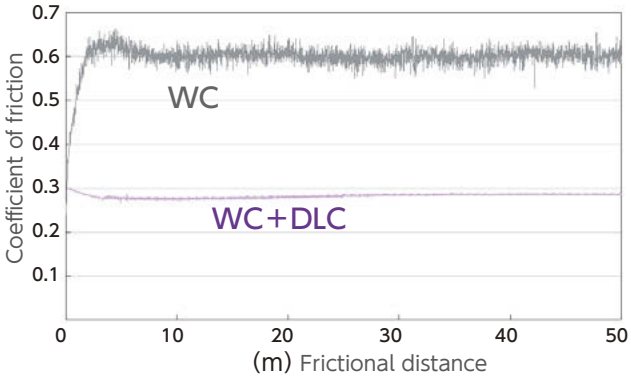
Our in-house developed DLC Coating

Diamond-like hardness (around 4,000 – 6,000HV)

Hardness of normal coating for Steels is 3,000 – 4,000HV

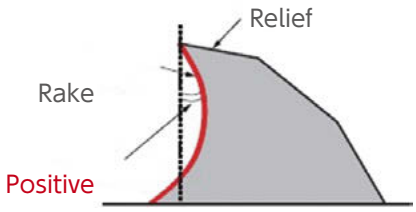


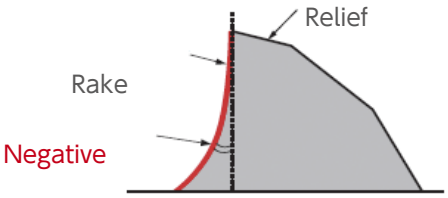
Excellent lubricity and high resistance to welding
Best for Copper and Aluminum milling



Coating thickness suited for sharp cutting edges
Thinner than normal coating for Steels

Sharp Cutting Edge





DLC Series

Rake and relief angle are designed for copper milling
Sharp cutting edge reduces burrs on milling surface

Normal Cutting Edge for Hard Materials

Negative rake angle for chipping resistance

Higher Grade Precision

DLCLB

Long Neck Ball

Radius of Ball Nose	D ≦ R0.5	D > R0.5
Diameter Tolerance	0/-0.006	0/-0.01

Radius of Ball Nose	R0.05~R0.2	R0.25~R2	R3
Radius Accuracy	± 0.002	± 0.003	± 0.004
Shank Diameter Tolerance	0/-0.004		

DLCLRS

Long Neck Radius

Outside Diameter	Ø0.2~Ø3
Diameter Tolerance	0/-0.005
CR Tolerance	± 0.005
Shank Diameter Tolerance	0/-0.004

DLCLS

Long Neck Square

Outside Diameter	Ø0.1~Ø3
Diameter Tolerance	0/-0.005
Shank Diameter Tolerance	0/-0.004

Unit (mm)

DLCLB
Milling example

Cu30 : W70
Tungsten Copper

Work Size 50 × 50 × 50 mm
Coolant: Oil Mist

DLCLB series
Housing-rib
Electrode Milling Video

No	Milling Process	Tool	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Allowance (mm)	Cycle Time (h:m:s)
1	Roughing	**R1.5 × EL10**	12,000	1,800	0.6	1.2	0.1	0:19:07
2	Roughing	**R0.75 × EL6**	21,300	1,530	0.3	0.6	0.1	0:21:34
3	Semi-finishing Flat surface	**R1 × EL6**	14,000	1,250	0.05	0.1	0.05	0:32:15
4	Semi-finishing Convex Pocket	**R0.5 × EL5**	29,500	1,530	0.05	0.06	0.05	1:43:09
5	Semi-finishing Corner	**R0.4 × EL6**	21,800	550	0.06	0.06	0.05	1:10:33
6	Finishing Flat surface	**R1 × EL6**	14,000	1,250	0.05	0.04	0	1:25:15
7	Finishing Convex Pocket	**R0.5 × EL5**	29,500	1,530	0.05	0.028	0	1:37:19
8	Finishing Cylinder corner	**R0.3 × EL5**	24,000	330	0.0002 Cusp Height	0.0002 Cusp Height	0	4:54:10

Total 12:03:22

DLC coating off ers high wear resistance and is suited even for Tungsten Copper that is hard to mill.

DLCLB
Milling example

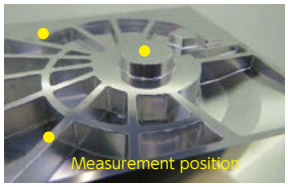
A7075
Aluminum

Work Size 50 × 50 × 50 mm
Coolant: Water Soluble

Reflection of the background

The surface finish is of such high quality that the letters refl ect perfectly in it.

Surface roughness



Ra 0.03 μm
Average of 3 positions
Ra 0.03 μm

No	Milling Process	Tool	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Allowance (mm)	Cycle Time (h:m:s)
1	Roughing	**R1.5 × EL10**	15,000	2,550	0.6	1.2	0.1	0:17:49
2	Roughing	**R0.75 × EL6**	25,500	2,040	0.3	0.6	0.1	0:20:22
3	Semi-finishing Flat surface	**R1 × EL6**	18,700	2,100	0.05	0.1	0.05	0:25:06
4	Semi-finishing Convex Pocket	**R0.5 × EL5**	30,000	1,700	0.05	0.06	0.05	0:53:17
5	Semi-finishing Corner	**R0.4 × EL6**	30,000	1,000	0.06	0.06	0.05	0:17:02
6	Finishing Flat surface	**R1 × EL6**	18,700	2,100	0.05	0.04	0	1:06:03
7	Finishing Convex Pocket	**R0.5 × EL5**	30,000	1,700	0.05	0.028	0	1:31:32
8	Finishing Cylinder corner	**R0.3 × EL5**	30,000	650	0.0002 Cusp Height	0.0002 Cusp Height	0	2:40:18

Total 7:31:29

Suited even for Aluminum milling as the cutting edge is sharper than normal endmills for Steels.

DLCLB

DLCCOAT 2 Flute Long Neck Ball End Mills for Copper Electrode Milling

R0.05～R3

Super MG | DLC | 30° | R ±0.002 (R0.05～R0.2) | R ±0.003 (R0.25～R2) | R ±0.004 (R3) | Shank Dia 0/-0.004 | Back Taper Geometry

Back taper geometry does not apply to R0.15 or below.

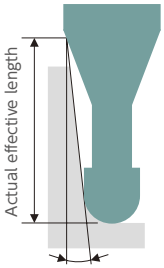
Material Applications (★ Highly Recommended ● Recommended ○ Suggested)

Work Material																
CARBON STEELS S45C S55C	ALLOY STEELS SK / SCM SUS	PREHARDENED STEELS NAK HPM	HARDENED STEELS ～50 HRC	～55 HRC	～60 HRC	～65 HRC	～70 HRC	CAST IRON	ALUMINUM ALLOYS	GRAPHITE	COPPER	PLASTICS	GLASS FILLED PLASTICS	TITANIUM ALLOYS	HEAT RESISTANT ALLOYS	CEMENTED CARBIDE	HARD BRITTLE (NON-METALLIC) MATERIALS
									●		★						

Unit (mm)

Radius of Ball Nose	D ≦ R0.5	D > R0.5
Diameter Tolerance	0/-0.006	0/-0.01

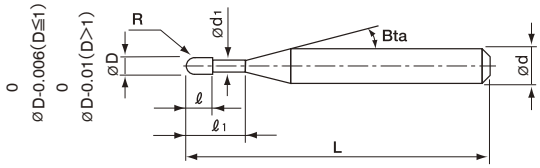
Radius of Ball Nose	R0.05～R0.2	R0.25～R2	R3
Radius Accuracy	± 0.002	± 0.003	± 0.004



Label Sample

#001 ØD0.597 R+0.001/−0.001

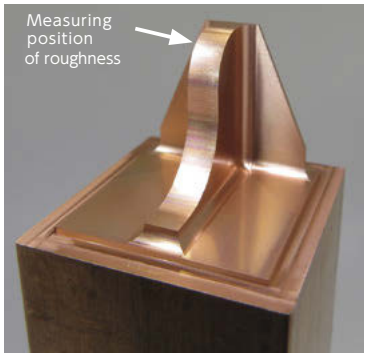
Diameter and Ball Radius accuracy measurements are printed on the label to support High Precision milling.



The shank taper angle shown is not an exact value.

Milling Example of Copper Electrode Model
DLCLB R1 × EL16

C1100
Tough Pitch Copper



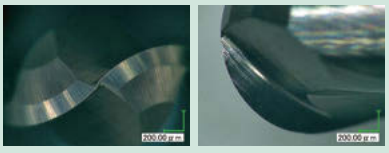
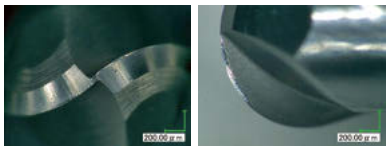
Milling Process	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Cycle Time (h:m:s)
Roughing	10,800	1,090	0.25	0.5	1:31:59
Semi-finishing	10,800	1,090	0.05	0.05	1:31:15
Finishing	13,090	545	0.0001 Cusp Height	0.03	1:15:26

Total 4:18:40

Work Size 20 × 20 × D 16 mm

Milling Method Contouring
Overhang Length 24 mm
Coolant Oil Mist

DLCLB series Introduction Video

DLCLB R1 × EL16	R1 × EL16 Conventional
Tool after milling (4h)	Tool after milling (4h)
	
45° Inclined surface Ra **0.18** μm	45° Inclined surface Ra **0.22** μm

DLCLB has less wear and damage after 4 hours of milling.

DLCCOAT 2 Flute Long Neck Ball End Mills for Copper Electrode Milling

Total 71 models

Unit (mm)

Model Number	Radius of Ball Nose R	Effective Length ℓ_1	Length of Cut ℓ	Neck Diameter $\varnothing d_1$	Shank Taper Angle Bta	Overall Length L	Shank Diameter $\varnothing d$	Suggested Retail Price ¥	Effective Length by Inclined Angles				
									30′	1°	1°30′	2°	3°
DLCLB 2001-003	**R0.05**	0.3	0.08	0.095	11°	45	4	10,600	0.34	0.36	0.39	0.41	0.46
DLCLB 2001-005		0.5				45	4	11,000	0.55	0.59	0.62	0.65	0.73
DLCLB 20015-003	**R0.075**	0.3	0.12	0.14	11°	45	4	11,700	0.36	0.38	0.40	0.42	0.47
DLCLB 20015-005		0.5				45	4	12,400	0.57	0.60	0.63	0.66	0.74
DLCLB 20015-010		1				45	4	12,900	1.09	1.15	1.21	1.27	1.43
DLCLB 2002-003	**R0.1**	0.3	0.16	0.19	11°	45	4	8,500	0.41	0.43	0.45	0.47	0.53
DLCLB 2002-005		0.5				45	4	8,500	0.62	0.65	0.68	0.72	0.80
DLCLB 2002-010		1				45	4	8,900	1.14	1.20	1.26	1.33	1.49
DLCLB 2002-015		1.5				45	4	9,200	1.67	1.75	1.84	1.94	2.17
DLCLB 2003-006	**R0.15**	0.6	0.24	0.29	11°	45	4	8,900	0.72	0.75	0.79	0.83	0.92
DLCLB 2003-010		1				45	4	8,900	1.14	1.19	1.25	1.32	1.47
DLCLB 2003-015		1.5				45	4	9,200	1.67	1.74	1.83	1.93	2.15
DLCLB 2003-020		2				45	4	9,600	2.19	2.29	2.41	2.53	2.84
DLCLB 2004-010	**R0.2**	1	0.32	0.39	11°	45	4	7,700	1.14	1.19	1.24	1.30	1.45
DLCLB 2004-020		2				45	4	7,900	2.19	2.29	2.40	2.52	2.82
DLCLB 2004-030		3				45	4	8,000	3.23	3.39	3.56	3.74	4.19
DLCLB 2004-040		4				45	4	8,200	4.28	4.49	4.71	4.96	5.56
DLCLB 2005-010	**R0.25**	1	0.4	0.49	11°	45	4	7,600	1.14	1.18	1.24	1.29	1.43
DLCLB 2005-020		2				45	4	7,600	2.18	2.28	2.39	2.51	2.80
DLCLB 2005-030		3				45	4	7,700	3.23	3.38	3.55	3.73	4.17
DLCLB 2005-040		4				45	4	7,900	4.28	4.48	4.70	4.95	5.54
DLCLB 2005-050		5				45	4	8,000	5.33	5.58	5.86	6.17	6.91
DLCLB 2006-010	**R0.3**	1	0.48	0.59	11°	45	4	5,900	1.14	1.18	1.23	1.28	1.41
DLCLB 2006-020		2				45	4	5,900	2.18	2.28	2.38	2.50	2.78
DLCLB 2006-030		3				45	4	6,100	3.23	3.38	3.54	3.72	4.15
DLCLB 2006-040		4				45	4	6,200	4.28	4.48	4.70	4.94	5.52
DLCLB 2006-050		5				45	4	6,400	5.32	5.57	5.85	6.16	6.89
DLCLB 2006-060		6				45	4	6,500	6.37	6.67	7.01	7.38	8.26
DLCLB 2008-020	**R0.4**	2	0.64	0.79	11°	45	4	6,100	2.18	2.27	2.37	2.48	2.75
DLCLB 2008-030		3				45	4	6,100	3.22	3.37	3.52	3.70	4.12
DLCLB 2008-040		4				45	4	6,200	4.27	4.47	4.68	4.92	5.48
DLCLB 2008-060		6				45	4	6,400	6.37	6.66	6.99	7.36	8.22
DLCLB 2008-080		8				45	4	6,500	8.46	8.86	9.30	9.79	10.96
DLCLB 2010-020	**R0.5**	2	0.8	0.98	11°	45	4	5,800	2.19	2.28	2.37	2.48	2.73
DLCLB 2010-030		3				45	4	5,800	3.24	3.37	3.53	3.70	4.10
DLCLB 2010-040		4				45	4	5,800	4.28	4.47	4.68	4.92	5.47
DLCLB 2010-050		5				45	4	5,900	5.33	5.57	5.84	6.14	6.84
DLCLB 2010-060		6				45	4	5,900	6.38	6.67	6.99	7.35	8.21
DLCLB 2010-080		8				45	4	6,200	8.47	8.87	9.31	9.79	10.95
DLCLB 2010-100		10				45	4	6,200	10.57	11.07	11.62	12.23	13.68
DLCLB 2010-120		12				45	4	6,200	12.66	13.26	13.93	14.67	16.42

DLCCOAT 2 Flute Long Neck Ball End Mills for Copper Electrode Milling

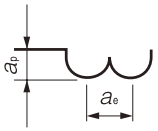
Model Number	Radius of Ball Nose R	Effective Length ℓ_1	Length of Cut ℓ	Neck Diameter $\varnothing d_1$	Shank Taper Angle Bta	Overall Length L	Shank Diameter $\varnothing d$	Suggested Retail Price ¥	Effective Length by Inclined Angles				
									30′	1°	1°30′	2°	3°
DLCLB 2015-040	**R0.75**	4	1.2	1.47	11°	45	4	5,900	4.21	4.39	4.58	4.80	5.31
DLCLB 2015-060		6				45	4	5,900	6.31	6.59	6.89	7.23	8.04
DLCLB 2015-120		12				50	4	6,700	12.59	13.18	13.83	14.55	16.26
DLCLB 2015-180		18				55	4	7,400	18.87	19.77	20.76	21.86	24.47
DLCLB 2020-040	**R1**	4	1.6	1.98	11°	45	4	6,100	4.18	4.34	4.51	4.71	5.18
DLCLB 2020-060		6				45	4	6,100	6.27	6.53	6.82	7.15	7.92
DLCLB 2020-080		8				45	4	6,200	8.36	8.73	9.14	9.59	10.66
DLCLB 2020-100		10				45	4	6,200	10.46	10.93	11.45	12.02	13.39
DLCLB 2020-120		12				50	4	6,200	12.55	13.12	13.76	14.46	16.13
DLCLB 2020-140		14				50	4	6,200	14.65	15.32	16.07	16.90	18.87
DLCLB 2020-160		16				50	4	6,200	16.74	17.52	18.38	19.34	No Interference
DLCLB 2020-200		20				55	4	6,900	20.93	21.91	23.00	24.21	No Interference
DLCLB 2020-250		25				65	4	7,700	26.16	27.41	28.78	No Interference	No Interference
DLCLB 2030-100	**R1.5**	10	2.4	2.95	11°	60	6	7,900	10.51	10.96	11.46	12.01	13.32
DLCLB 2030-120		12				60	6	8,100	12.61	13.16	13.77	14.45	16.06
DLCLB 2030-140		14				60	6	8,100	14.70	15.36	16.08	16.89	18.80
DLCLB 2030-160		16				60	6	8,400	16.80	17.56	18.39	19.32	21.54
DLCLB 2030-200		20				70	6	8,400	20.98	21.95	23.02	24.20	27.01
DLCLB 2030-250		25				70	6	8,400	26.22	27.44	28.79	30.30	No Interference
DLCLB 2030-300		30				70	6	9,200	31.45	32.94	34.57	36.39	No Interference
DLCLB 2040-100	**R2**	10	3.2	3.95	11°	70	6	7,300	10.49	10.91	11.38	11.90	13.14
DLCLB 2040-150		15				70	6	7,300	15.73	16.41	17.16	18.00	19.99
DLCLB 2040-200		20				70	6	8,600	20.96	21.90	22.94	24.09	No Interference
DLCLB 2040-250		25				70	6	9,200	26.20	27.39	28.72	30.19	No Interference
DLCLB 2040-300		30				70	6	9,500	31.43	32.89	34.50	No Interference	No Interference
DLCLB 2040-400		40				80	6	10,300	41.90	43.87	No Interference	No Interference	No Interference
DLCLB 2060-100	**R3**	10	4.8	5.95	—	80	6	9,500	No Interference	No Interference	No Interference	No Interference	No Interference
DLCLB 2060-150		15				80	6	9,500	No Interference	No Interference	No Interference	No Interference	No Interference
DLCLB 2060-200		20				80	6	9,500	No Interference	No Interference	No Interference	No Interference	No Interference
DLCLB 2060-300		30				80	6	10,000	No Interference	No Interference	No Interference	No Interference	No Interference

DLCLB Milling Conditions

WORK MATERIAL			COPPER/ALUMINUM ALLOYS				TUNGSTEN COPPER			
Model Number	Radius of Ball Nose (mm)	Effective Length (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
2001-003	**R0.05**	0.3	43,600	220	0.01	0.01	32,700	160	0.008	0.008
2001-005		0.5	43,600	160	0.007	0.007	32,700	110	0.005	0.005
20015-003	**R0.075**	0.3	43,600	250	0.015	0.02	32,700	190	0.012	0.016
20015-005		0.5	43,600	220	0.015	0.02	32,700	150	0.012	0.016
20015-010		1	43,600	160	0.007	0.01	32,700	120	0.006	0.008
2002-003	**R0.1**	0.3	43,600	550	0.025	0.05	32,700	380	0.02	0.04
2002-005		0.5	43,600	550	0.025	0.05	32,700	380	0.02	0.04
2002-010		1	43,600	440	0.02	0.04	32,700	270	0.015	0.03
2002-015		1.5	32,900	250	0.015	0.03	24,700	120	0.008	0.02
2003-006	**R0.15**	0.6	43,600	760	0.03	0.07	32,700	550	0.03	0.07
2003-010		1	43,600	760	0.03	0.07	32,700	550	0.03	0.07
2003-015		1.5	43,600	550	0.025	0.05	32,700	290	0.02	0.05
2003-020		2	39,200	390	0.02	0.03	29,400	200	0.01	0.02
2004-010	**R0.2**	1	43,600	1,090	0.05	0.1	32,700	760	0.04	0.08
2004-020		2	43,600	650	0.035	0.06	32,700	380	0.02	0.05
2004-030		3	35,000	470	0.02	0.04	29,200	230	0.01	0.03
2004-040		4	27,300	270	0.008	0.015	19,600	110	0.005	0.01
2005-010	**R0.25**	1	43,600	1,420	0.08	0.15	32,700	890	0.08	0.15
2005-020		2	43,600	870	0.08	0.15	32,700	550	0.08	0.15
2005-030		3	38,200	650	0.06	0.1	29,500	390	0.06	0.08
2005-040		4	32,700	440	0.04	0.08	24,000	220	0.025	0.05
2005-050		5	27,300	330	0.02	0.04	19,600	160	0.01	0.02
2006-010	**R0.3**	1	43,600	1,870	0.12	0.2	32,700	1,400	0.12	0.2
2006-020		2	43,600	1,750	0.12	0.2	32,700	1,310	0.12	0.2
2006-030		3	43,600	1,090	0.1	0.14	32,700	760	0.08	0.1
2006-040		4	32,700	760	0.07	0.1	27,300	440	0.04	0.06
2006-050		5	29,500	650	0.05	0.08	24,000	330	0.02	0.04
2006-060		6	27,300	550	0.04	0.06	21,800	220	0.01	0.03
2008-020	**R0.4**	2	43,600	2,820	0.15	0.3	32,700	1,980	0.15	0.3
2008-030		3	43,600	2,180	0.15	0.3	32,700	1,530	0.15	0.3
2008-040		4	38,200	1,750	0.12	0.2	29,500	1,090	0.1	0.16
2008-060		6	32,700	1,090	0.08	0.15	21,800	550	0.05	0.1
2008-080		8	23,800	760	0.05	0.06	17,300	320	0.02	0.025
2010-020	**R0.5**	2	39,100	2,740	0.25	0.4	30,000	2,050	0.25	0.4
2010-030		3	39,100	2,740	0.25	0.4	30,000	1,960	0.25	0.4
2010-040		4	39,100	2,350	0.2	0.4	29,500	1,560	0.2	0.4
2010-050		5	38,200	2,180	0.16	0.3	29,500	1,530	0.12	0.25
2010-060		6	34,500	1,840	0.14	0.3	26,200	1,150	0.1	0.25
2010-080		8	27,300	1,090	0.12	0.2	19,600	550	0.06	0.1
2010-100		10	20,300	810	0.08	0.15	16,200	300	0.03	0.05
2010-120		12	13,100	490	0.06	0.1	9,800	160	0.015	0.04
2015-040	**R0.75**	4	25,500	2,270	0.3	0.6	21,300	1,700	0.3	0.6
2015-060		6	25,500	2,040	0.3	0.6	21,300	1,530	0.3	0.6
2015-120		12	17,500	1,090	0.15	0.3	13,100	550	0.1	0.2
2015-180		18	8,500	590	0.08	0.12	6,800	170	0.02	0.06

DLCLB Milling Conditions

WORK MATERIAL			COPPER/ALUMINUM ALLOYS				TUNGSTEN COPPER			
Model Number	Radius of Ball Nose (mm)	Effective Length (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
2020-040	**R1**	4	18,700	2,490	0.45	0.8	14,000	1,500	0.45	0.8
2020-060		6	18,700	2,080	0.45	0.8	14,000	1,250	0.45	0.8
2020-080		8	18,700	1,800	0.4	0.8	13,500	1,200	0.4	0.8
2020-100		10	18,700	1,700	0.3	0.6	13,500	1,190	0.25	0.5
2020-120		12	16,800	1,470	0.3	0.6	12,600	950	0.25	0.5
2020-140		14	15,000	1,250	0.28	0.5	11,200	750	0.18	0.4
2020-160		16	13,100	1,090	0.25	0.5	9,800	550	0.12	0.25
2020-200		20	10,000	800	0.15	0.3	8,000	350	0.06	0.1
2020-250		25	6,700	500	0.08	0.15	5,000	170	0.03	0.05
2030-100	**R1.5**	10	15,000	2,550	0.6	1.2	12,000	1,800	0.6	1.2
2030-120		12	15,000	2,550	0.6	1.2	11,800	1,740	0.6	1.2
2030-140		14	15,000	2,510	0.6	1.2	11,700	1,670	0.6	1.2
2030-160		16	14,200	2,140	0.6	1	10,700	1,600	0.5	1
2030-200		20	12,700	1,910	0.5	0.8	9,500	1,110	0.4	0.6
2030-250		25	10,100	1,520	0.4	0.6	8,400	760	0.2	0.3
2030-300		30	8,700	1,310	0.2	0.4	6,500	550	0.08	0.15
2040-100	**R2**	10	11,500	2,880	0.8	1.6	8,600	2,010	0.8	1.6
2040-150		15	11,500	2,670	0.8	1.6	8,600	1,880	0.8	1.6
2040-200		20	11,500	2,460	0.8	1.6	8,200	1,640	0.8	1.2
2040-250		25	10,300	2,210	0.6	1.2	6,700	1,270	0.5	1
2040-300		30	9,000	1,800	0.5	1	5,300	900	0.3	0.5
2040-400		40	6,000	900	0.4	0.8	3,800	380	0.15	0.3
2060-100	**R3**	10	10,000	4,190	1	2.2	7,500	3,150	1	2.2
2060-150		15	10,000	4,190	1	2.2	7,500	2,800	1	2.2
2060-200		20	10,000	3,000	1	2	7,500	2,000	0.7	1.5
2060-300		30	10,000	3,000	0.8	1.6	7,000	1,800	0.4	0.8



Note :
- Decrease the feed rate more than 50% from the milling parameters when slot milling.
- Decrease both spindle speed and feed rate proportionally when the milling parameters exceed the machine's maximum spindle speed, or when chattering occurs.
- Recommend wet coolant for Copper and Tungsten-Copper.

Advisory for Safe Use of End Mills

Correct application and operation is strongly advised to avoid clogging, abrasion, etc, that could cause serious accidents or injuries.
Ignition or sparks generated during milling could lead to fire or extreme damage to the work piece.
End Mills are made with very sharp cutting edges and must be handled with extra care.

- Never touch the cutting edge with your bare hands, as this could cause serious injury. Special caution is required when opening the package.
- Dropping the tool could cause breakage or flying debris, leading to serious injury.
- During milling, unexpected impact or shock on the tool could cause breakage or flying debris. Ensure to use protective items such as safety glasses and a face guard.
- For best results, fine parameter adjustment may be required, depending on the materials; milling shape and strategy; machine rigidity and spindle capability.
- Use a machine that has high rigidity and generates a low level of vibration. Recommend setting the runout control value at 5μm or below for the small diameter tools ϕ1 or below.
- Do not use flammable cutting oils.

Advisory for Regrinding End Mills

- Never regrind the tool without wearing safety glasses and a face guard.

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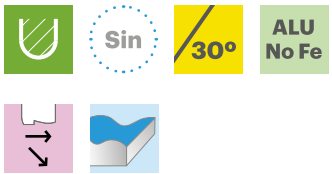

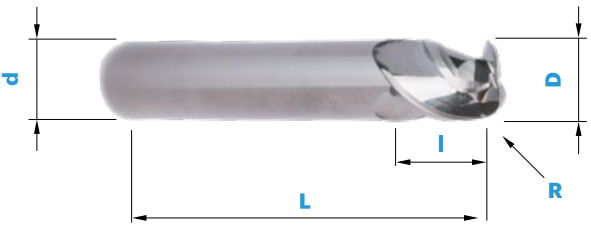

	Z	D	R	l	L	d
Referencia Reference	**Nº. de dientes** No. of flutes	**Diámetro de corte** Cutting diameter	**Radio** Radius	**Longitud de corte** Lenght of cut	**Longitud Total** Overall length	**Diámetro del mango** Shank diameter
ALBA-3060	3	6	3	12	75	6
ALBA-3080	3	8	4	16	80	8
ALBA-3100	3	10	5	20	100	10
ALBA-3120	3	12	6	24	100	12
ALBA-3160	3	16	8	32	107	16

Disponible en otros diámetros y longitudes bajo demanda.
Available for other diameters and lengths up to request.

CONDICIONES DE CORTE
CUTTING PARAMETERS

DEBASTE / ROUGHING

				D3	D4	D5	D6	D8	D10	D12	D16	D20	D25
Material	V. corte	Ap	Ae	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz
1													
2													
3													
4													
5													
6													
7													
8	400-500	0,10 x D	0,30 x D				0,10	0,11	0,13	0,14	0,16		
9													
10													
11													

ACABADO / FINISHING

				D3	D4	D5	D6	D8	D10	D12	D16	D20	D25
Material	V. corte	Ap	Ae	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz
1													
2													
3													
4													
5													
6													
7													
8	600-700	0,02 x D	0,02 x D				0,10	0,11	0,13	0,14	0,16		
9													
10													
11													