Tungsten Carbide End Mills
UNIMAX Series

For Cemented Carbide and Hard Brittle Materials

UDC

Ball Series Vol.2

2 Flute Diamond Coated UDC Series

Add 2 Total 6 Models	UDCBH	High-speed Ball End Mills
new Total 22 Models	UDCLBH	High-speed Long Neck Ball End Mills
Total 16 Models	UDCBF	High-grade Ball End Mills
Total 61 Models	UDCLBF	High-grade Long Neck Ball End Mills
Total 14 Models	UDCB	Ball End Mills
Total 37 Models	UDCLB	Long Neck Ball End Mills

UNION TOOL

UNION TOOL CO.

UDC Choose by application

UDC
ULTRA DIAMOND COAT

For highly efficient roughing and semi-finishing	For better surface finish	For cost saving purposes
series	series	
Ball: UDCBH, UDCLBH (New!)	UDCBF, UDCLBF	UDCB, UDCLB
Radius	UDCLRSF	UDCLRS

The long-awaited 3rd generation UDC!

UDC-H

Patent pending

The best match for roughing and semi-finishing of cemented carbide.

Features of H series

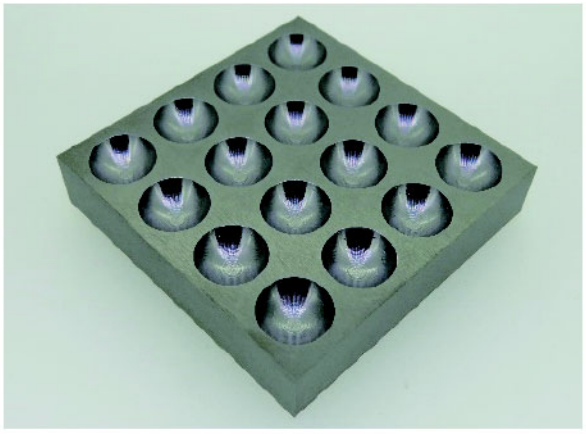
High-level Treatment!!	Unbelievable milling performance
High Speed!!	Mill at surprisingly high feed rate
High Material Removal Volume!!	Highly improved material removal volume

Attain both high efficiency and long tool life!

The key points

New generation edge treatment minimizes tool damage × Improved diamond coating to enhance wear resistance

UDCBH



7.5
7.5 times the efficiency

4
Over 4 times the removal volume

Work Size: 50 x 50 x 10 mm

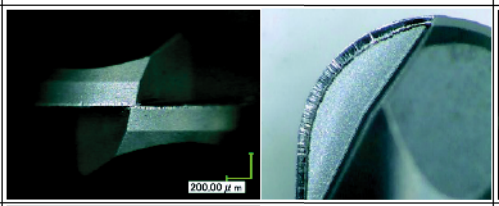
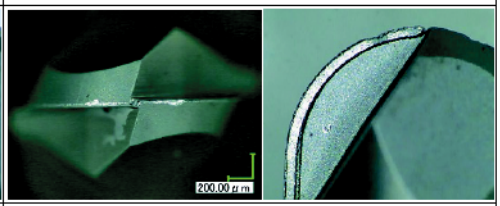
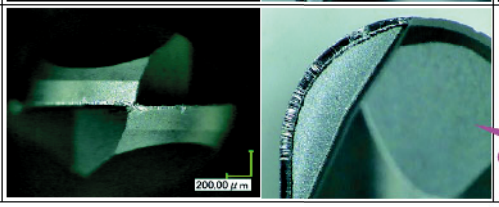
Pocket Size: Top ø 10 x Depth 3.5 mm

Material Removal Volume : 160 mm^3 / Pocket

Coolant : Air Blow

UDCBH shows maximum tool performance under high-speed conditions.
Tool life may shorten when used at the same feed rate as before.

UDCBH
Milling example

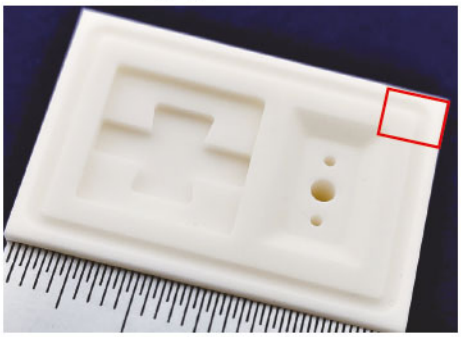
Tool	UDCBH	UDCBF
Milling Conditions		
Spindle Speed	30,000 min^{-1}	20,000 min^{-1}
Feed Rate	1,500 mm/min	200 mm/min
Axial Depth a_p	0.1 mm	
Radial Depth a_e	0.3 mm	
Milling Results		
1 side 16 pockets	1 Tool Milling time 76 min	4 Tool Milling time 7 h 28 min
Tool after milling 4 pockets		
Tool after milling 16 pockets		Still functional

Hard Brittle Materials Electronic component assembly jig shaped milling with UDCBH R0.5 x Length of Cut 0.7

Alumina Al_2O_3 (99.5%)

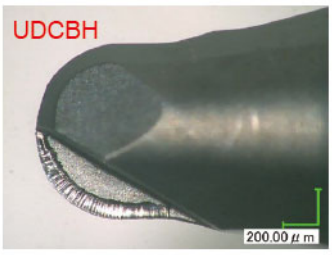
Zirconia ZrO_2 (94%)

Alumina Al_2O_3 (99.5%)

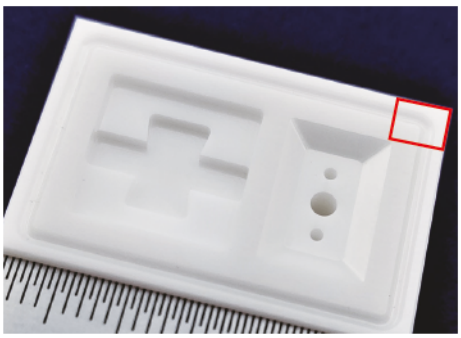


Work Size : 30 x 20 x 10 mm

Coolant : Water Soluble

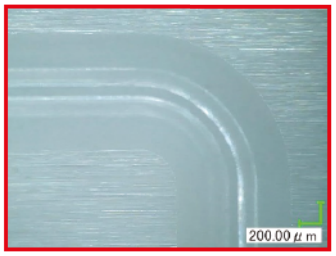


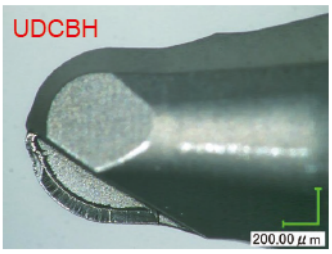
Zirconia ZrO_2 (94%)



Work Size : 30 x 20 x 10 mm

Coolant : Water Soluble



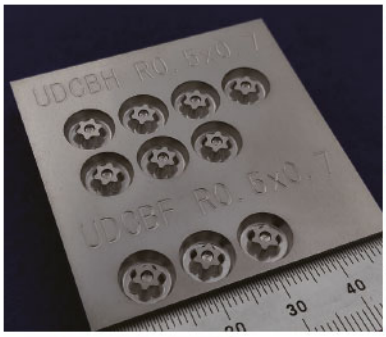


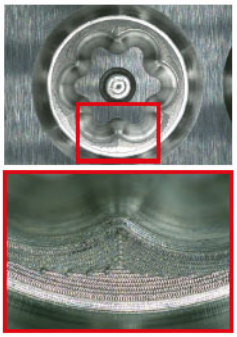
No	Process	Tool	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Allowance (mm)	Cycle Time
1	Slotting and inclined pocket roughing	UDCBH 2010-0070 (R0.5 × Length of Cut 0.7)	30,000	300	0.05	0.25	0.01/0.03	0:36:29
2	Slot finishing						0	0:19:17
3	2-stage pocket roughing	UDCLBF 2010-0200 (R0.5 × Effective Length 2)	30,000	300	0.028	0.028	0.03	0:52:42
4	Re-machining	UDCLRSF 2008-005024 (Ø 0.8 × CR0.05 × Effective Length 2.4)	30,000	175	0.023	0.5	0.03	0:18:26
5	Semi-finishing				0.02	0.25	0.01	0:51:09
6	Finishing				0.014	0.25	0	1:12:32
7	Drilling	UDCMX 2200-100 (Ø 2 × Flute Length 10)	2,400	5	0.15	—	—	0:03:15
8		UDCMX 2100-100 (Ø 1 × Flute Length 10)	5,000	7.5	0.05	—	—	0:10:44

Hole Depth 7 mm Total 4:24:34

Cemented Carbide Hexalobular Comparison of efficiency and material removal volume with UDCBH / UDCBF R0.5 x Length of Cut 0.7

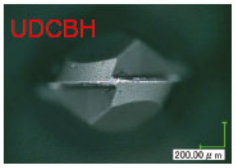
VM-40 (90 HRA)

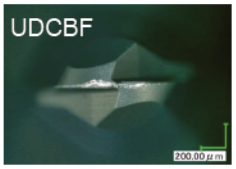




Model Size : ϕ9 x 2.2 mm 91 mm³ / pc
Coolant : Air Blow

Less than 1/3 of the cycle time
More than twice the tool life of UDCBF



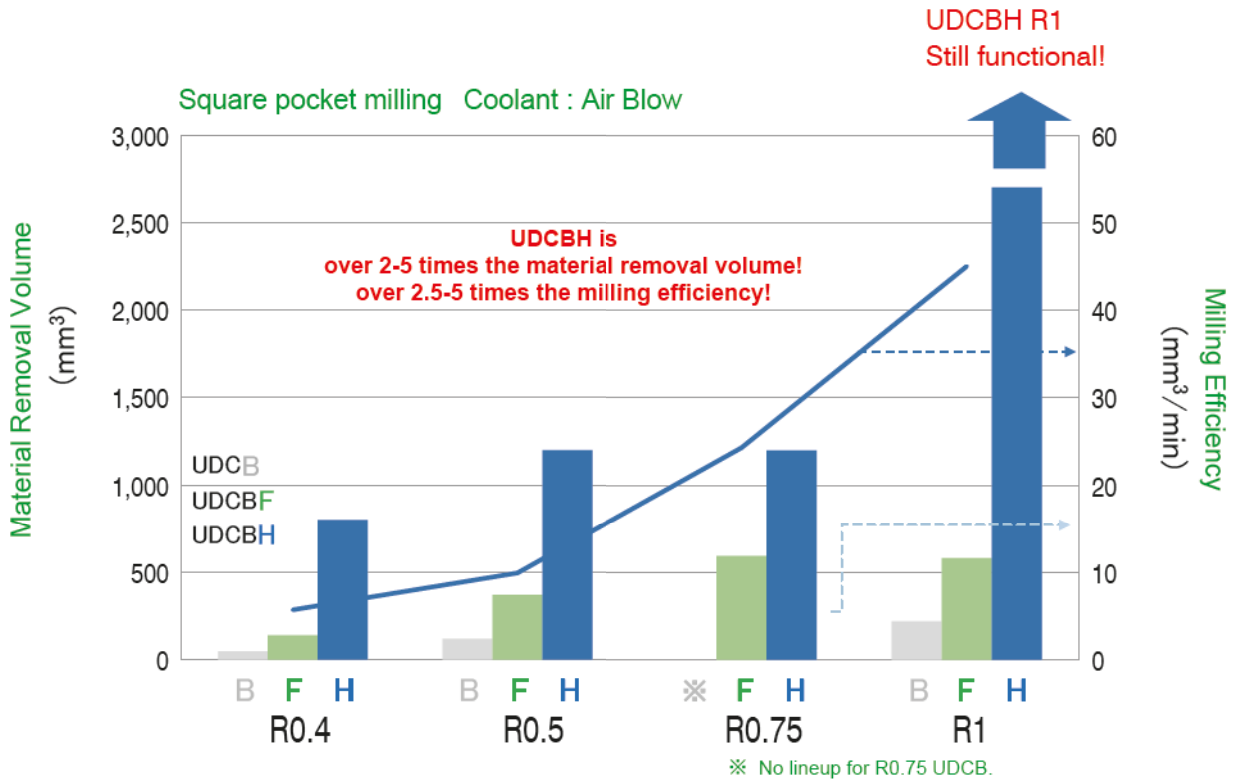


Tool damage at the time of machining 3 pieces

Tool	UDCBF			UDCBH	
Model	Hexalobular	Character engraving		Hexalobular	Character engraving
Cycle Time / pc	38 min 21 sec	1 min 56 sec	Efficiency x 3.2 Tool life x 2.3	11 min 50 sec	38 sec
Number of processed pieces / pc	3	–		7	–
Material Removal Volume	273 mm³	–		637 mm³	–
Spindle Speed	30,000 min⁻¹	15,000 min⁻¹		30,000 min⁻¹	15,000 min⁻¹
Feed Rate	300 mm/min	150 mm/min		900 mm/min	450 mm/min
Feed Rate 2	30 mm/min	30 mm/min		300 mm/min	300 mm/min
Axial Depth a_p	0.05 mm	0.05 mm		0.05 mm	0.05 mm
Radial Depth a_e	0.25 mm	–		0.25 mm	–

Cemented Carbide Comparison of efficiency and material removal volume in roughing with UDCB / UDCBF / UDCBH

VM-40 (90HRA)

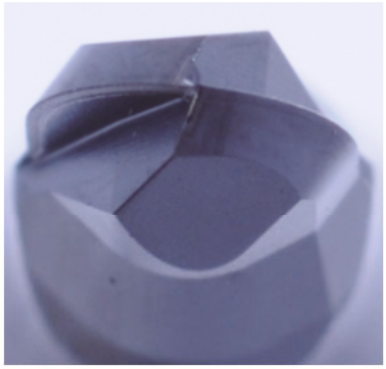


UDC-F

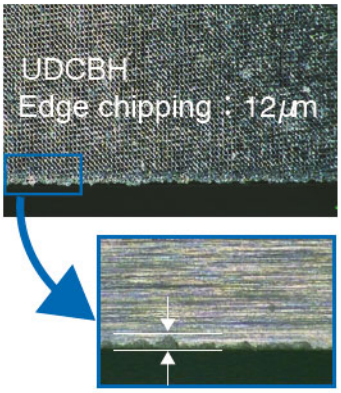
The sharpest cutting edge in the UDC series
The best choice for high quality milling surface

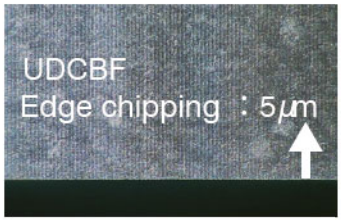
F (Fine) Features of F series

①UDC Coating	Optimized coating for F series
②Special treatment for a sharp edge	Minimized edge chipping and the level of the gap
③Chip pocket designed on tool tip	Excellent surface finish



Cemented Carbide Flat surface milling Comparison of edge chipping on work piece with UDCBH / UDCBF R0.4 × Length of Cut 0.56 VM-40 (90 HRA)





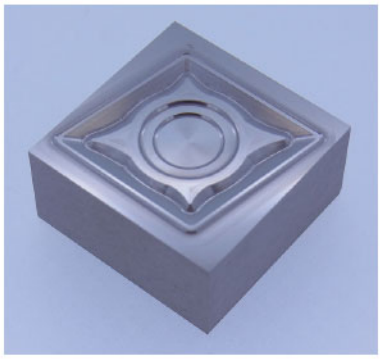
Milling direction

Tool	UDCBH	UDCBF
Spindle Speed	30,000 min^{-1}	
Feed Rate	750 mm/min	250 mm/min
Axial Depth a_p	0.02 mm	
Radial Depth a_e	0.02 mm	
Coolant	Air Blow	

Improve efficiency and lower costs by using the right tool to meet your edge chipping requirements.

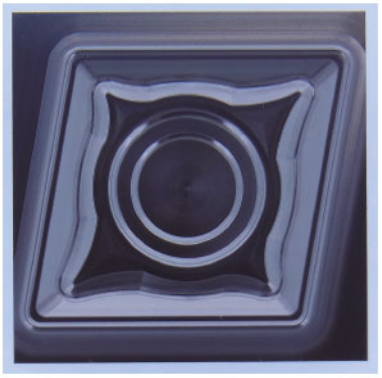
Cemented Carbide Indexable Insert Mold with UDCBF R0.5 × Length of Cut 0.7 Ball End Mill

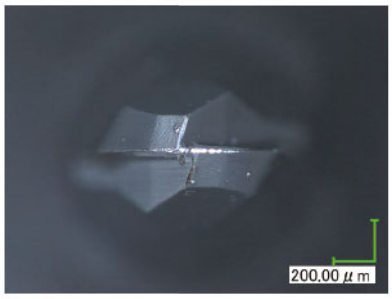
VM-40（90 HRA）



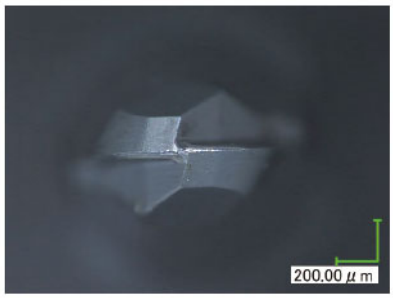
	Roughing	Finishing
Tool	UDCBF 2010-0070（R0.5×0.7）	
Spindle Speed	30,000 min^{-1}	
Feed Rate	300 mm/min	
Axial Depth a_p	0.05 mm	0.028 mm
Radial Depth a_e	0.25 mm	0.02 mm
Coolant	Air Blow	
Cycle Time	43 min	2 h 17 min
Material Removal Volume	86.3 mm^3	12.0 mm^3

※ One End Mill for both roughing and finishing processes. Total 2 tools are used.





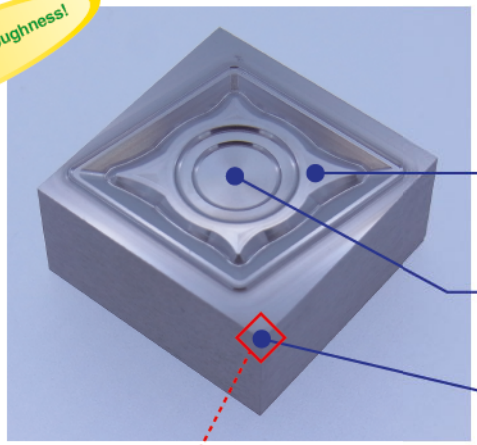
Tool after roughing



Tool after finishing

■ Surface Roughness

Excellent surface roughness!



Ra: 0.051μm
Rz: 0.399μm

Ra: 0.068μm
Rz: 0.520μm

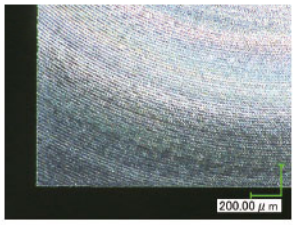
Ra: 0.054μm
Rz: 0.408μm

Size : 20 × 20 × 10 mm

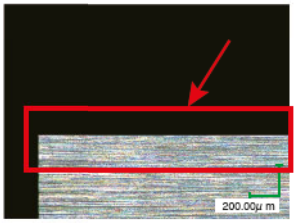
Minimized edge chipping

Work sample after finishing

Top



Side



UDCBF Series
Indexable Insert Mold
Milling Video

2 Flute High-speed Ball End Mills for Cemented Carbide and Hard Brittle Materials

Size **R0.3～R1**

UDCBH

MG UDC 0° R ±0.01 Shank Dia 0/-0.005

Patent pending | Additional 2 Models

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

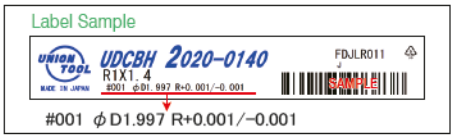
Work Material															
CARBON STEELS S45C S55C	ALLOY STEELS SK / SCM SUS	PREHARDENED STEELS NAK HPM	HARDENED STEELS ～55HRC	HARDENED STEELS ～60HRC	HARDENED STEELS ～70HRC	CAST IRON	ALUMINUM ALLOYS	GRAPHITE	COPPER	PLASTICS	GLASS FILLED PLASTICS	TITANIUM ALLOYS	HEAT RESISTANT ALLOYS	CEMENTED CARBIDE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

* Hard Brittle (Non-Metallic) Materials: Ceramics (Alumina, Zirconia, etc.), Glasses and etc.

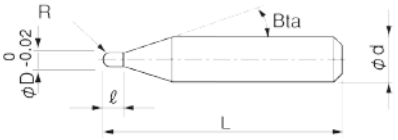
Features

High efficiency and long life Ball End Mills for milling Cemented Carbide.
High-level treatment to reduce cutting resistance and mill at a high feed rate.
Wear resistance improved drastically with optimized diamond coating.
Best for roughing and semi-finishing.

Label Sample



Diameter and Ball R 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 6 models

Unit (mm)

	Model Number	Radius of Ball Nose R	Length of Cut ℓ	Shank Taper Angle Bta	Overall Length L	Shank Diameter ø d	Price ¥
*	UDCBH 2006-0042	R0.3	0.42	16°	50	4	44,160
*	UDCBH 2007-0049	R0.35	0.49	16°	50	4	44,160
	UDCBH 2008-0056	R0.4	0.56	16°	50	4	44,160
	UDCBH 2010-0070	R0.5	0.7	16°	50	4	44,160
	UDCBH 2015-0105	R0.75	1.05	16°	50	4	44,160
	UDCBH 2020-0140	R1	1.4	16°	50	4	44,160

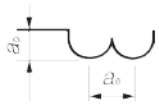
*Additional model

UDCBH Milling Conditions

WORK MATERIAL			CEMENTED CARBIDE (≧87HRA)					CEMENTED CARBIDE (<87HRA)					HARD BRITTLE MATERIALS				
Model Number	Radius of Ball Nose (mm)	Length of Cut (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	* Feed Rate 2 (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	* Feed Rate 2 (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	* Feed Rate 2 (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
2006-0042	R0.3	0.42	30,000	600	200	0.03	0.14	30,000	900	300	0.17	0.03	30,000	200	20	0.03	0.14
2007-0049	R0.35	0.49	30,000	690	230	0.035	0.17	30,000	1,050	350	0.18	0.035	30,000	225	23	0.035	0.17
2008-0056	R0.4	0.56	30,000	750	250	0.04	0.19	30,000	1,250	420	0.19	0.04	30,000	250	25	0.04	0.19
2010-0070	R0.5	0.7	30,000	900	300	0.05	0.22	25,000	1,300	430	0.2	0.05	30,000	300	30	0.05	0.25
2015-0105	R0.75	1.05	30,000	1,200	400	0.075	0.27	19,000	1,450	480	0.23	0.07	24,000	400	45	0.075	0.27
2020-0140	R1	1.4	30,000	1,500	500	0.1	0.3	16,500	1,600	530	0.25	0.1	18,000	600	200	0.1	0.3

These milling parameters are based on VF-20, VM-40, VC-70, VU-70 (TAS standard) for Cemented Carbide, and Alumina for Hard Brittle Materials. These are for reference only.
Tool life may differ depending on the type of Cemented Carbide / Hard Brittle Materials.
For best result, fine parameter adjustments may be required, depending on the materials of Cemented Carbide / Hard Brittle Materials; milling shape and strategy; machine rigidity and spindle capability.

* Feed Rate2: Feed Rate of Approach and *Connection links.
*Changing from one engagement point to the next.



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

Note:
- This application requires a high cutting force. A machine with poor rigidity and high vibration is not recommended.
- Allow sufficient machine and spindle warm-up time for stability and to remove any expansion of the main spindle before running the program.
- Tool setting length should achieve the least possible overhang.
- Avoid contact with the coated area of the shank. This will prevent tip vibration and tool jamming in the collet / holder.
- Run-out and vibration should be checked dynamically at the tool point while mounted in the machine and both should achieve the lowest level possible.
- Use an inclined or helical approach (Recommended inclination angle: <5 degree).
- Decrease both spindle speed and feed rate proportionally.
- Air blow is highly recommended for longer tool life. Both oil mist and oil coolant are alternatives.
- Recommend water soluble coolant for Hard Brittle (Non-Metallic) Materials.
- When milling some work pieces, heavier chips may be created. To evacuate these chips it is important to accurately position the coolant nozzle on the milling part.
- Remove chips to prevent heat generation and ignition during milling process.
- Protective gear, such as safety glasses and face guards are required when milling.
- Chips / dust generated while milling can have adverse affects on the machine parts if they are not properly evacuated. Take steps to assure proper evacuation.
- The tool life may shorten due to a large difference between the commanded feed speed and the actual machining speed caused by factors as machining model and machining machine.
- Decrease both feed rate and feed rate 2 proportionally.
- Tool damage may progress rapidly near the end of the tool life.

2 Flute High-speed Long Neck Ball End Mills for Cemented Carbide and Hard Brittle Materials

Size **R0.3～R1**

UDCLBH

MG | UDC | 0° | R ±0.01 | Shank Dia 0/-0.005

Patent pending | New

Material Applications （☆ Highly Recommended ◎ Recommended ○ Suggested）

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

•Hard Brittle (Non-Metallic) Materials: Ceramics (Alumina, Zirconia, etc.), Glasses and etc.

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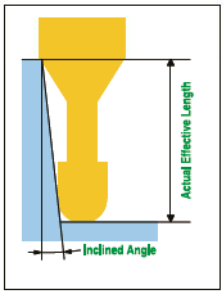
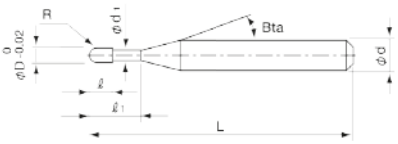
Long life Long Neck Ball End Mills for milling Cemented Carbide.
High-level treatment to reduce cutting resistance and minimize damage on cutting edge.
Wear resistance improved drastically with optimized diamond coating.
Best for roughing and semi-finishing.



Label Sample

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



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Total 22 models

Unit （mm）

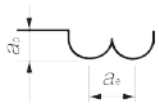
Model Number	Radius of Ball Nose R	Effective Length ℓ1	Length of Cut ℓ	Neck Diameter ød1	Shank Taper Angle Bta	Overall Length L	Shank Diameter ød	Price ¥	Effective Length by Inclined Angles 30′	1°	1°30′	2°	3°
UDCLBH 2006-0100	R0.3	1	0.42	0.575	16°	50	4	44,740	1.03	1.05	1.08	1.10	1.17
UDCLBH 2006-0150		1.5				50	4	44,740	1.54	1.58	1.63	1.67	1.78
UDCLBH 2006-0200		2				50	4	44,740	2.06	2.12	2.18	2.24	2.39
UDCLBH 2006-0300		3				50	4	44,740	3.09	3.18	3.28	3.38	3.61
UDCLBH 2007-0100	R0.35	1	0.49	0.675	16°	50	4	44,740	1.02	1.05	1.07	1.10	1.16
UDCLBH 2008-0200	R0.4	2	0.56	0.775	16°	50	4	44,740	2.05	2.11	2.17	2.23	2.37
UDCLBH 2008-0300		3				50	4	44,740	3.09	3.17	3.27	3.37	3.59
UDCLBH 2008-0400		4				50	4	44,740	4.12	4.24	4.37	4.51	4.82
UDCLBH 2010-0150	R0.5	1.5	0.7	0.975	16°	50	4	44,740	1.54	1.57	1.61	1.65	1.73
UDCLBH 2010-0200		2				50	4	44,740	2.05	2.10	2.16	2.22	2.35
UDCLBH 2010-0250		2.5				50	4	44,740	2.57	2.63	2.71	2.78	2.96
UDCLBH 2010-0300		3				50	4	44,740	3.08	3.17	3.26	3.35	3.57
UDCLBH 2010-0400		4				50	4	44,740	4.11	4.23	4.36	4.49	4.79
UDCLBH 2010-0500		5				50	4	44,740	5.15	5.30	5.46	5.63	6.02
UDCLBH 2015-0200	R0.75	2	1.05	1.455	16°	50	4	44,740	2.08	2.12	2.17	2.22	2.33
UDCLBH 2015-0400		4				50	4	44,740	4.14	4.25	4.37	4.50	4.78
UDCLBH 2015-0600		6				50	4	44,740	6.21	6.38	6.57	6.78	7.23
UDCLBH 2020-0300	R1	3	1.4	1.915	16°	50	4	44,740	3.18	3.25	3.32	3.41	3.59
UDCLBH 2020-0400		4				50	4	44,740	4.21	4.31	4.42	4.54	4.81
UDCLBH 2020-0600		6				50	4	44,740	6.27	6.44	6.62	6.82	7.26
UDCLBH 2020-0800		8				50	4	44,740	8.33	8.57	8.83	9.10	9.71
UDCLBH 2020-1000		10				50	4	44,740	10.39	10.70	11.03	11.38	12.15

UDCLBH Milling Conditions

WORK MATERIAL			CEMENTED CARBIDE (≧87HRA)					CEMENTED CARBIDE (<87HRA)					HARD BRITTLE MATERIALS				
Model Number	Radius of Ball Nose (mm)	Effective Length (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	* Feed Rate 2 (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	* Feed Rate 2 (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	* Feed Rate 2 (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
2006-0100	R0.3	1	30,000	600	200	0.03	0.14	30,000	450	150	0.17	0.03	30,000	200	20	0.03	0.14
2006-0150		1.5	30,000	600	200	0.03	0.14	30,000	300	100	0.14	0.025	30,000	200	20	0.03	0.14
2006-0200		2	30,000	300	100	0.022	0.11	30,000	220	70	0.11	0.02	30,000	150	15	0.02	0.11
2006-0300		3	30,000	75	10	0.01	0.08	30,000	75	10	0.08	0.01	30,000	75	10	0.01	0.08
2007-0100	R0.35	1	30,000	690	230	0.035	0.17	30,000	525	260	0.18	0.035	30,000	225	23	0.035	0.17
2008-0200	R0.4	2	30,000	750	250	0.04	0.19	27,000	480	240	0.19	0.04	30,000	250	25	0.04	0.19
2008-0300		3	30,000	350	100	0.037	0.17	25,500	300	100	0.17	0.035	30,000	230	23	0.037	0.17
2008-0400		4	26,000	210	70	0.035	0.16	24,000	210	21	0.16	0.035	30,000	210	21	0.035	0.16
2010-0150	R0.5	1.5	30,000	900	300	0.05	0.22	25,000	650	325	0.2	0.05	30,000	300	30	0.05	0.25
2010-0200		2	30,000	900	300	0.05	0.22	24,000	580	290	0.2	0.05	30,000	300	30	0.05	0.25
2010-0250		2.5	30,000	800	300	0.05	0.22	23,500	520	260	0.2	0.05	30,000	300	30	0.05	0.25
2010-0300		3	30,000	600	200	0.05	0.22	23,000	450	220	0.2	0.05	30,000	300	30	0.05	0.25
2010-0400		4	30,000	400	100	0.05	0.22	21,000	320	160	0.2	0.05	30,000	300	30	0.05	0.25
2010-0500		5	27,000	270	100	0.045	0.2	20,000	250	125	0.2	0.05	27,000	270	30	0.045	0.2
2015-0200	R0.75	2	30,000	1,200	400	0.075	0.27	19,000	750	375	0.23	0.07	24,000	400	45	0.075	0.27
2015-0400		4	30,000	900	250	0.075	0.27	18,000	580	290	0.23	0.07	24,000	350	40	0.075	0.27
2015-0600		6	25,000	500	100	0.075	0.27	17,000	400	200	0.23	0.07	24,000	320	36	0.075	0.27
2020-0300	R1	3	30,000	1,500	500	0.1	0.3	16,500	800	400	0.25	0.1	18,000	600	200	0.1	0.3
2020-0400		4	30,000	1,500	500	0.1	0.3	15,750	750	375	0.25	0.1	18,000	500	160	0.1	0.3
2020-0600		6	20,000	850	280	0.1	0.3	15,000	620	310	0.25	0.1	18,000	400	130	0.1	0.3
2020-0800		8	13,000	400	130	0.1	0.3	14,000	520	260	0.25	0.1	18,000	350	120	0.1	0.3
2020-1000		10	10,000	200	60	0.1	0.3	13,000	420	210	0.25	0.1	18,000	300	100	0.1	0.3

These milling parameters are based on VF-20, VM-40, VC-70, VU-70 (TAS standard) for Cemented Carbide, and Alumina for Hard Brittle Materials. These are for reference only.
Tool life may differ depending on the type of Cemented Carbide / Hard Brittle Materials.
For best result, fine parameter adjustments may be required, depending on the materials of Cemented Carbide / Hard Brittle Materials; milling shape and strategy; machine rigidity and spindle capability.

*Feed Rate2: Feed Rate of Approach and *Connection links.
*Changing from one engagement point to the next.



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

Note:
- This application requires a high cutting force. A machine with poor rigidity and high vibration is not recommended.
- Allow sufficient machine and spindle warm-up time for stability and to remove any expansion of the main spindle before running the program.
- Tool setting length should achieve the least possible overhang.
- Avoid contact with the coated area of the shank. This will prevent tip vibration and tool jamming in the collet / holder.
- Run-out and vibration should be checked dynamically at the tool point while mounted in the machine and both should achieve the lowest level possible.
- Use an inclined or helical approach (Recommended inclination angle: <5 degree).
- Decrease both spindle speed and feed rate proportionally.
- Air blow is highly recommended for longer tool life. Both oil mist and oil coolant are alternatives.
- Recommend water soluble coolant for Hard Brittle (Non-Metallic) Materials.
- When milling some work pieces, heavier chips may be created. To evacuate these chips it is important to accurately position the coolant nozzle on the milling part.
- Remove chips to prevent heat generation and ignition during milling process.
- Protective gear, such as safety glasses and face guards are required when milling.
- Chips / dust generated while milling can have adverse affects on the machine parts if they are not properly evacuated. Take steps to assure proper evacuation.
- The tool life may shorten due to a large difference between the commanded feed speed and the actual machining speed caused by factors as machining model and machining machine.
- Decrease both feed rate and feed rate 2 proportionally.
- Tool damage may progress rapidly near the end of the tool life.

Size **R0.1～R3**

UDCBF

MG UDC 0° R ±0.01 Shank Dia 0/-0.005

Patented in Japan

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

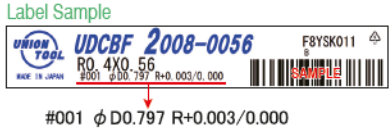
Work Material														
CARBON STEELS S45C S55C	ALLOY STEELS SK / SCM SUS	PREHARDENED STEELS NAK HPM	HARDENED STEELS ~ 55HRC	HARDENED STEELS ~ 60HRC	HARDENED STEELS ~ 70HRC	CAST IRON	ALUMINUM ALLOYS	GRAPHITE	COPPER	PLASTICS	GLASS FILLED PLASTICS	TITANIUM ALLOYS	HEAT RESISTANT ALLOYS	CEMENTED CARBIDE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

* Hard Brittle (Non-Metallic) Materials: Ceramics (Alumina, Zirconia, etc.), Glasses and etc.

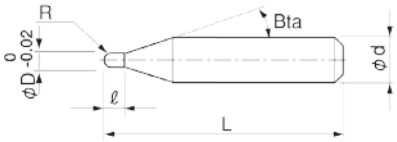
Features

Ball End Mills for milling Cemented Carbide and Hard Brittle (Non-Metallic) Materials. Upgraded version of UDCB.
Improved tool geometry and diamond coating greatly increase material removal volume.
Chip pocket designed on tool tip improves the surface finishing quality.
Special cutting edge treatment helps to avoid the edge chipping & level gap.
Recommended to use on semi-roughing & finishing process.

Label Sample



Diameter and Dall R 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 16 models

Unit (mm)

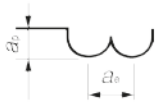
Model Number	Radius of Ball Nose R	Length of Cut ℓ	Shank Taper Angle Bta	Overall Length L	Shank Diameter ød	Price ¥
UDCBF 2002-0014	R0.1	0.14	16°	50	4	47,000
UDCBF 2003-0021	R0.15	0.21	16°	50	4	47,000
UDCBF 2004-0028	R0.2	0.28	16°	50	4	42,800
UDCBF 2005-0035	R0.25	0.35	16°	50	4	42,800
UDCBF 2006-0042	R0.3	0.42	16°	50	4	38,400
UDCBF 2007-0049	R0.35	0.49	16°	50	4	38,400
UDCBF 2008-0056	R0.4	0.56	16°	50	4	38,400
UDCBF 2009-0063	R0.45	0.63	16°	50	4	38,400
UDCBF 2010-0070	R0.5	0.7	16°	50	4	38,400
UDCBF 2012-0084	R0.6	0.84	16°	50	4	38,400
UDCBF 2015-0105	R0.75	1.05	16°	50	4	38,400
UDCBF 2020-0140	R1	1.4	16°	50	4	38,400
UDCBF 2030-0210	R1.5	2.1	16°	60	6	42,300
UDCBF 2040-0280	R2	2.8	16°	60	6	42,300
UDCBF 2050-0350	R2.5	3.5	16°	60	6	42,300
UDCBF 2060-0420	R3	4.2	⊠	60	6	42,300

UDCBF Milling Conditions

WORK MATERIAL			CEMENTED CARBIDE (≧87HRA) / HARD BRITTLE MATERIALS					CEMENTED CARBIDE (<87HRA)				
Model Number	Radius of Ball Nose (mm)	Length of Cut (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	* Feed Rate 2 (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	* Feed Rate 2 (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
2002-0014	**R0.1**	0.14	30,000	100	10	0.01	0.01	30,000	100	10	0.01	0.01
2003-0021	**R0.15**	0.21	30,000	125	13	0.015	0.03	30,000	125	13	0.015	0.03
2004-0028	**R0.2**	0.28	30,000	150	15	0.02	0.08	30,000	150	15	0.02	0.08
2005-0035	**R0.25**	0.35	30,000	175	18	0.025	0.11	30,000	175	18	0.025	0.11
2006-0042	**R0.3**	0.42	30,000	200	20	0.03	0.14	30,000	200	20	0.03	0.14
2007-0049	**R0.35**	0.49	30,000	225	23	0.035	0.17	30,000	225	23	0.035	0.17
2008-0056	**R0.4**	0.56	30,000	250	25	0.04	0.19	30,000	250	25	0.04	0.19
2009-0063	**R0.45**	0.63	30,000	275	28	0.045	0.22	30,000	275	28	0.045	0.22
2010-0070	**R0.5**	0.7	30,000	300	30	0.05	0.25	30,000	300	150	0.35	0.075
2012-0084	**R0.6**	0.84	27,500	275	36	0.06	0.26	25,000	250	125	0.42	0.09
2015-0105	**R0.75**	1.05	25,000	250	45	0.075	0.27	19,000	190	95	0.525	0.12
2020-0140	**R1**	1.4	20,000	200	60	0.1	0.3	12,500	125	60	0.7	0.15
2030-0210	**R1.5**	2.1	20,000	200	100	0.15	0.3	9,000	280	140	0.38	0.15
2040-0280	**R2**	2.8	18,000	180	90	0.175	0.32	7,200	280	140	0.5	0.2
2050-0350	**R2.5**	3.5	16,000	160	80	0.225	0.31	6,000	330	170	0.6	0.25
2060-0420	**R3**	4.2	15,000	150	75	0.3	0.3	5,500	280	140	0.65	0.28

These milling parameters are based on VF-20, VM-40, VC-70, VU-70 (TAS standard) for Cemented Carbide, and Alumina for Hard Brittle Materials. These are for reference only.
Tool life may differ depending on the type of Cemented Carbide / Hard Brittle Materials.
For best result, fine parameter adjustments may be required, depending on the materials of Cemented Carbide / Hard Brittle Materials; milling shape and strategy; machine rigidity and spindle capability.

* Feed Rate2: Feed Rate of Approach and *Connection links.
*Changing from one engagement point to the next.



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

Note:
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- Decrease both spindle speed and feed rate proportionally.
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Size **R0.1～R3**

UDCLBF

MG | UDC | 0° | R ±0.01 | Shank Dia 0/-0.005

Patented in Japan

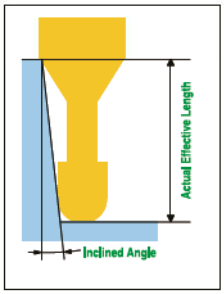
Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

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

* Hard Brittle (Non-Metallic) Materials: Ceramics (Alumina, Zirconia, etc.), Glasses and etc.

Features

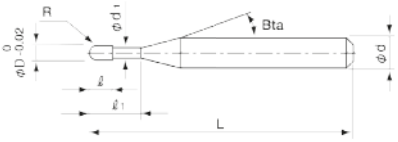
Long Neck Ball End Mills for milling Cemented Carbide and Hard Brittle (Non-Metallic) Materials. Upgraded version of UDCLB.
Improved tool geometry and diamond coating greatly increase material removal volume.
Chip pocket designed on tool tip improves the surface finishing quality.
Special cutting edge treatment helps to avoid the edge chipping & level gap.
Recommended to use on semi-roughing & finishing process.



Label Sample

#001 ϕD0.389 R0.000/−0.004

Diameter and Ball R 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 61 models

Unit (mm)

Model Number	Radius of Ball Nose R	Effective Length ℓ1	Length of Cut ℓ	Neck Diameter ød1	Shank Taper Angle Bta	Overall Length L	Shank Diameter ød	Price ¥	Effective Length by Inclined Angles 30'	1°	1°30'	2°	3°
UDCLBF 2002-0030	R0.1	0.3	0.14	0.18	16°	50	4	47,500	0.30	0.31	0.32	0.32	0.34
UDCLBF 2002-0050		0.5				50	4	47,500	0.51	0.52	0.54	0.55	0.59
UDCLBF 2002-0075		0.75				50	4	47,500	0.77	0.79	0.81	0.84	0.89
UDCLBF 2002-0100		1				50	4	47,500	1.02	1.05	1.09	1.12	1.20
UDCLBF 2003-0050	R0.15	0.5	0.21	0.28	16°	50	4	47,500	0.51	0.52	0.53	0.55	0.58
UDCLBF 2003-0075		0.75				50	4	47,500	0.76	0.78	0.81	0.83	0.88
UDCLBF 2003-0100		1				50	4	47,500	1.02	1.05	1.08	1.11	1.19
UDCLBF 2004-0050	R0.2	0.5	0.28	0.36	16°	50	4	43,300	0.54	0.55	0.56	0.58	0.61
UDCLBF 2004-0100		1				50	4	43,300	1.06	1.08	1.12	1.15	1.22
UDCLBF 2004-0150		1.5				50	4	43,300	1.57	1.62	1.67	1.72	1.83
UDCLBF 2004-0200		2				50	4	43,300	2.09	2.15	2.22	2.29	2.44
UDCLBF 2004-0250		2.5				50	4	43,300	2.60	2.68	2.77	2.86	3.06
UDCLBF 2006-0100	R0.3	1	0.42	0.56	16°	50	4	38,900	1.05	1.08	1.11	1.13	1.20
UDCLBF 2006-0150		1.5				50	4	38,900	1.57	1.61	1.66	1.70	1.81
UDCLBF 2006-0200		2				50	4	38,900	2.08	2.14	2.21	2.27	2.42
UDCLBF 2006-0300		3				50	4	38,900	3.12	3.21	3.31	3.41	3.65
UDCLBF 2006-0400		4				50	4	38,900	4.15	4.27	4.41	4.55	4.87
UDCLBF 2006-0500		5				50	4	38,900	5.18	5.34	5.51	5.69	6.09
UDCLBF 2006-0600		6				50	4	38,900	6.21	6.40	6.61	6.83	7.32

2 Flute High-grade Long Neck Ball End Mills for Cemented Carbide and Hard Brittle Materials

Model Number	Radius of Ball Nose R	Effective Length ℓ_1	Length of Cut ℓ	Neck Diameter ød_1	Shank Taper Angle Bta	Overall Length L	Shank Diameter ø d	Price ¥	Effective Length by Inclined Angles				
									30′	1°	1°30′	2°	3°
UDCLBF 2008-0200	R0.4	2	0.56	0.76	16°	50	4	38,900	2.08	2.14	2.20	2.26	2.40
UDCLBF 2008-0300		3				50	4	38,900	3.11	3.20	3.30	3.40	3.62
UDCLBF 2008-0400		4				50	4	38,900	4.14	4.27	4.40	4.54	4.85
UDCLBF 2008-0500		5				50	4	38,900	5.18	5.33	5.50	5.67	6.07
UDCLBF 2008-0600		6				50	4	38,900	6.21	6.40	6.60	6.81	7.29
UDCLBF 2008-0800		8				50	4	38,900	8.27	8.53	8.80	9.09	9.74
UDCLBF 2010-0150	R0.5	1.5	0.7	0.96	16°	50	4	38,900	1.56	1.60	1.64	1.68	1.77
UDCLBF 2010-0200		2				50	4	38,900	2.08	2.13	2.19	2.25	2.38
UDCLBF 2010-0250		2.5				50	4	38,900	2.59	2.66	2.74	2.81	2.99
UDCLBF 2010-0300		3				50	4	38,900	3.11	3.20	3.29	3.38	3.60
UDCLBF 2010-0400		4				50	4	38,900	4.14	4.26	4.39	4.52	4.83
UDCLBF 2010-0600		6				50	4	38,900	6.20	6.39	6.59	6.80	7.27
UDCLBF 2010-0800		8				50	4	38,900	8.27	8.52	8.79	9.08	9.72
UDCLBF 2010-1000		10				50	4	38,900	10.33	10.65	10.99	11.35	12.17
UDCLBF 2015-0200	R0.75	2	1.05	1.44	16°	50	4	38,900	2.11	2.15	2.20	2.25	2.37
UDCLBF 2015-0400		4				50	4	38,900	4.17	4.28	4.40	4.53	4.81
UDCLBF 2015-0600		6				50	4	38,900	6.23	6.41	6.60	6.81	7.26
UDCLBF 2015-0800		8				50	4	38,900	8.29	8.54	8.80	9.08	9.71
UDCLBF 2015-1000		10				50	4	38,900	10.36	10.67	11.00	11.36	12.16
UDCLBF 2015-1200		12				50	4	38,900	12.42	12.80	13.20	13.64	14.60
UDCLBF 2020-0300	R1	3	1.4	1.9	16°	50	4	38,900	3.20	3.27	3.35	3.43	3.62
UDCLBF 2020-0400		4				50	4	38,900	4.23	4.34	4.45	4.57	4.84
UDCLBF 2020-0600		6				50	4	38,900	6.30	6.47	6.65	6.85	7.29
UDCLBF 2020-0800		8				50	4	38,900	8.36	8.60	8.85	9.13	9.74
UDCLBF 2020-1000		10				50	4	38,900	10.42	10.73	11.06	11.41	12.19
UDCLBF 2020-1200		12				50	4	38,900	12.48	12.86	13.26	13.68	14.63
UDCLBF 2020-1400		14				50	4	38,900	14.55	14.99	15.46	15.96	17.08
UDCLBF 2020-1600		16				50	4	38,900	16.61	17.12	17.66	18.24	19.53
UDCLBF 2020-1800		18				60	4	38,900	18.67	19.25	19.86	20.52	No Interference
UDCLBF 2020-2000		20				60	4	38,900	20.74	21.38	22.06	22.79	No Interference
UDCLBF 2030-0600	R1.5	6	2.1	2.9	16°	60	6	42,800	6.28	6.44	6.60	6.78	7.18
UDCLBF 2030-0800		8				60	6	42,800	8.34	8.57	8.80	9.06	9.63
UDCLBF 2030-1000		10				60	6	42,800	10.41	10.70	11.01	11.34	12.08
UDCLBF 2030-1200		12				60	6	42,800	12.47	12.83	13.21	13.61	14.52
UDCLBF 2030-1400		14				60	6	42,800	14.53	14.96	15.41	15.89	16.97
UDCLBF 2040-0800	R2	8	2.8	3.9	16°	60	6	42,800	8.33	8.53	8.76	8.99	9.52
UDCLBF 2040-1000		10				60	6	42,800	10.39	10.66	10.96	11.27	11.97
UDCLBF 2040-1500		15				60	6	42,800	15.55	15.99	16.46	16.96	18.09
UDCLBF 2050-1000	R2.5	10	3.5	4.8	16°	60	6	42,800	10.55	10.82	11.10	11.40	12.07
UDCLBF 2050-1500		15				60	6	42,800	15.71	16.14	16.60	17.09	No Interference
UDCLBF 2060-1000	R3	10	4.2	5.7	⊠	60	6	42,800	No Interference	No Interference	No Interference	No Interference	No Interference
UDCLBF 2060-1500		15				60	6	42,800	No Interference	No Interference	No Interference	No Interference	No Interference

UDCLBF Milling Conditions

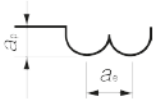
WORK MATERIAL			CEMENTED CARBIDE(≧87HRA) / HARD BRITTLE MATERIALS					CEMENTED CARBIDE(<87HRA)				
Model Number	Radius of Ball Nose (mm)	Effective Length (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	* Feed Rate 2 (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	* Feed Rate 2 (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
2002-0030	R0.1	0.3	30,000	100	10	0.01	0.01	30,000	100	10	0.01	0.01
2002-0050		0.5	30,000	30	10	0.005	0.008	30,000	30	10	0.005	0.008
2002-0075		0.75	30,000	30	10	0.005	0.006	30,000	30	10	0.005	0.006
2002-0100		1	30,000	25	10	0.005	0.005	30,000	25	10	0.005	0.005
2003-0050	R0.15	0.5	30,000	100	10	0.01	0.03	30,000	100	10	0.01	0.03
2003-0075		0.75	30,000	80	10	0.01	0.02	30,000	80	10	0.01	0.02
2003-0100		1	30,000	60	10	0.01	0.02	30,000	60	10	0.01	0.02
2004-0050	R0.2	0.5	30,000	150	15	0.02	0.08	30,000	150	15	0.02	0.08
2004-0100		1	30,000	100	10	0.015	0.07	30,000	100	10	0.015	0.07
2004-0150		1.5	30,000	60	10	0.01	0.06	30,000	60	10	0.01	0.06
2004-0200		2	30,000	30	10	0.008	0.05	30,000	30	10	0.008	0.05
2004-0250		2.5	30,000	15	10	0.006	0.03	30,000	15	10	0.006	0.03
2006-0100	R0.3	1	30,000	200	20	0.03	0.14	30,000	200	20	0.03	0.14
2006-0150		1.5	30,000	200	20	0.03	0.14	30,000	200	20	0.03	0.14
2006-0200		2	30,000	150	15	0.022	0.11	30,000	150	15	0.022	0.11
2006-0300		3	30,000	75	10	0.01	0.08	30,000	75	10	0.01	0.08
2006-0400		4	30,000	75	10	0.01	0.08	30,000	75	10	0.01	0.08
2006-0500		5	30,000	75	10	0.01	0.06	30,000	75	10	0.01	0.06
2006-0600		6	30,000	75	10	0.01	0.03	30,000	75	10	0.01	0.03
2008-0200	R0.4	2	30,000	250	25	0.04	0.19	30,000	250	25	0.04	0.19
2008-0300		3	30,000	230	23	0.037	0.17	30,000	230	23	0.037	0.17
2008-0400		4	30,000	210	21	0.035	0.16	30,000	210	21	0.035	0.16
2008-0500		5	25,000	170	20	0.03	0.12	25,000	170	20	0.03	0.12
2008-0600		6	20,000	130	20	0.025	0.08	20,000	130	20	0.025	0.08
2008-0800		8	15,000	100	20	0.015	0.03	15,000	100	20	0.015	0.03
2010-0150	R0.5	1.5	30,000	300	30	0.05	0.25	30,000	300	150	0.35	0.075
2010-0200		2	30,000	300	30	0.05	0.25	30,000	300	150	0.35	0.075
2010-0250		2.5	30,000	300	30	0.05	0.25	30,000	300	150	0.35	0.075
2010-0300		3	30,000	300	30	0.05	0.25	25,000	250	125	0.35	0.075
2010-0400		4	30,000	300	30	0.05	0.25	25,000	250	125	0.2	0.1
2010-0600		6	25,000	250	25	0.04	0.15	25,000	250	125	0.1	0.1
2010-0800		8	20,000	200	25	0.025	0.07	20,000	200	100	0.03	0.08
2010-1000		10	10,000	100	20	0.018	0.03	20,000	200	100	0.02	0.04
2015-0200	R0.75	2	25,000	250	45	0.075	0.27	18,000	180	90	0.52	0.12
2015-0400		4	25,000	250	45	0.075	0.27	18,000	180	90	0.52	0.12
2015-0600		6	25,000	250	45	0.075	0.27	18,000	180	90	0.4	0.12
2015-0800		8	20,000	160	30	0.075	0.27	18,000	180	90	0.2	0.2
2015-1000		10	20,000	130	30	0.05	0.15	18,000	180	90	0.075	0.25
2015-1200		12	16,000	100	30	0.03	0.08	13,500	135	70	0.05	0.16

UDCLBF Milling Conditions

WORK MATERIAL			CEMENTED CARBIDE (≧87HRA) / HARD BRITTLE MATERIALS					CEMENTED CARBIDE (<87HRA)				
Model Number	Radius of Ball Nose (mm)	Effective Length (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	⧈ Feed Rate 2 (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	* Feed Rate 2 (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
2020-0300	**R1**	3	20,000	200	60	0.1	0.3	12,500	125	60	0.7	0.15
2020-0400		4	20,000	200	60	0.1	0.3	12,500	125	60	0.7	0.15
2020-0600		6	20,000	200	60	0.1	0.3	12,500	125	60	0.7	0.15
2020-0800		8	20,000	200	60	0.1	0.3	12,500	125	60	0.4	0.2
2020-1000		10	20,000	200	60	0.1	0.3	12,500	125	60	0.25	0.25
2020-1200		12	20,000	200	60	0.09	0.25	12,500	125	60	0.1	0.3
2020-1400		14	20,000	200	60	0.07	0.15	12,500	125	60	0.1	0.3
2020-1600		16	13,000	130	36	0.04	0.08	12,500	125	60	0.1	0.3
2020-1800		18	10,000	100	30	0.025	0.05	10,000	100	50	0.04	0.1
2020-2000		20	10,000	100	30	0.02	0.035	10,000	100	50	0.02	0.07
2030-0600	**R1.5**	6	20,000	200	100	0.15	0.3	9,000	280	140	0.38	0.15
2030-0800		8	20,000	200	100	0.15	0.3	9,000	280	140	0.38	0.15
2030-1000		10	20,000	200	100	0.15	0.3	9,000	280	140	0.38	0.15
2030-1200		12	20,000	200	100	0.15	0.3	9,000	280	140	0.38	0.15
2030-1400		14	20,000	200	100	0.15	0.3	9,000	280	140	0.38	0.15
2040-0800	**R2**	8	18,000	180	90	0.175	0.32	7,200	280	140	0.5	0.2
2040-1000		10	18,000	180	90	0.175	0.32	7,200	280	140	0.5	0.2
2040-1500		15	18,000	180	90	0.175	0.32	7,200	280	140	0.5	0.2
2050-1000	**R2.5**	10	16,000	160	80	0.225	0.31	6,000	330	170	0.6	0.25
2050-1500		15	16,000	160	80	0.225	0.31	6,000	330	170	0.6	0.25
2060-1000	**R3**	10	15,000	150	75	0.3	0.3	5,500	280	140	0.65	0.28
2060-1500		15	15,000	150	75	0.3	0.3	5,500	280	140	0.65	0.28

These milling parameters are based on VF-20, VM-40, VC-70, VU-70 (TAS standard) for Cemented Carbide, and Alumina for Hard Brittle Materials. These are for reference only.
Tool life may differ depending on the type of Cemented Carbide / Hard Brittle Materials.
For best result, fine parameter adjustments may be required, depending on the materials of Cemented Carbide / Hard Brittle Materials; milling shape and strategy; machine rigidity and spindle capability.

Feed Rate2: Feed Rate of Approach and *Connection links.
*Changing from one engagement point to the next.



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

Note:
- This application requires a high cutting force. A machine with poor rigidity and high vibration is not recommended.
- Allow sufficient machine and spindle warm-up time for stability and to remove any expansion of the main spindle before running the program.
- Tool setting length should achieve the least possible overhang.
- Avoid contact with the coated area of the shank. This will prevent tip vibration and tool jamming in the collet / holder.
- Run-out and vibration should be checked dynamically at the tool point while mounted in the machine and both should achieve the lowest level possible.
- Use an inclined or helical approach (Recommended inclination angle: <5 degree).
- Decrease both spindle speed and feed rate proportionally.
- Air blow is highly recommended for longer tool life. Both oil mist and oil coolant are alternatives.
- Recommend water soluble coolant for Hard Brittle (Non-Metallic) Materials.
- When milling some work pieces, heavier chips may be created. To evacuate these chips it is important to accurately position the coolant nozzle on the milling part.
- Remove chips to prevent heat generation and ignition during milling process.
- Protective gear, such as safety glasses and face guards are required when milling.
- Chips / dust generated while milling can have adverse affects on the machine parts if they are not properly evacuated. Take steps to assure proper evacuation.

2 Flute Ball End Mills for Cemented Carbide and Hard Brittle Materials

Size **R0.1～R3**

UDCB

MG | UDC | 0° | R ±0.01 | Shank Dia 0/-0.005

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

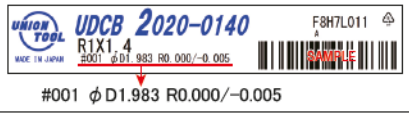
Work Material															
CARBON STEELS S45C S55C	ALLOY STEELS SK / SCM SUS	PREHARDENED STEELS NAK HPM	HARDENED STEELS ~ 55HRC	HARDENED STEELS ~ 60HRC	HARDENED STEELS ~ 70HRC	CAST IRON	ALUMINUM ALLOYS	GRAPHITE	COPPER	PLASTICS	GLASS FILLED PLASTICS	TITANIUM ALLOYS	HEAT RESISTANT ALLOYS	CEMENTED CARBIDE	HARD BRITTLE (NON-METALLIC) MATERIALS
											○ *1			☆	◎ *2

*1 DCB / DCLB series are highly recommended for Glass Filled Plastic milling.
*2 Hard Brittle (Non-Metallic) Materials: Ceramics (Alumina, Zirconia, etc.), Glasses and etc.

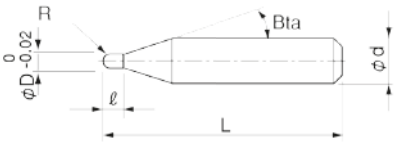
Features

Ball End Mills for milling Cemented Carbide and Hard Brittle (Non-Metallic) Materials.
New diamond coating offers excellent hardness, toughness and adhesion.
Achieve remarkable cutting depth with optimum tool geometry.
Leaves a burr and pit free surface finish on semi-roughing & finishing process.

Label Sample



Diameter and Dall R 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 14 models

Unit (mm)

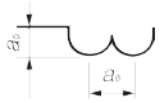
Model Number	Radius of Ball Nose R	Length of Cut ℓ	Shank Taper Angle Bta	Overall Length L	Shank Diameter φ d	Price ¥
UDCB 2002-0014	R0.1	0.14	16°	50	4	39,160
UDCB 2003-0021	R0.15	0.21	16°	50	4	39,160
UDCB 2004-0028	R0.2	0.28	16°	50	4	35,660
UDCB 2005-0035	R0.25	0.35	16°	50	4	35,660
UDCB 2006-0042	R0.3	0.42	16°	50	4	32,000
UDCB 2007-0049	R0.35	0.49	16°	50	4	32,000
UDCB 2008-0056	R0.4	0.56	16°	50	4	32,000
UDCB 2009-0063	R0.45	0.63	16°	50	4	32,000
UDCB 2010-0070	R0.5	0.7	16°	50	4	32,000
UDCB 2020-0140	R1	1.4	16°	50	4	32,000
UDCB 2030-0210	R1.5	2.1	16°	60	6	35,160
UDCB 2040-0280	R2	2.8	16°	60	6	35,160
UDCB 2050-0350	R2.5	3.5	16°	60	6	35,160
UDCB 2060-0420	R3	4.2	⊠	60	6	35,160

UDCB Milling Conditions

WORK MATERIAL			CEMENTED CARBIDE (≧87HRA)					CEMENTED CARBIDE (<87HRA)					HARD BRITTLE MATERIALS				
Model Number	Radius of Ball Nose (mm)	Length of Cut (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	* Feed Rate 2 (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	* Feed Rate 2 (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	*Feed Rate 2 (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
2002-0014	**R0.1**	0.14	30,000	100	10	0.01	0.01	30,000	100	10	0.01	0.01	30,000	100	10	0.01	0.01
2003-0021	**R0.15**	0.21	30,000	125	13	0.015	0.03	30,000	125	13	0.015	0.03	30,000	125	13	0.015	0.03
2004-0028	**R0.2**	0.28	30,000	150	15	0.02	0.08	30,000	150	15	0.02	0.08	30,000	150	15	0.02	0.08
2005-0035	**R0.25**	0.35	30,000	175	18	0.025	0.11	30,000	175	18	0.025	0.11	30,000	175	18	0.025	0.11
2006-0042	**R0.3**	0.42	30,000	200	20	0.03	0.14	30,000	200	20	0.03	0.14	30,000	200	20	0.03	0.14
2007-0049	**R0.35**	0.49	30,000	225	23	0.035	0.17	30,000	225	23	0.035	0.17	30,000	225	23	0.035	0.17
2008-0056	**R0.4**	0.56	30,000	250	25	0.04	0.19	30,000	250	25	0.04	0.19	30,000	250	25	0.04	0.19
2009-0063	**R0.45**	0.63	30,000	275	28	0.045	0.22	30,000	275	28	0.045	0.22	30,000	275	28	0.045	0.22
2010-0070	**R0.5**	0.7	30,000	300	30	0.05	0.25	20,000	400	200	0.35	0.075	30,000	300	30	0.05	0.25
2020-0140	**R1**	1.4	30,000	300	100	0.1	0.3	16,500	420	210	0.25	0.1	24,000	240	100	0.1	0.3
2030-0210	**R1.5**	2.1	27,500	275	140	0.125	0.33	11,000	280	140	0.38	0.15	24,000	240	120	0.125	0.33
2040-0280	**R2**	2.8	24,000	240	120	0.15	0.35	8,250	300	150	0.5	0.2	24,000	240	120	0.15	0.35
2050-0350	**R2.5**	3.5	22,000	220	110	0.175	0.37	6,600	330	160	0.6	0.25	22,000	220	110	0.175	0.37
2060-0420	**R3**	4.2	20,000	200	100	0.2	0.4	5,500	280	140	0.65	0.28	20,000	200	100	0.2	0.4

These milling parameters are based on VF-20, VM-40, VC-70, VU-70 (TAS standard) for Cemented Carbide, and Alumina for Hard Brittle Materials. These are for reference only.
Tool life may differ depending on the type of Cemented Carbide / Hard Brittle Materials. For best result, fine parameter adjustments may be required, depending on the materials of Cemented Carbide / Hard Brittle Materials; milling shape and strategy; machine rigidity and spindle capability.

• Feed Rate2: Feed Rate of Approach and *Connection links.
*Changing from one engagement point to the next.



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

Note:
- This application requires a high cutting force. A machine with poor rigidity and high vibration is not recommended.
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- Tool setting length should achieve the least possible overhang.
- Avoid contact with the coated area of the shank. This will prevent tip vibration and tool jamming in the collet / holder.
- Run-out and vibration should be checked dynamically at the tool point while mounted in the machine and both should achieve the lowest level possible.
- Use an inclined or helical approach (Recommended inclination angle: <5 degree).
- Decrease both spindle speed and feed rate proportionally.
- Air blow is highly recommended for longer tool life. Both oil mist and oil coolant are alternatives.
- Recommend water soluble coolant for Hard Brittle (Non-Metallic) Materials.
- When milling some work pieces, heavier chips may be created. To evacuate these chips it is important to accurately position the coolant nozzle on the milling part.
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Size **R0.1～R3**

UDCLB

MG | UDC | 0° | R ±0.01 | Shank Dia 0/-0.005

Material Applications （☆ Highly Recommended ◎ Recommended ○ Suggested）

Work Material															
CARBON STEELS S45C S55C	ALLOY STEELS SK / SCM SUS	PREHARDENED STEELS NAK HPM	HARDENED STEELS ～55HRC	HARDENED STEELS ～60HRC	HARDENED STEELS ～70HRC	CAST IRON	ALUMINUM ALLOYS	GRAPHITE	COPPER	PLASTICS	GLASS FILLED PLASTICS	TITANIUM ALLOYS	HEAT RESISTANT ALLOYS	CEMENTED CARBIDE	HARD BRITTLE (NON-METALLIC) MATERIALS
											○ *1			☆	◎ *2

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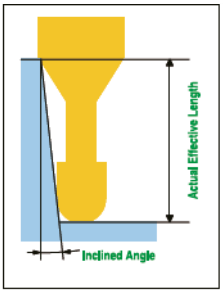
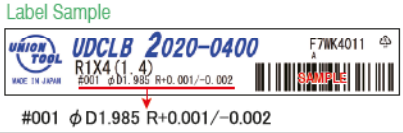
*2 Hard Brittle (Non-Metallic) Materials: Ceramics (Alumina, Zirconia, etc.), Glasses and etc.

Features

Long Neck Ball End Mills for milling Cemented Carbide and Hard Brittle (Non-Metallic) Materials.
New diamond coating offers excellent hardness, toughness and adhesion.
Achieve remarkable cutting depth with optimum tool geometry.
Leaves a burr and pit free surface finish on semi-roughing & finishing process.

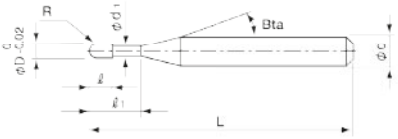


Label Sample



#001 φD1.985 R+0.001/−0.002

Diameter and Ball R 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 37 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 $\varnothing d$	Price ¥	Effective Length by Inclined Angles 30′	1°	1°30′	2°	3°
UDCLB 2002-0030	R0.1	0.3	0.14	0.18	16°	50	4	39,580	0.30	0.31	0.32	0.32	0.34
UDCLB 2002-0050		0.5				50	4	39,580	0.51	0.52	0.54	0.55	0.59
UDCLB 2002-0075		0.75				50	4	39,580	0.77	0.79	0.81	0.84	0.89
UDCLB 2002-0100		1				50	4	39,580	1.02	1.05	1.09	1.12	1.20
UDCLB 2004-0050	R0.2	0.5	0.28	0.36	16°	50	4	36,080	0.54	0.55	0.56	0.58	0.61
UDCLB 2004-0100		1				50	4	36,080	1.06	1.08	1.12	1.15	1.22
UDCLB 2004-0150		1.5				50	4	36,080	1.57	1.62	1.67	1.72	1.83
UDCLB 2004-0200		2				50	4	36,080	2.09	2.15	2.22	2.29	2.44
UDCLB 2006-0100	R0.3	1	0.42	0.56	16°	50	4	32,410	1.05	1.08	1.11	1.13	1.20
UDCLB 2006-0150		1.5				50	4	32,410	1.57	1.61	1.66	1.70	1.81
UDCLB 2006-0200		2				50	4	32,410	2.08	2.14	2.21	2.27	2.42
UDCLB 2006-0300		3				50	4	32,410	3.12	3.21	3.31	3.41	3.65
UDCLB 2008-0200	R0.4	2	0.56	0.76	16°	50	4	32,410	2.08	2.14	2.20	2.26	2.40
UDCLB 2008-0300		3				50	4	32,410	3.11	3.20	3.30	3.40	3.62
UDCLB 2008-0400		4				50	4	32,410	4.14	4.27	4.40	4.54	4.85

2 Flute Long Neck Ball End Mills for Cemented Carbide and Hard Brittle Materials

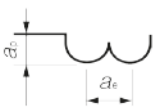
Model Number	Radius of Ball Nose R	Effective Length ℓ_1	Length of Cut ℓ	Neck Diameter $\varnothing d_1$	Shank Taper Angle Bta	Overall Length L	Shank Diameter $\varnothing d$	Price ¥	Effective Length by Inclined Angles				
									30′	1°	1°30′	2°	3°
UDCLB 2010-0200	R0.5	2	0.7	0.96	16°	50	4	32,410	2.08	2.13	2.19	2.25	2.38
UDCLB 2010-0250		2.5				50	4	32,410	2.59	2.66	2.74	2.81	2.99
UDCLB 2010-0300		3				50	4	32,410	3.11	3.20	3.29	3.38	3.60
UDCLB 2010-0400		4				50	4	32,410	4.14	4.26	4.39	4.52	4.83
UDCLB 2010-0500		5				50	4	32,410	5.17	5.32	5.49	5.66	6.05
UDCLB 2020-0300	R1	3	1.4	1.9	16°	50	4	32,410	3.20	3.27	3.35	3.43	3.62
UDCLB 2020-0400		4				50	4	32,410	4.23	4.34	4.45	4.57	4.84
UDCLB 2020-0600		6				50	4	32,410	6.30	6.47	6.65	6.85	7.29
UDCLB 2020-0800		8				50	4	32,410	8.36	8.60	8.85	9.13	9.74
UDCLB 2020-1000		10				50	4	32,410	10.42	10.73	11.06	11.41	12.19
UDCLB 2030-0600	R1.5	6	2.1	2.9	16°	60	6	35,580	6.28	6.44	6.60	6.78	7.18
UDCLB 2030-0800		8				60	6	35,580	8.34	8.57	8.80	9.06	9.63
UDCLB 2030-1000		10				60	6	35,580	10.41	10.70	11.01	11.34	12.08
UDCLB 2030-1200		12				60	6	35,580	12.47	12.83	13.21	13.61	14.52
UDCLB 2030-1400		14				60	6	35,580	14.53	14.96	15.41	15.89	16.97
UDCLB 2040-0800	R2	8	2.8	3.9	16°	60	6	35,580	8.33	8.53	8.76	8.99	9.52
UDCLB 2040-1000		10				60	6	35,580	10.39	10.66	10.96	11.27	11.97
UDCLB 2040-1500		15				60	6	35,580	15.55	15.99	16.46	16.96	18.09
UDCLB 2050-1000	R2.5	10	3.5	4.8	16°	60	6	35,580	10.55	10.82	11.10	11.40	12.07
UDCLB 2050-1500		15				60	6	35,580	15.71	16.14	16.60	17.09	No Interference
UDCLB 2060-1000	R3	10	4.2	5.7	⊠	60	6	35,580	No Interference	No Interference	No Interference	No Interference	No Interference
UDCLB 2060-1500		15				60	6	35,580	No Interference	No Interference	No Interference	No Interference	No Interference

UDCLB Milling Conditions

WORK MATERIAL			CEMENTED CARBIDE (≧87HRA)					CEMENTED CARBIDE (<87HRA)					HARD BRITTLE MATERIALS				
Model Number	Radius of Ball Nose (mm)	Effective Length (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	*Feed Rate 2 (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	* Feed Rate 2 (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	* Feed Rate 2 (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
2002-0030	R0.1	0.3	30,000	100	10	0.01	0.01	30,000	100	10	0.01	0.01	30,000	100	10	0.01	0.01
2002-0050		0.5	30,000	30	10	0.005	0.008	30,000	30	10	0.005	0.008	30,000	30	10	0.005	0.008
2002-0075		0.75	30,000	30	10	0.005	0.006	30,000	30	10	0.005	0.006	30,000	30	10	0.005	0.006
2002-0100		1	30,000	25	10	0.005	0.005	30,000	25	10	0.005	0.005	30,000	25	10	0.005	0.005
2004-0050	R0.2	0.5	30,000	150	15	0.02	0.08	30,000	150	15	0.02	0.08	30,000	150	15	0.02	0.08
2004-0100		1	30,000	100	10	0.015	0.07	30,000	100	10	0.015	0.07	30,000	100	10	0.015	0.07
2004-0150		1.5	30,000	60	10	0.01	0.06	30,000	60	10	0.01	0.06	30,000	60	10	0.01	0.06
2004-0200		2	30,000	30	10	0.008	0.05	30,000	30	10	0.008	0.05	30,000	30	10	0.008	0.05
2006-0100	R0.3	1	30,000	200	20	0.03	0.14	30,000	200	20	0.03	0.14	30,000	200	20	0.03	0.14
2006-0150		1.5	30,000	200	20	0.03	0.14	30,000	200	20	0.03	0.14	30,000	200	20	0.03	0.14
2006-0200		2	30,000	150	15	0.022	0.11	30,000	150	15	0.022	0.11	30,000	150	15	0.022	0.11
2006-0300		3	30,000	75	10	0.01	0.08	30,000	75	10	0.01	0.08	30,000	75	10	0.01	0.08
2008-0200	R0.4	2	30,000	250	25	0.04	0.19	30,000	250	25	0.04	0.19	30,000	250	25	0.04	0.19
2008-0300		3	30,000	230	23	0.037	0.17	30,000	230	23	0.037	0.17	30,000	230	23	0.037	0.17
2008-0400		4	30,000	210	21	0.035	0.16	30,000	210	21	0.035	0.16	30,000	210	21	0.035	0.16
2010-0200	R0.5	2	30,000	300	30	0.05	0.25	20,000	400	200	0.35	0.075	30,000	300	30	0.05	0.25
2010-0250		2.5	30,000	300	30	0.05	0.25	20,000	400	200	0.35	0.075	30,000	300	30	0.05	0.25
2010-0300		3	30,000	300	30	0.05	0.25	20,000	400	200	0.35	0.075	30,000	300	30	0.05	0.25
2010-0400		4	30,000	300	30	0.05	0.25	20,000	400	200	0.3	0.07	30,000	300	30	0.05	0.25
2010-0500		5	30,000	300	30	0.05	0.25	20,000	400	200	0.3	0.07	30,000	300	30	0.05	0.25
2020-0300	R1	3	30,000	300	100	0.1	0.3	16,500	420	210	0.25	0.1	24,000	240	100	0.1	0.3
2020-0400		4	30,000	300	100	0.1	0.3	16,500	420	210	0.25	0.1	24,000	240	100	0.1	0.3
2020-0600		6	30,000	300	100	0.1	0.3	16,500	420	210	0.25	0.1	24,000	240	100	0.1	0.3
2020-0800		8	30,000	300	100	0.1	0.3	16,500	420	210	0.25	0.1	24,000	240	100	0.1	0.3
2020-1000		10	30,000	300	100	0.1	0.3	16,500	420	210	0.25	0.1	24,000	240	100	0.1	0.3
2030-0600	R1.5	6	27,500	275	140	0.125	0.33	11,000	280	140	0.38	0.15	24,000	240	120	0.125	0.33
2030-0800		8	27,500	275	140	0.125	0.33	11,000	280	140	0.38	0.15	24,000	240	120	0.125	0.33
2030-1000		10	27,500	275	140	0.125	0.33	11,000	280	140	0.3	0.15	24,000	240	120	0.125	0.33
2030-1200		12	27,500	220	110	0.125	0.33	11,000	280	140	0.3	0.15	24,000	200	100	0.125	0.33
2030-1400		14	27,500	220	110	0.125	0.33	11,000	280	140	0.3	0.15	24,000	200	100	0.125	0.33
2040-0800	R2	8	24,000	240	120	0.15	0.35	8,250	300	150	0.5	0.2	24,000	240	120	0.15	0.35
2040-1000		10	24,000	240	120	0.15	0.35	8,250	300	150	0.5	0.2	24,000	240	120	0.15	0.35
2040-1500		15	24,000	240	120	0.15	0.35	8,250	300	150	0.5	0.2	24,000	240	120	0.15	0.35
2050-1000	R2.5	10	22,000	220	110	0.175	0.37	6,600	330	160	0.6	0.25	22,000	220	110	0.175	0.37
2050-1500		15	22,000	220	110	0.175	0.37	6,600	330	160	0.6	0.25	22,000	220	110	0.175	0.37
2060-1000	R3	10	20,000	200	100	0.2	0.4	5,500	280	140	0.65	0.28	20,000	200	100	0.2	0.4
2060-1500		15	20,000	200	100	0.2	0.4	5,500	280	140	0.65	0.28	20,000	200	100	0.2	0.4

These milling parameters are based on VF-20, VM-40, VC-70, VU-70 (TAS standard) for Cemented Carbide, and Alumina for Hard Brittle Materials. These are for reference only. Tool life may differ depending on the type of Cemented Carbide / Hard Brittle Materials. For best result, fine parameter adjustments may be required, depending on the materials of Cemented Carbide / Hard Brittle Materials; milling shape and strategy; machine rigidity and spindle capability.

* Feed Rate2: Feed Rate of Approach and *Connection links.
*Changing from one engagement point to the next.



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

UDCLB Note

Note:

- This application requires a high cutting force. A machine with poor rigidity and high vibration is not recommended.
- Allow sufficient machine and spindle warm-up time for stability and to remove any expansion of the main spindle before running the program.
- Tool setting length should achieve the least possible overhang.
- Avoid contact with the coated area of the shank. This will prevent tip vibration and tool jamming in the collet / holder.
- Run-out and vibration should be checked dynamically at the tool point while mounted in the machine and both should achieve the lowest level possible.
- Use an inclined or helical approach (Recommended inclination angle: <5 degree).
- Decrease both spindle speed and feed rate proportionally.
- Air blow is highly recommended for longer tool life. Both oil mist and oil coolant are alternatives.
- Recommend water soluble coolant for Hard Brittle (Non-Metallic) Materials.
- When milling some work pieces, heavier chips may be created. To evacuate these chips it is important to accurately position the coolant nozzle on the milling part.
- Remove chips to prevent heat generation and ignition during milling process.
- Protective gear, such as safety glasses and face guards are required when milling.
- Chips / dust generated while milling can have adverse affects on the machine parts if they are not properly evacuated. Take steps to assure proper evacuation.

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.

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