

UNION TOOL

Tungsten Carbide End Mills UNIMAX Series

Vol. 2

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

Add 24

DLCLB

Total 71 Models



UNION TOOL CO.

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



Size **R0.05~R3**

DLCLB

Super MG

DLC

30°

R ±0.002

R ±0.003

R ±0.004

Shank Dia 0/-0.004

Back Taper Geometry

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

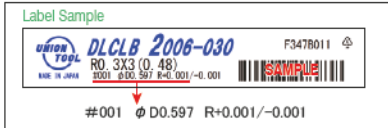
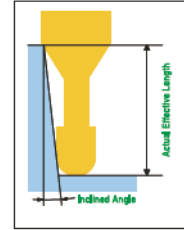
Additional 24 Models

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

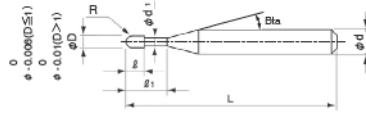
Work Material															
CARBON STEELS S45C S55C	ALLOY STEELS SK / SCM SUS	PREHARDENED STEELS NAK HPM	HARDENED STEELS			CAST IRON	ALUMINUM ALLOYS	GRAPHITE	COPPER	PLASTICS	GLASS FILLED PLASTICS	TITANIUM ALLOYS	HEAT RESISTANT ALLOYS	CEMENTED CARBIDE	HARD BRITTLE (NON-METALLIC) MATERIALS
			~55HRC	~60HRC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

Features

- DLC coating offers excellent welding and wear resistance.
- The flute geometry specially designed for copper milling offers outstanding tool life.
- High precision shank diameter tolerance of 0/-0.004 mm.



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 and to avoid contact with the workpiece, we recommend the user controls the precise value of this angle. Shank taper angle should not make contact with the work piece.

Total 71 models

Unit (mm)

Model Number	Radius of Ball Nose R	Effective Length l_1	Length of Cut l	Neck Diameter ϕd_1	Shank Taper Angle Bta	Overall Length L	Shank Diameter ϕd	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	14,100	0.34	0.36	0.39	0.41	0.46
DLCLB 2001-005		0.5							0.55	0.59	0.62	0.65	0.73
DLCLB 20015-003	R0.075	0.3	0.12	0.14	11°	45	4	15,600	0.36	0.38	0.40	0.42	0.47
DLCLB 20015-005		0.5							0.57	0.60	0.63	0.66	0.74
DLCLB 20015-010		1							1.09	1.15	1.21	1.27	1.43
DLCLB 2002-003	R0.1	0.3	0.16	0.19	11°	45	4	11,300	0.41	0.43	0.45	0.47	0.53
DLCLB 2002-005		0.5							0.62	0.65	0.68	0.72	0.80
DLCLB 2002-010		1							1.14	1.20	1.26	1.33	1.49
DLCLB 2002-015		1.5							1.67	1.75	1.84	1.94	2.17
DLCLB 2003-006	R0.15	0.6	0.24	0.29	11°	45	4	11,800	0.72	0.75	0.79	0.83	0.92
DLCLB 2003-010		1							1.14	1.19	1.25	1.32	1.47
DLCLB 2003-015		1.5							1.67	1.74	1.83	1.93	2.15
DLCLB 2003-020		2							2.19	2.29	2.41	2.53	2.84

* Additional model

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 $\varnothing d$	Price ¥	Effective Length by Inclined Angles				
									30°	1°	1°30'	2°	3°
• DLCLB 2004-010	R0.2	1	0.32	0.39	11°	45	4	10,300	1.14	1.19	1.24	1.30	1.45
• DLCLB 2004-020		2				45	4	10,500	2.19	2.29	2.40	2.52	2.82
• DLCLB 2004-030		3				45	4	10,700	3.23	3.39	3.56	3.74	4.19
• DLCLB 2004-040		4				45	4	10,900	4.28	4.49	4.71	4.96	5.56
• DLCLB 2005-010	R0.25	1	0.4	0.49	11°	45	4	10,100	1.14	1.18	1.24	1.29	1.43
• DLCLB 2005-020		2				45	4	10,100	2.18	2.28	2.39	2.51	2.80
• DLCLB 2005-030		3				45	4	10,300	3.23	3.38	3.55	3.73	4.17
• DLCLB 2005-040		4				45	4	10,500	4.28	4.48	4.70	4.95	5.54
• DLCLB 2005-050		5				45	4	10,700	5.33	5.58	5.86	6.17	6.91
• DLCLB 2006-010	R0.3	1	0.48	0.59	11°	45	4	7,900	1.14	1.18	1.23	1.28	1.41
• DLCLB 2006-020		2				45	4	7,900	2.18	2.28	2.38	2.50	2.78
• DLCLB 2006-030		3				45	4	8,100	3.23	3.38	3.54	3.72	4.15
• DLCLB 2006-040		4				45	4	8,300	4.28	4.48	4.70	4.94	5.52
• DLCLB 2006-050		5				45	4	8,500	5.32	5.57	5.85	6.16	6.89
• DLCLB 2006-060		6				45	4	8,700	6.37	6.67	7.01	7.38	8.26
• DLCLB 2008-020	R0.4	2	0.64	0.79	11°	45	4	8,100	2.18	2.27	2.37	2.48	2.75
• DLCLB 2008-030		3				45	4	8,100	3.22	3.37	3.52	3.70	4.12
• DLCLB 2008-040		4				45	4	8,300	4.27	4.47	4.68	4.92	5.48
• DLCLB 2008-060		6				45	4	8,500	6.37	6.66	6.99	7.36	8.22
• DLCLB 2008-080		8				45	4	8,700	8.46	8.86	9.30	9.79	10.96
• DLCLB 2010-020	R0.5	2	0.8	0.98	11°	45	4	7,700	2.19	2.28	2.37	2.48	2.73
• DLCLB 2010-030		3				45	4	7,700	3.24	3.37	3.53	3.70	4.10
• DLCLB 2010-040		4				45	4	7,700	4.28	4.47	4.68	4.92	5.47
• DLCLB 2010-050		5				45	4	7,900	5.33	5.57	5.84	6.14	6.84
• DLCLB 2010-060		6				45	4	7,900	6.38	6.67	6.99	7.35	8.21
• DLCLB 2010-080		8				45	4	8,300	8.47	8.87	9.31	9.79	10.95
• DLCLB 2010-100		10				45	4	8,300	10.57	11.07	11.62	12.23	13.68
• DLCLB 2010-120		12				45	4	8,300	12.66	13.26	13.93	14.67	16.42
• DLCLB 2015-040	R0.75	4	1.2	1.47	11°	45	4	7,900	4.21	4.39	4.58	4.80	5.31
• DLCLB 2015-060		6				45	4	7,900	6.31	6.59	6.89	7.23	8.04
• DLCLB 2015-120		12				50	4	8,900	12.59	13.18	13.83	14.55	16.26
• DLCLB 2015-180		18				55	4	9,900	18.87	19.77	20.76	21.86	24.47

* Additional model

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

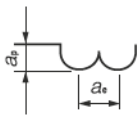
Model Number	Radius of Ball Nose R	Effective Length ℓ_1	Length of Cut ℓ	Neck Diameter $\varnothing d_1$	Shank Taper Angle Bta	Overall Length L	Shank Diameter $\varnothing d$	Price ¥	Effective Length by Inclined Angles				
									30°	1°	1°30'	2°	3°
DLCLB 2020-040	R1	4	1.6	1.98	11°	45	4	8,100	4.18	4.34	4.51	4.71	5.18
DLCLB 2020-060		6				45	4	8,100	6.27	6.53	6.82	7.15	7.92
DLCLB 2020-080		8				45	4	8,300	8.36	8.73	9.14	9.59	10.66
DLCLB 2020-100		10				45	4	8,300	10.46	10.93	11.45	12.02	13.39
DLCLB 2020-120		12				50	4	8,300	12.55	13.12	13.76	14.46	16.13
DLCLB 2020-140		14				50	4	8,300	14.65	15.32	16.07	16.90	18.87
DLCLB 2020-160		16				50	4	8,300	16.74	17.52	18.38	19.34	No Interference
DLCLB 2020-200		20				55	4	9,200	20.93	21.91	23.00	24.21	No Interference
DLCLB 2020-250		25				65	4	10,200	26.16	27.41	28.78	No Interference	No Interference
DLCLB 2030-100	R1.5	10	2.4	2.95	11°	60	6	10,500	10.51	10.96	11.46	12.01	13.32
DLCLB 2030-120		12				60	6	10,800	12.61	13.16	13.77	14.45	16.06
DLCLB 2030-140		14				60	6	10,800	14.70	15.36	16.08	16.89	18.80
DLCLB 2030-160		16				60	6	11,200	16.80	17.56	18.39	19.32	21.54
DLCLB 2030-200		20				70	6	11,200	20.98	21.95	23.02	24.20	27.01
DLCLB 2030-250		25				70	6	11,200	26.22	27.44	28.79	30.30	No Interference
DLCLB 2030-300		30				70	6	12,200	31.45	32.94	34.57	36.39	No Interference
DLCLB 2040-100	R2	10	3.2	3.95	11°	70	6	9,700	10.49	10.91	11.38	11.90	13.14
DLCLB 2040-150		15				70	6	9,700	15.73	16.41	17.16	18.00	19.99
DLCLB 2040-200		20				70	6	11,500	20.96	21.90	22.94	24.09	No Interference
DLCLB 2040-250		25				70	6	12,200	26.20	27.39	28.72	30.19	No Interference
DLCLB 2040-300		30				70	6	12,700	31.43	32.89	34.50	No Interference	No Interference
DLCLB 2040-400		40				80	6	13,700	41.90	43.87	No Interference	No Interference	No Interference
DLCLB 2060-100	R3	10	4.8	5.95	-	80	6	12,700	No Interference	No Interference	No Interference	No Interference	No Interference
DLCLB 2060-150		15				80	6	12,700	No Interference	No Interference	No Interference	No Interference	No Interference
DLCLB 2060-200		20				80	6	12,700	No Interference	No Interference	No Interference	No Interference	No Interference
DLCLB 2060-300		30				80	6	13,300	No Interference	No Interference	No Interference	No Interference	No Interference

DLCLB Milling Conditions

WORK MATERIAL			COPPER				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
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

DLCLB Milling Conditions

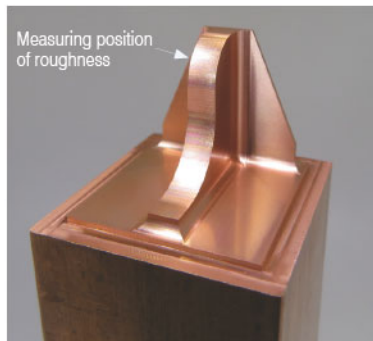
WORK MATERIAL			COPPER				TUNGSTEN COPPER			
Model Number	Radius of Ball Nose (mm)	Effective Length (mm)	Spindle Speed (min ⁻¹)	Feed Rate (mm/min)	a _p Axial Depth (mm)	a _e Radial Depth (mm)	Spindle Speed (min ⁻¹)	Feed Rate (mm/min)	a _p Axial Depth (mm)	a _e Radial Depth (mm)
2030-100	R1.5	10	15,000	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



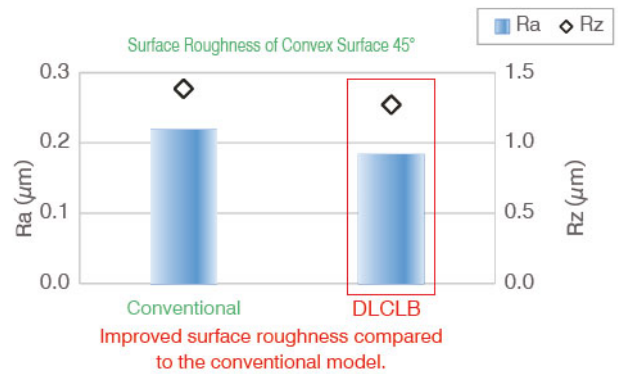
a_p : Axial Depth (mm)
a_e : Radial Depth (mm)

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.



Model Size : 20 x 20 x Depth 16 mm
Coolant : Oil Mist

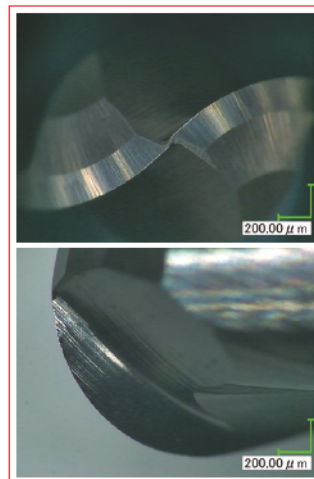
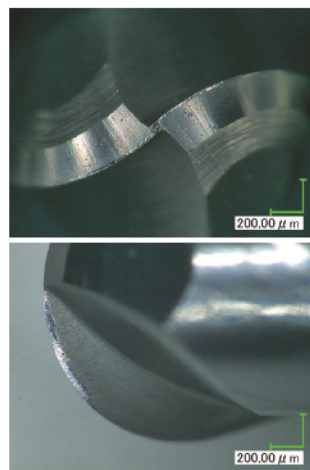


No	Milling Process	Milling Method	Tool	Spindle Speed (min ⁻¹)	Feed Rate (mm/min)	a _p Axial Depth (mm)	a _e Radial Depth (mm)	Overhang Length (mm)	Cycle Time
1	Roughing	Contouring	DLCLB 2020-160	10,800	1,090	0.25	0.5	24	1:31:59
2	Semi-finishing			10,800	1,090	0.05	0.05		1:31:15
3	Finishing			13,090	545	0.0001 (Cusp Height)	0.03		1:15:26

Total 4:18:40

Conventional

DLCLB



Tools after milling

DLCLB has less wear and damage after 4 hours of milling, and enables stable milling throughout the long cycle time.



Advisory for Safe Use of UNIMAX Tungsten Carbide 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.
- * Do not use flammable cutting oils.

Advisory for regrinding UNIMAX Tungsten Carbide End Mills

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



UNION TOOL CO.

U.S. UNION TOOL, INC.

(U.S. HEADQUARTERS)

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(Customer Service, Santa Clara, California)

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UPPER MIDWEST REGIONAL SERVICE CENTER

(Customer Service, Minneapolis, Minnesota)

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