UNION TOOL

Tungsten Carbide End Mills
UNIMAX Series

For Cemented Carbide and Hard Brittle Materials

Vol.12
Published April 2021

2 Flutes　Diamond Coated UDC Series

UDC

Total 6 Models	**UDCBH**	High-speed Ball End Mills
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
Add 6 Total 58 Models	**UDCLRSF**	High-grade Long Neck Radius End Mills
Total 14 Models	**UDCB**	Ball End Mills
Total 37 Models	**UDCLB**	Long Neck Ball End Mills
Total 30 Models	**UDCLRS**	Long Neck Radius End Mills
Total 35 Models	**UDCMX**	Drills
Total 10 Models	**UDCT**	Thread Mills

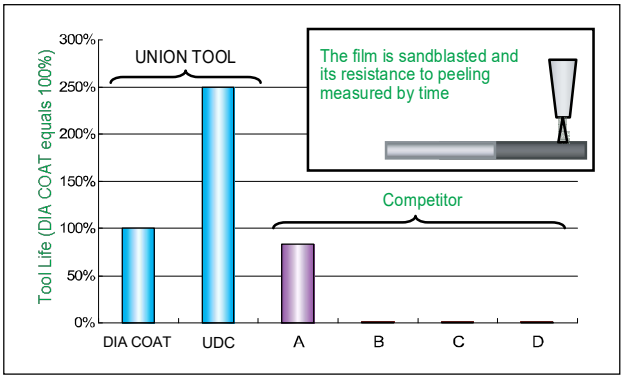
UNION TOOL CO.

Coating Patented in Japan

Optimized diamond coating for Cemented Carbide and Hard Brittle Materials

Special high-performance Diamond film.
New Diamond coating developed to improve hardness and durability, with outstanding adhesion to the cutting tool.

Sandblasting tests the film adhesion and wear resistance

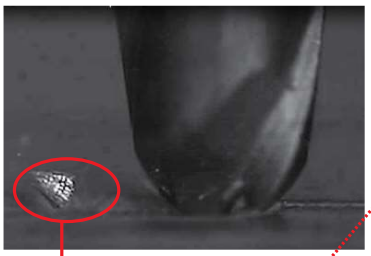


UNION TOOL's Diamond film that coated using the hot filament CVD method is developed to improve hardness and durability, with outstanding adhesion to the cutting tool. Using fine particle composition control, the UDC coating has dramatically improved hardness and durability.

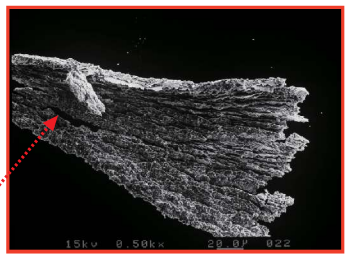
Direct Milling of Cemented Carbide - No Grinding!

The normal expectation when milling Cemented Carbide would be a powdered swarf….

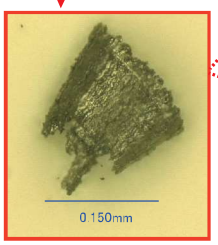
By using a deep cut into the Cemented Carbide, UDCB creates a “fan shaped” chip, just like cutting steel!



UDCB chip evacuation



(a) Inside view of a curled chip (surface side)



Chip size

“Fan-shaped” chip created

(b) Outside view (tool / rake side)

UDCB R0.5 Ball End Mill

Tool	UDCB 2010-0070 (R0.5×0.7)
Spindle Speed	30,000 min^{-1}
Feed Rate	300 mm/min
Axial Depth	0.1 mm
Coolant	Air Blow
Work Material	VM-40 (90HRA)

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; New! UDCLBH	UDCBF; UDCLBF	UDCB; UDCLB
Radius	UDCLRSF	UDCLRS

The long-awaited 3rd generation UDC!

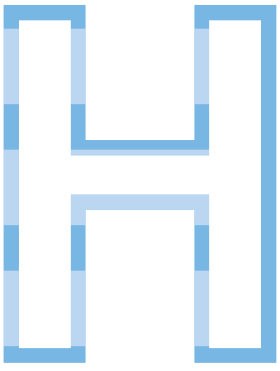
UDC-H

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

Cemented Carbide Lens shaped milling Comparison of efficiency and material removal volume with UDCBH / UDCBF R1 x Length of Cut 1.4

VM-40（90 HRA）

UDCBH

7.5
7.5 times the efficiency

4
Over 4 times the removal volume

Work Size : 50 x 50 x 10 mm

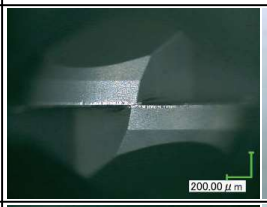
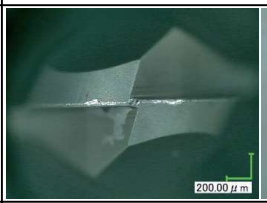
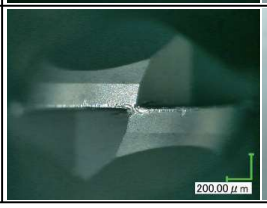
Pocket Size : Top ø 10 x Depth 3.5 mm

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

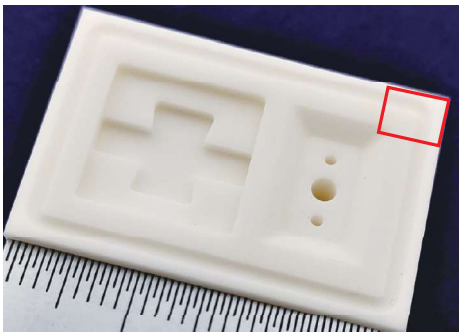
Tool	UDCBH	UDCBF
Milling Conditions		
Spindle Speed	30,000 min^{-1}	20,000 min^{-1}
Feed Rate	1,500 mm/min	200 mm/min
Axial Depth a_p	0.1 mm	
Radial Depth a_e	0.3 mm	
Milling Results		
1 side 16 pockets	1 Tool Milling time 76 min	4 Tool Milling time 7 h 28 min
Tool after milling 4 pockets		
Tool after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

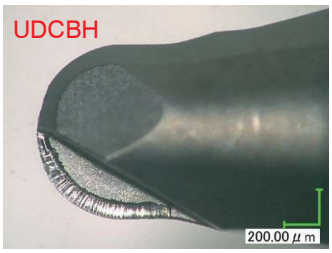
Zirconia ZrO_2 (94%)

Alumina Al_2O_3 (99.5%)

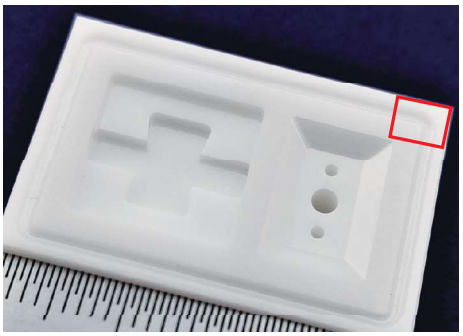


Work Size : 30 x 20 x 10 mm

Coolant : Water Soluble

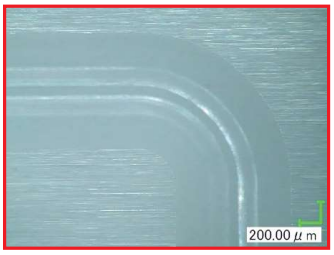


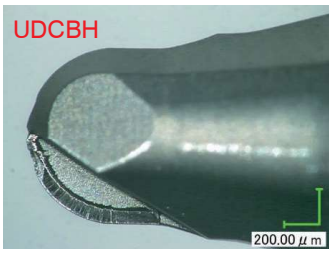
Zirconia ZrO_2 (94%)



Work Size : 30 x 20 x 10 mm

Coolant : Water Soluble



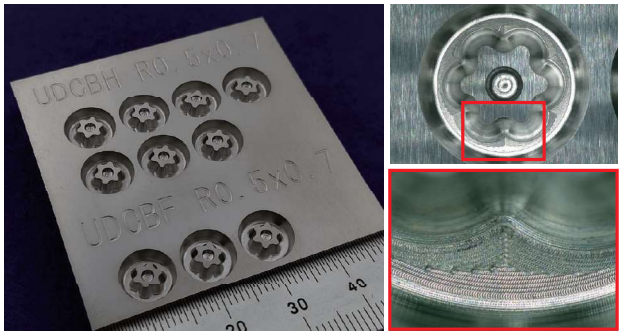


No	Process	Tool	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Allowance (mm)	Cycle Time
1	Slotting and inclined pocket roughing	UDCBH 2010-0070 (R0.5 × Length of Cut 0.7)	30,000	300	0.05	0.25	0.01/0.03	0:36:29
2	Slot finishing						0	0:19:17
3	2-stage pocket roughing	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

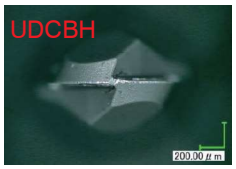
Cemented Carbide Hexalobular Comparison of efficiency and material removal volume with UDCBH / UDCBF R0.5 x Length of Cut 0.7

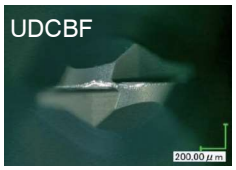
VM-40 (90 HRA)



Model Size : Ø9 x 2.2 mm 91 mm ^{3} / pc
Coolant : Air Blow

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





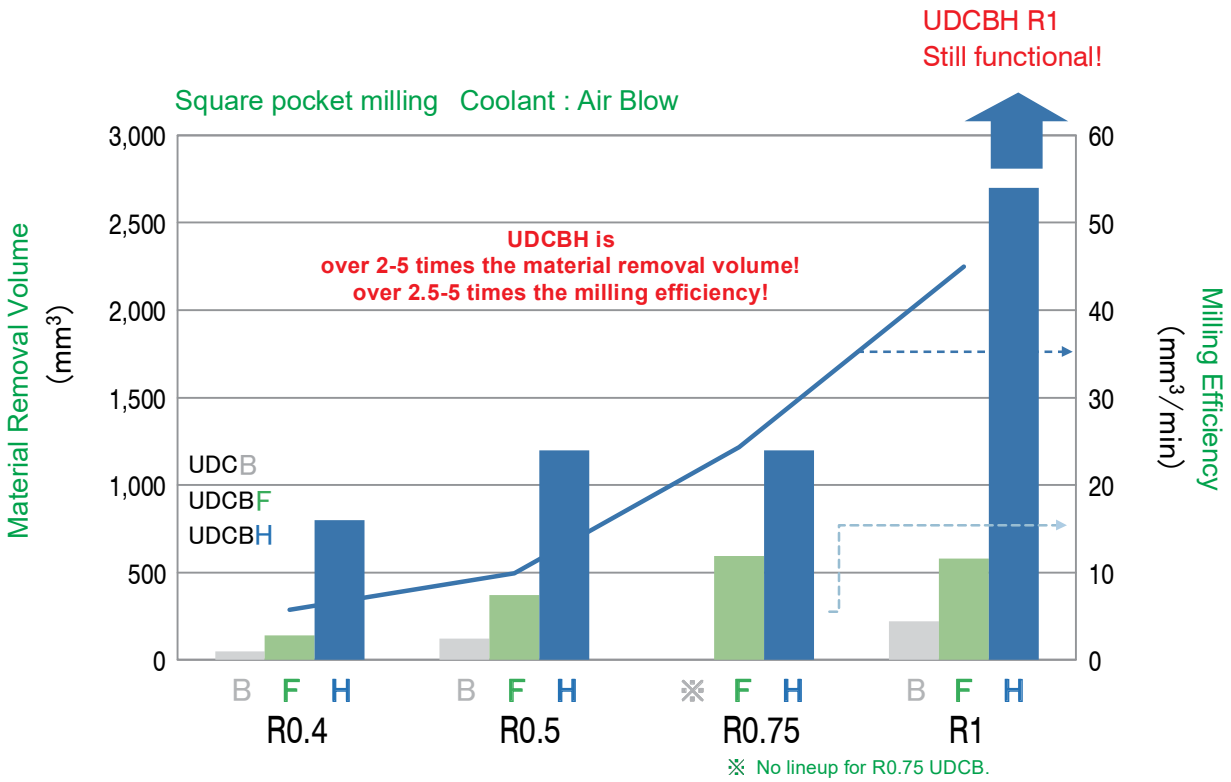
Tool damage at the time of machining 3 pieces

Tool	UDCBF		UDCBH	
Model	Hexalobular	Character engraving	Hexalobular	Character engraving
Cycle Time / pc	38 min 21 sec	1 min 56 sec	11 min 50 sec	38 sec
Number of processed pieces / pc	3	–	7	–
Material Removal Volume	273 mm^3	–	637 mm^3	–
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	–

Efficiency x 3.2
Tool life x 2.3

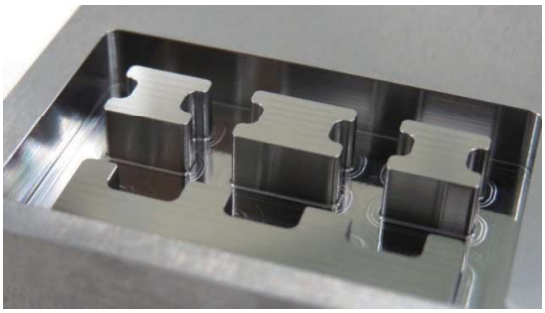
Cemented Carbide Comparison of efficiency and material removal volume in roughing with UDCB / UDCBF / UDCBH

VM-40 (90HRA)



Cemented Carbide Connector shaped milling with UDCLBH R1 x Effective Length 4

VM-40 (90HRA)

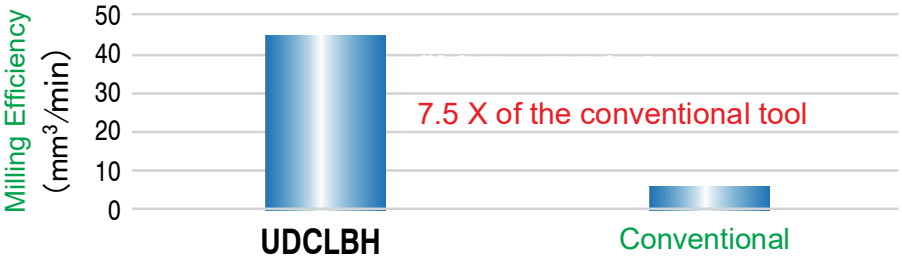


Model Size : 26 x 16 x 4 mm

Pocket Volume : 1,304 mm^3

Coolant : Air Blow

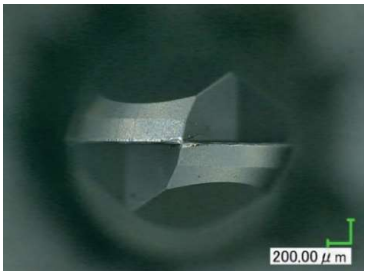
R1 × Effective Length 4 Comparison of milling efficiency

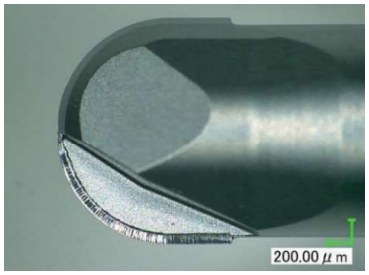


Milling Efficiency

$= \text{Feed Rate} \times a_p \times a_e$

Tool after milling





Less tool damage even with highly efficient milling!

No	Process	Tool No.	Tool	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Allowance (mm)	Cycle Time
1	Roughing	T1	UDCLBH 2020-0400 (R1 x Effective Length 4)	30,000	1,500	0.1	0.3	0.03	0:24:52
2	Corner Removal 1	T2	UDCLBH 2010-0400 (R0.5 x Effective Length 4)	30,000	400	0.05	0.11	0.03	0:33:12
3	Corner Removal 2	T3	UDCLRSF 2010-005040 (Ø 1 x CR0.05 x Effective Length 4)	30,000	190	0.02	0.6	0.03	0:15:23
4	Top surface/ Semi-finishing			30,000	190	—	0.6	0.01	0:03:11
5	Wall surface / Semi-finishing	T2	UDCLBH 2010-0400 (R0.5 x Effective Length 4)	30,000	400	0.05	0.22	0.01	0:38:22
6	Corner & Bottom surface/ Semi-finishing	T3	UDCLRSF 2010-005040 (Ø 1 x CR0.05 x Effective Length 4)	30,000	190	0.006	0.3	0.01	0:48:30
7	Top surface / Finishing	T4	UDCLRSF 2010-005040 (Ø 1 x CR0.05 x Effective Length 4)	30,000	190	—	0.6	0	0:03:15
8	Wall surface / Finishing			30,000	375	0.25	—	0	0:08:17
9	Corner & Bottom surface/ Finishing			30,000	190	0.014	0.3	0	0:46:09

Total 4pcs are used.

Total 3:41:11

UDC-F

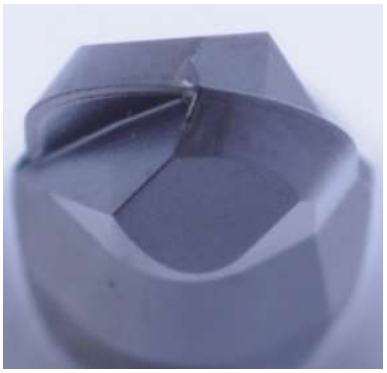
The sharpest cutting edge in the UDC series
The best choice for high quality milling surface

F (Fine) Features of F series

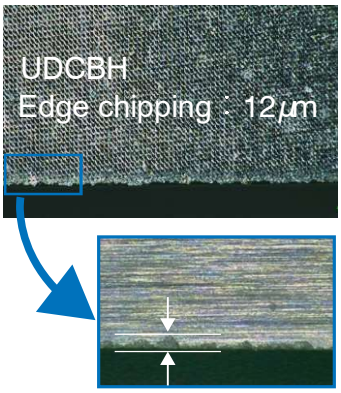
① UDC Coating — Optimized coating for F series

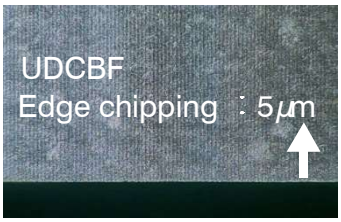
② Special treatment for a sharp edge — Minimized edge chipping and the level of the gap

③ Chip 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)**





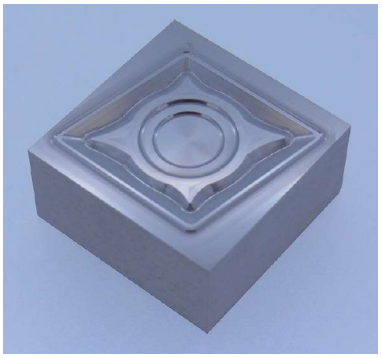
Milling direction

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.

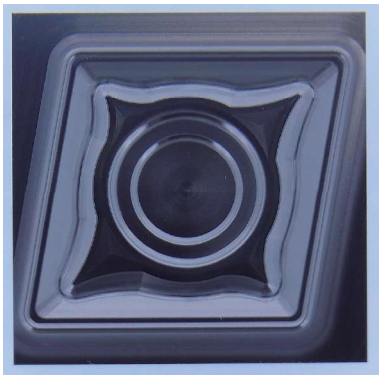
Cemented Carbide Indexable Insert Mold with UDCBF R0.5 × Length of Cut 0.7 Ball End Mill

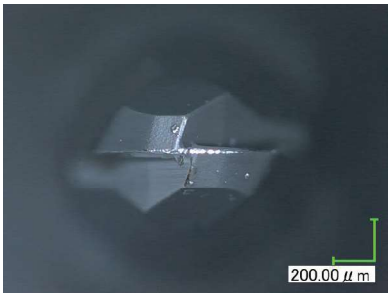
VM-40（90 HRA）



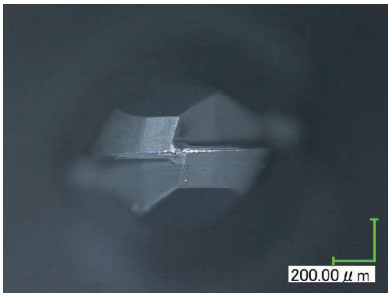
	Roughing	Finishing
Tool	UDCBF 2010-0070（R0.5×0.7）	
Spindle Speed	30,000 min^{-1}	
Feed Rate	300 mm/min	
Axial Depth a_p	0.05 mm	0.028 mm
Radial Depth a_e	0.25 mm	0.02 mm
Coolant	Air Blow	
Cycle Time	43 min	2 h 17 min
Material Removal Volume	86.3 mm^3	12.0 mm^3

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





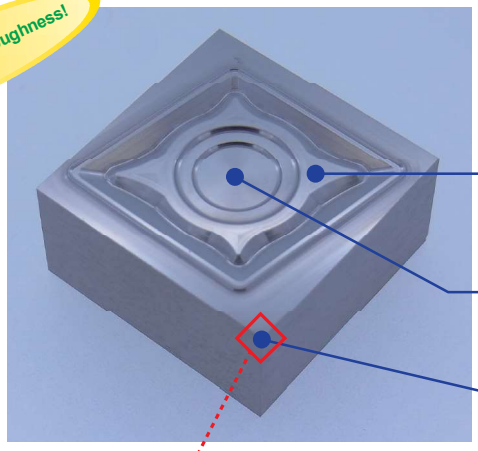
Tool after roughing



Tool after finishing

■ Surface Roughness

Excellent surface roughness!



Ra: 0.051μm
Rz: 0.399μm

Ra: 0.068μm
Rz: 0.520μm

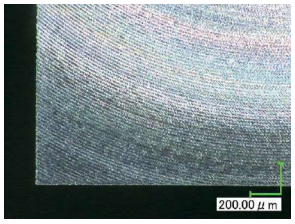
Ra: 0.054μm
Rz: 0.408μm

Size：20 × 20 × 10 mm

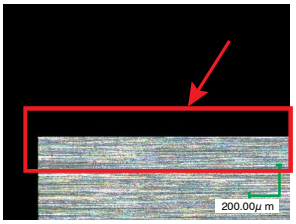
Minimized edge chipping

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

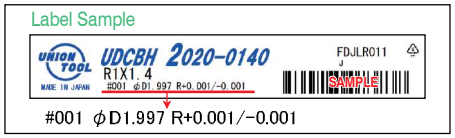
Material Applications （☆ Highly Recommended ◎ Recommended ○ Suggested）

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

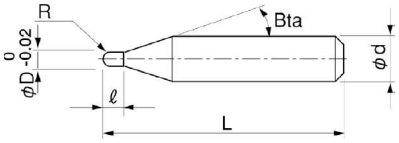
* Hard Brittle (Non-Metallic) Materials: Ceramics (Alumina, Zirconia, etc.), Glasses and etc.

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.



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）

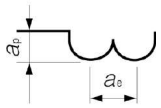
Model Number	Radius of Ball Nose R	Length of Cut ℓ	Shank Taper Angle Bta	Overall Length L	Shank Diameter ø d	Price ¥
UDCBH 2006-0042	R0.3	0.42	16°	50	4	44,160
UDCBH 2007-0049	R0.35	0.49	16°	50	4	44,160
UDCBH 2008-0056	R0.4	0.56	16°	50	4	44,160
UDCBH 2010-0070	R0.5	0.7	16°	50	4	44,160
UDCBH 2015-0105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

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

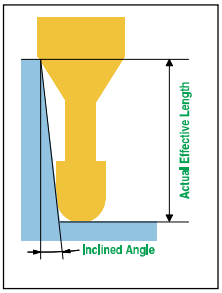
Material Applications （☆ Highly Recommended ◎ Recommended ○ Suggested）

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

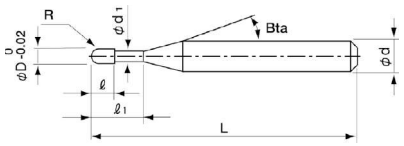
Long life Long Neck Ball End Mills for milling Cemented Carbide.
High-level treatment to reduce cutting resistance and minimize damage on cutting edge.
Wear resistance improved drastically with optimized diamond coating.
Best for roughing and semi-finishing.



Label Sample

#001 ϕD1.989 R0.001/−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 22 models

Unit （mm）

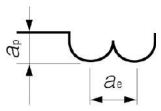
Model Number	Radius of Ball Nose R	Effective Length ℓ1	Length of Cut ℓ	Neck Diameter ød1	Shank Taper Angle Bta	Overall Length L	Shank Diameter ød	Price ¥	Effective Length by Inclined Angles 30′	1°	1°30′	2°	3°
UDCLBH 2006-0100	R0.3	1	0.42	0.575	16°	50	4	44,740	1.03	1.05	1.08	1.10	1.17
UDCLBH 2006-0150		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)

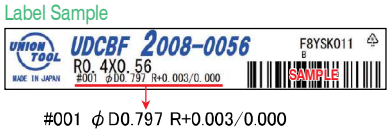
Work Material														
CARBON STEELS S45C S55C	ALLOY STEELS SK / SCM SUS	PREHARDENED STEELS NAK HPM	HARDENED STEELS ～55HRC	～60HRC	～70HRC	CAST IRON	ALUMINUM ALLOYS	GRAPHITE	COPPER	PLASTICS	GLASS FILLED PLASTICS	TITANIUM ALLOYS	HEAT RESISTANT ALLOYS	CEMENTED CARBIDE	HARD BRITTLE (NON-METALLIC) MATERIALS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

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

Features

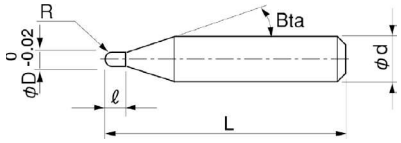
Ball End Mills for milling Cemented Carbide and Hard Brittle (Non-Metallic) Materials. Upgraded version of UDCB.
Improved tool geometry and diamond coating greatly increase material removal volume.
Chip pocket designed on tool tip improves the surface finishing quality.
Special cutting edge treatment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

Label Sample



#001 φ D0.797 R+0.003/0.000

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 16 models

Unit (mm)

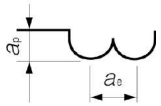
Model Number	Radius of Ball Nose R	Length of Cut ℓ	Shank Taper Angle Bta	Overall Length L	Shank Diameter ød	Price ¥
UDCBF 2002-0014	R0.1	0.14	16°	50	4	47,000
UDCBF 2003-0021	R0.15	0.21	16°	50	4	47,000
UDCBF 2004-0028	R0.2	0.28	16°	50	4	42,800
UDCBF 2005-0035	R0.25	0.35	16°	50	4	42,800
UDCBF 2006-0042	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:
- 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.
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- 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.
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- Decrease both spindle speed and feed rate proportionally.
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- 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.

Size **R0.1～R3**

UDCLBF

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

Patented in Japan

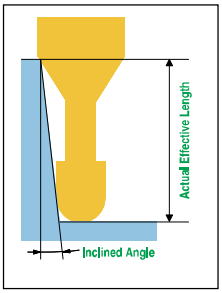
Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

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

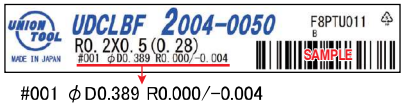
* Hard Brittle (Non-Metallic) Materials: Ceramics (Alumina, Zirconia, etc.), Glasses and etc.

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.

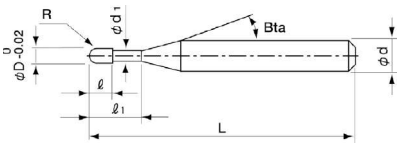


Label Sample



#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 ø d1	Shank Taper Angle Bta	Overall Length L	Shank Diameter ø d	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 ø d_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

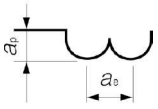
WORK MATERIAL			CEMENTED CARBIDE (≧87HRA) / HARD BRITTLE MATERIALS					CEMENTED CARBIDE (<87HRA)				
Model Number	Radius of Ball Nose (mm)	Effective Length (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	* Feed Rate 2 (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed 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 High-grade Long Neck Radius End Mills for Cemented Carbide and Hard Brittle Materials

Size Ø0.25～Ø2

UDCLRSF

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

Additional 6 Models | Patented in Japan

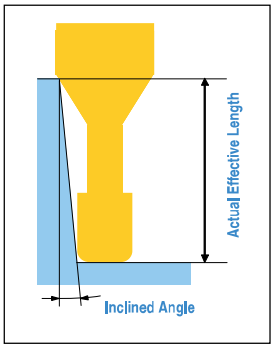
Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

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
											○			☆	◎ ※

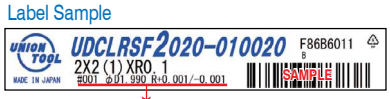
※Hard Brittle (Non-Metallic) Materials: Ceramics (Alumina, Zirconia, etc.), Glasses and etc.

Features

Long Neck Radius End Mills for milling Cemented Carbide & Hard Brittle (Non-Metallic) Materials.
Upgraded version of UDCLRS.
Achieve remarkable cutting depth and longer tool life.
Special cutting edge treatment helps to avoid the edge chipping & level gap on the work piece.
Recommended to use on semi-roughing & finishing process.

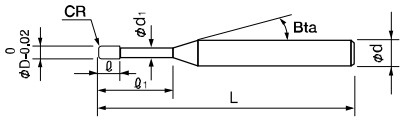


Label Sample



#001 ϕD1.990 R+0.001/−0.001

Diameter and Corner 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 58 models

Unit (mm)

	Model Number	Outside Diameter ϕD	Corner Radius CR	Effective Length ℓ1	Length of Cut ℓ	Neck Diameter ϕd1	Shank Taper Angle Bta	Overall Length L	Shank Diameter ϕd	Suggested Retail Price ¥	Effective Length by Inclined Angles 30′	1°	1°30′	2°	3°
※	UDCLRSF 20025-003X5	0.25	R0.03	0.5	0.125	0.23	16°	50	4	54,600	0.51	0.53	0.54	0.56	0.60
※	UDCLRSF 20025-003X8			0.8				50	4	54,600	0.82	0.84	0.87	0.90	0.97
※	UDCLRSF 20025-005X5		R0.05	0.5				50	4	54,600	0.51	0.52	0.54	0.56	0.60
※	UDCLRSF 20025-005X8			0.8				50	4	54,600	0.82	0.84	0.87	0.90	0.96
	UDCLRSF 2003-003006	0.3	R0.03	0.6	0.15	0.28	16°	50	4	54,600	0.61	0.63	0.65	0.67	0.72
※	UDCLRSF 2003-003009			0.9				50	4	54,600	0.92	0.95	0.98	1.02	1.09
	UDCLRSF 2003-005006		R0.05	0.6				50	4	54,600	0.61	0.63	0.65	0.67	0.72
※	UDCLRSF 2003-005009			0.9				50	4	54,600	0.92	0.95	0.98	1.01	1.09
	UDCLRSF 2005-003005	0.5	R0.03	0.5	0.25	0.46	16°	50	4	52,000	0.55	0.56	0.58	0.60	0.64
	UDCLRSF 2005-003010			1				50	4	52,000	1.06	1.10	1.13	1.17	1.25
	UDCLRSF 2005-003015			1.5				50	4	52,000	1.58	1.63	1.68	1.74	1.87
	UDCLRSF 2005-005005		R0.05	0.5				50	4	52,000	0.55	0.56	0.58	0.60	0.64
	UDCLRSF 2005-005010			1				50	4	52,000	1.06	1.09	1.13	1.17	1.25
	UDCLRSF 2005-005015			1.5				50	4	52,000	1.58	1.63	1.68	1.74	1.86

※ Additional model

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

Model Number	Outside Diameter φD	Corner Radius CR	Effective Length ℓ1	Length of Cut ℓ	Neck Diameter φd1	Shank Taper Angle Bta	Overall Length L	Shank Diameter φd	Suggested Retail Price ¥	Effective Length by Inclined Angles				
										30′	1°	1°30′	2°	3°
UDCLRSF 2008-003008	0.8	R0.03	0.8	0.4	0.76	16°	50	4	46,700	0.86	0.88	0.91	0.94	1.01
UDCLRSF 2008-003016			1.6				50	4	46,700	1.68	1.73	1.79	1.85	1.99
UDCLRSF 2008-003024			2.4				50	4	46,700	2.51	2.59	2.67	2.76	2.97
UDCLRSF 2008-005008		R0.05	0.8				50	4	46,700	0.85	0.88	0.91	0.94	1.01
UDCLRSF 2008-005016			1.6				50	4	46,700	1.68	1.73	1.79	1.85	1.98
UDCLRSF 2008-005024			2.4				50	4	46,700	2.50	2.58	2.67	2.76	2.96
UDCLRSF 2008-010008		R0.1	0.8				50	4	46,700	0.85	0.88	0.90	0.93	0.99
UDCLRSF 2008-010016			1.6				50	4	46,700	1.68	1.73	1.78	1.84	1.97
UDCLRSF 2008-010024			2.4				50	4	46,700	2.50	2.58	2.66	2.75	2.95
UDCLRSF 2010-003010	1	R0.03	1	0.5	0.96	16°	50	4	46,700	1.06	1.10	1.13	1.17	1.25
UDCLRSF 2010-003020			2				50	4	46,700	2.09	2.16	2.23	2.31	2.48
UDCLRSF 2010-003040			4				50	4	46,700	4.16	4.29	4.43	4.59	4.93
UDCLRSF 2010-003060			6				50	4	46,700	6.22	6.42	6.63	6.86	7.37
UDCLRSF 2010-005010		R0.05	1				50	4	46,700	1.06	1.09	1.13	1.17	1.25
UDCLRSF 2010-005020			2				50	4	46,700	2.09	2.16	2.23	2.31	2.47
UDCLRSF 2010-005040			4				50	4	46,700	4.15	4.29	4.43	4.58	4.92
UDCLRSF 2010-005060			6				50	4	46,700	6.22	6.42	6.63	6.86	7.37
UDCLRSF 2010-010010		R0.1	1				50	4	46,700	1.06	1.09	1.12	1.16	1.24
UDCLRSF 2010-010020			2				50	4	46,700	2.09	2.16	2.22	2.30	2.46
UDCLRSF 2010-010040			4				50	4	46,700	4.15	4.28	4.43	4.58	4.91
UDCLRSF 2010-010060			6				50	4	46,700	6.22	6.41	6.63	6.85	7.36
UDCLRSF 2015-003015	1.5	R0.03	1.5	0.75	1.44	16°	50	4	46,700	1.61	1.66	1.72	1.78	1.91
UDCLRSF 2015-003030			3				50	4	46,700	3.16	3.26	3.37	3.49	3.74
UDCLRSF 2015-005015		R0.05	1.5				50	4	46,700	1.61	1.66	1.72	1.78	1.90
UDCLRSF 2015-005030			3				50	4	46,700	3.16	3.26	3.37	3.48	3.74
UDCLRSF 2015-010015		R0.1	1.5				50	4	46,700	1.61	1.66	1.71	1.77	1.89
UDCLRSF 2015-010030			3				50	4	46,700	3.16	3.26	3.36	3.48	3.73
UDCLRSF 2015-010040			4				50	4	46,700	4.19	4.32	4.46	4.62	4.95
UDCLRSF 2015-010060			6				50	4	46,700	6.25	6.45	6.66	6.89	7.40
UDCLRSF 2020-003020	2	R0.03	2	1	1.9	16°	50	4	46,700	2.20	2.27	2.35	2.43	2.61
UDCLRSF 2020-003040			4				50	4	46,700	4.26	4.40	4.55	4.70	5.05
UDCLRSF 2020-003060			6				50	4	46,700	6.33	6.53	6.75	6.98	7.50
UDCLRSF 2020-003080			8				50	4	46,700	8.39	8.66	8.95	9.26	9.95
UDCLRSF 2020-003100			10				50	4	46,700	10.45	10.79	11.15	11.54	12.40
UDCLRSF 2020-005020		R0.05	2				50	4	46,700	2.20	2.27	2.34	2.42	2.60
UDCLRSF 2020-005040			4				50	4	46,700	4.26	4.40	4.55	4.70	5.05
UDCLRSF 2020-005060			6				50	4	46,700	6.33	6.53	6.75	6.98	7.50
UDCLRSF 2020-005080			8				50	4	46,700	8.39	8.66	8.95	9.26	9.94
UDCLRSF 2020-005100			10				50	4	46,700	10.45	10.79	11.15	11.53	12.39
UDCLRSF 2020-010020		R0.1	2				50	4	46,700	2.20	2.27	2.34	2.42	2.59
UDCLRSF 2020-010040			4				50	4	46,700	4.26	4.40	4.54	4.69	5.04
UDCLRSF 2020-010060			6				50	4	46,700	6.32	6.53	6.74	6.97	7.49
UDCLRSF 2020-010080			8				50	4	46,700	8.39	8.66	8.94	9.25	9.93
UDCLRSF 2020-010100			10				50	4	46,700	10.45	10.79	11.14	11.53	12.38

UDCLRSF Milling Conditions

Refer to page 26 for UDCLRSF note.

WORK MATERIAL	CEMENTED CARBIDE(≧87HRA) / HARD BRITTLE MATERIALS												
Model Number	Spindle Speed (min^{-1})	Z-Level Milling				Flat Milling			Side Milling			Slotting	
		Feed Rate (mm/min)	※Feed Rate 2 (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Feed Rate (mm/min)	a_p Axial Depth (mm)
20025-003X5	30,000	220	50	0.014	0.2	220	0.014	0.2	100	0.063	0.006	110	0.014
20025-003X8	30,000	170	50	0.014	0.2	170	0.014	0.2	80	0.032	0.006	90	0.014
20025-005X5	30,000	220	50	0.018	0.2	220	0.018	0.2	100	0.063	0.006	110	0.018
20025-005X8	30,000	170	50	0.018	0.2	170	0.018	0.2	80	0.032	0.006	90	0.018
2003-003006	30,000	220	50	0.015	0.2	220	0.015	0.2	110	0.075	0.006	110	0.015
2003-003009	30,000	175	50	0.015	0.2	175	0.015	0.2	90	0.038	0.006	90	0.015
2003-005006	30,000	220	50	0.02	0.2	220	0.02	0.2	110	0.075	0.006	110	0.02
2003-005009	30,000	175	50	0.02	0.2	175	0.015	0.2	90	0.038	0.006	90	0.02
2005-003005	30,000	190	90	0.02	0.4	190	0.02	0.4	180	0.25	0.01	190	0.02
2005-003010	30,000	190	90	0.02	0.4	190	0.02	0.4	180	0.125	0.01	190	0.02
2005-003015	30,000	140	65	0.015	0.3	140	0.015	0.3	130	0.125	0.007	140	0.015
2005-005005	30,000	190	125	0.02	0.4	190	0.02	0.4	180	0.25	0.01	190	0.02
2005-005010	30,000	190	125	0.02	0.4	190	0.02	0.4	180	0.125	0.01	190	0.02
2005-005015	30,000	140	65	0.015	0.3	140	0.015	0.3	130	0.125	0.007	140	0.015
2008-003008	30,000	190	90	0.02	0.6	190	0.02	0.6	300	0.4	0.016	190	0.02
2008-003016	30,000	190	90	0.02	0.6	190	0.02	0.6	300	0.2	0.01	190	0.02
2008-003024	30,000	175	80	0.018	0.5	175	0.018	0.5	275	0.2	0.007	175	0.018
2008-005008	30,000	190	150	0.025	0.6	190	0.025	0.6	300	0.4	0.016	190	0.025
2008-005016	30,000	190	150	0.025	0.6	190	0.025	0.6	300	0.2	0.01	190	0.025
2008-005024	30,000	175	80	0.023	0.5	175	0.023	0.5	275	0.2	0.007	175	0.023
2008-010008	30,000	190	150	0.03	0.6	190	0.03	0.6	300	0.4	0.016	190	0.03
2008-010016	30,000	190	150	0.03	0.6	190	0.03	0.6	300	0.2	0.01	190	0.03
2008-010024	30,000	175	80	0.028	0.5	175	0.028	0.5	275	0.2	0.007	175	0.028
2010-003010	30,000	190	90	0.02	0.8	190	0.02	0.8	375	0.5	0.02	190	0.02
2010-003020	30,000	190	90	0.02	0.8	190	0.02	0.8	375	0.25	0.01	190	0.02
2010-003040	30,000	190	90	0.016	0.6	190	0.016	0.6	375	0.25	0.005	190	0.016
2010-003060	25,000	155	75	0.01	0.5	155	0.01	0.5	300	0.25	0.005	155	0.01
2010-005010	30,000	190	185	0.025	0.8	190	0.025	0.8	375	0.5	0.02	190	0.025
2010-005020	30,000	190	185	0.025	0.8	190	0.025	0.8	375	0.25	0.01	190	0.025
2010-005040	30,000	190	185	0.02	0.6	190	0.02	0.6	375	0.25	0.005	190	0.02
2010-005060	25,000	155	150	0.012	0.5	155	0.012	0.5	300	0.25	0.005	155	0.012
2010-010010	30,000	190	185	0.03	0.8	190	0.03	0.8	375	0.5	0.02	190	0.03
2010-010020	30,000	190	185	0.03	0.8	190	0.03	0.8	375	0.25	0.01	190	0.03
2010-010040	30,000	190	185	0.025	0.6	190	0.025	0.6	375	0.25	0.005	190	0.025
2010-010060	25,000	155	150	0.015	0.5	155	0.015	0.5	300	0.25	0.005	155	0.015

UDCLRSF Milling Conditions

Refer to page 26 for UDCLRSF note.

WORK MATERIAL	CEMENTED CARBIDE(<87HRA)											
Model Number	Spindle Speed (min^{-1})	Z-Level Milling				Flat Milling			Side Milling			Slotting	
		Feed Rate (mm/min)	※Feed Rate 2 (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Feed Rate (mm/min)	a_p Axial Depth (mm)
20025-003X5	24,000	300	50	0.014	0.2	300	0.014	0.2	200	0.063	0.003	300	0.014
20025-003X8	24,000	230	50	0.01	0.2	230	0.01	0.2	150	0.032	0.003	230	0.01
20025-005X5	24,000	300	50	0.018	0.2	300	0.018	0.2	200	0.063	0.003	300	0.018
20025-005X8	24,000	230	50	0.012	0.2	230	0.012	0.2	150	0.032	0.003	230	0.012
2003-003006	21,000	300	50	0.015	0.2	300	0.015	0.2	200	0.075	0.003	300	0.015
2003-003009	21,000	240	50	0.012	0.2	240	0.012	0.2	160	0.038	0.003	240	0.012
2003-005006	21,000	300	50	0.02	0.2	300	0.02	0.2	200	0.075	0.003	300	0.02
2003-005009	21,000	240	50	0.014	0.2	240	0.014	0.2	160	0.038	0.003	240	0.014
2005-003005	16,000	500	160	0.02	0.4	500	0.02	0.4	800	0.25	0.005	500	0.02
2005-003010	16,000	500	160	0.02	0.4	500	0.02	0.4	400	0.125	0.005	500	0.02
2005-003015	16,000	375	120	0.014	0.3	375	0.014	0.3	300	0.125	0.005	375	0.014
2005-005005	16,000	500	160	0.025	0.4	500	0.025	0.4	800	0.25	0.005	500	0.025
2005-005010	16,000	500	160	0.025	0.4	500	0.025	0.4	400	0.125	0.005	500	0.025
2005-005015	16,000	375	120	0.017	0.3	375	0.017	0.3	300	0.125	0.005	375	0.017
2008-003008	13,000	390	130	0.02	0.6	390	0.02	0.6	1,200	0.4	0.008	390	0.02
2008-003016	13,000	390	130	0.02	0.6	390	0.02	0.6	600	0.2	0.008	390	0.02
2008-003024	13,000	350	120	0.014	0.5	350	0.014	0.5	540	0.2	0.006	350	0.014
2008-005008	13,000	390	130	0.025	0.6	390	0.025	0.6	1,200	0.4	0.008	390	0.025
2008-005016	13,000	390	130	0.025	0.6	390	0.025	0.6	600	0.2	0.008	390	0.025
2008-005024	13,000	350	120	0.017	0.5	350	0.017	0.5	540	0.2	0.006	350	0.017
2008-010008	13,000	390	130	0.03	0.6	390	0.03	0.6	1,200	0.4	0.008	390	0.03
2008-010016	13,000	390	130	0.03	0.6	390	0.03	0.6	600	0.2	0.008	390	0.03
2008-010024	13,000	350	120	0.02	0.5	350	0.02	0.5	540	0.2	0.006	350	0.02
2010-003010	12,000	360	120	0.02	0.8	360	0.02	0.8	1,440	0.5	0.01	360	0.02
2010-003020	12,000	360	120	0.02	0.8	360	0.02	0.8	720	0.25	0.01	360	0.02
2010-003040	10,000	300	100	0.012	0.7	300	0.012	0.7	600	0.25	0.008	300	0.012
2010-003060	10,000	300	100	0.008	0.7	300	0.008	0.7	600	0.25	0.006	300	0.008
2010-005010	12,000	360	120	0.025	0.8	360	0.025	0.8	1,440	0.5	0.01	360	0.025
2010-005020	12,000	360	120	0.025	0.8	360	0.025	0.8	720	0.25	0.01	360	0.025
2010-005040	10,000	300	100	0.015	0.7	300	0.015	0.7	600	0.25	0.008	300	0.015
2010-005060	10,000	300	100	0.01	0.7	300	0.01	0.7	600	0.25	0.006	300	0.01
2010-010010	12,000	360	120	0.03	0.8	360	0.03	0.8	1,440	0.5	0.01	360	0.03
2010-010020	12,000	360	120	0.03	0.8	360	0.03	0.8	720	0.25	0.01	360	0.03
2010-010040	10,000	300	100	0.02	0.7	300	0.02	0.7	600	0.25	0.008	300	0.02
2010-010060	10,000	300	100	0.012	0.7	300	0.012	0.7	600	0.25	0.006	300	0.012

UDCLRSF Milling Conditions

Refer to page 26 for UDCLRSF note.

WORK MATERIAL	CEMENTED CARBIDE(≧87HRA) / HARD BRITTLE MATERIALS												
Model Number	Spindle Speed (min^{-1})	Z-Level Milling				Flat Milling			Side Milling			Slotting	
		Feed Rate (mm/min)	※Feed Rate 2 (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Feed Rate (mm/min)	a_p Axial Depth (mm)
2015-003015	25,000	190	90	0.03	1.3	190	0.03	1.3	375	0.75	0.02	190	0.03
2015-003030	25,000	190	90	0.03	1.3	190	0.03	1.3	375	0.375	0.01	190	0.03
2015-005015	25,000	190	125	0.04	1.3	190	0.04	1.3	375	0.75	0.02	190	0.04
2015-005030	25,000	190	125	0.04	1.3	190	0.04	1.3	375	0.375	0.01	190	0.04
2015-010015	25,000	190	150	0.045	1.3	190	0.045	1.3	375	0.75	0.02	190	0.045
2015-010030	25,000	190	150	0.045	1.3	190	0.045	1.3	375	0.375	0.01	190	0.045
2015-010040	25,000	190	150	0.043	1.2	190	0.043	1.2	350	0.375	0.008	190	0.043
2015-010060	25,000	190	150	0.04	1	190	0.04	1	350	0.375	0.005	190	0.04
2020-003020	20,000	190	90	0.04	1.8	190	0.04	1.8	375	1	0.02	190	0.04
2020-003040	20,000	190	90	0.04	1.8	190	0.04	1.8	375	0.5	0.01	190	0.04
2020-003060	20,000	190	90	0.037	1.7	190	0.037	1.7	325	0.5	0.007	190	0.037
2020-003080	20,000	190	90	0.03	1.5	190	0.03	1.5	325	0.5	0.005	190	0.03
2020-003100	20,000	190	90	0.025	1.3	190	0.025	1.3	300	0.5	0.005	190	0.025
2020-005020	20,000	190	90	0.05	1.8	190	0.05	1.8	375	1	0.02	190	0.05
2020-005040	20,000	190	90	0.05	1.8	190	0.05	1.8	375	0.5	0.01	190	0.05
2020-005060	20,000	190	90	0.045	1.7	190	0.045	1.7	325	0.5	0.007	190	0.045
2020-005080	20,000	190	90	0.04	1.5	190	0.04	1.5	325	0.5	0.005	190	0.04
2020-005100	20,000	190	90	0.028	1.3	190	0.028	1.3	300	0.5	0.005	190	0.028
2020-010020	20,000	190	125	0.06	1.8	190	0.06	1.8	375	1	0.02	190	0.06
2020-010040	20,000	190	125	0.06	1.8	190	0.06	1.8	375	0.5	0.01	190	0.06
2020-010060	20,000	190	125	0.055	1.7	190	0.055	1.7	325	0.5	0.007	190	0.055
2020-010080	20,000	190	125	0.045	1.5	190	0.045	1.5	325	0.5	0.005	190	0.045
2020-010100	20,000	190	125	0.033	1.3	190	0.033	1.3	300	0.5	0.005	190	0.033

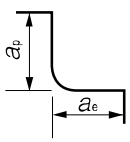
UDCLRSF Milling Conditions

Refer to page 26 for UDCLRSF note.

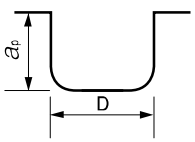
WORK MATERIAL	CEMENTED CARBIDE（<87HRA）												
Model Number	Spindle Speed (min^{-1})	Z-Level Milling				Flat Milling			Side Milling			Slotting	
		Feed Rate (mm/min)	※Feed Rate 2 (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Feed Rate (mm/min)	a_p Axial Depth (mm)
2015-003015	11,000	330	110	0.03	1.3	330	0.03	1.3	1,440	0.75	0.01	330	0.03
2015-003030	11,000	330	110	0.03	1.3	330	0.03	1.3	720	0.375	0.01	330	0.03
2015-005015	11,000	330	110	0.04	1.3	330	0.04	1.3	1,440	0.75	0.01	330	0.04
2015-005030	11,000	330	110	0.04	1.3	330	0.04	1.3	720	0.375	0.01	330	0.04
2015-010015	11,000	330	110	0.045	1.3	330	0.045	1.3	1,440	0.75	0.01	330	0.045
2015-010030	11,000	330	110	0.045	1.3	330	0.045	1.3	720	0.375	0.01	330	0.045
2015-010040	11,000	330	110	0.045	1.1	330	0.045	1.1	720	0.375	0.01	330	0.045
2015-010060	11,000	330	110	0.03	1.1	330	0.03	1.1	720	0.375	0.009	330	0.03
2020-003020	10,000	300	100	0.04	1.8	300	0.04	1.8	1,440	1	0.01	300	0.04
2020-003040	10,000	300	100	0.04	1.8	300	0.04	1.8	1,440	1	0.01	300	0.04
2020-003060	10,000	300	100	0.036	1.6	300	0.036	1.6	1,440	0.5	0.01	300	0.036
2020-003080	10,000	300	100	0.023	1.6	300	0.023	1.6	1,440	0.5	0.009	300	0.023
2020-003100	10,000	300	100	0.018	1.6	300	0.018	1.6	1,440	0.5	0.009	300	0.018
2020-005020	10,000	300	100	0.05	1.8	300	0.05	1.8	1,440	1	0.01	300	0.05
2020-005040	10,000	300	100	0.05	1.8	300	0.05	1.8	1,440	1	0.01	300	0.05
2020-005060	10,000	300	100	0.045	1.6	300	0.045	1.6	1,440	0.5	0.01	300	0.045
2020-005080	10,000	300	100	0.028	1.6	300	0.028	1.6	1,440	0.5	0.009	300	0.028
2020-005100	10,000	300	100	0.02	1.6	300	0.02	1.6	1,440	0.5	0.009	300	0.02
2020-010020	10,000	300	100	0.06	1.8	300	0.06	1.8	1,440	1	0.01	300	0.06
2020-010040	10,000	300	100	0.06	1.8	300	0.06	1.8	1,440	1	0.01	300	0.06
2020-010060	10,000	300	100	0.054	1.6	300	0.054	1.6	1,440	0.5	0.01	300	0.054
2020-010080	10,000	300	100	0.034	1.6	300	0.034	1.6	1,440	0.5	0.009	300	0.034
2020-010100	10,000	300	100	0.023	1.6	300	0.023	1.6	1,440	0.5	0.009	300	0.023

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.



Z-Level / Side / Flat Milling



Slotting
D : Outside Diameter（mm）

UDCLRSF Note

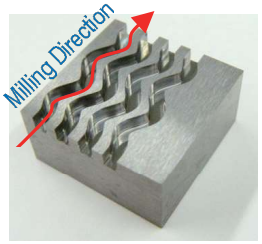
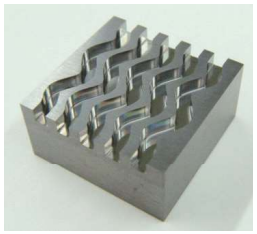
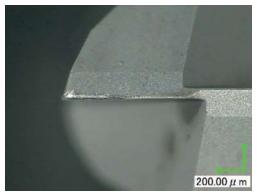
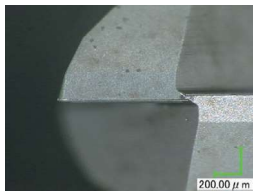
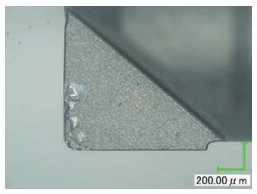
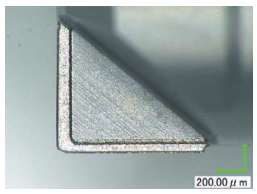
Note:

- 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.
- Does not require to be slowed down in the approach sequence when slotting and side milling.
- Use an inclined or helical approach when Z-level milling (Recommended inclination angle: <1 degree).
- For flat and side milling, set the axial depth (ap) and radial depth (ae) to allow for the uncut material of the corner radius.
- 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.

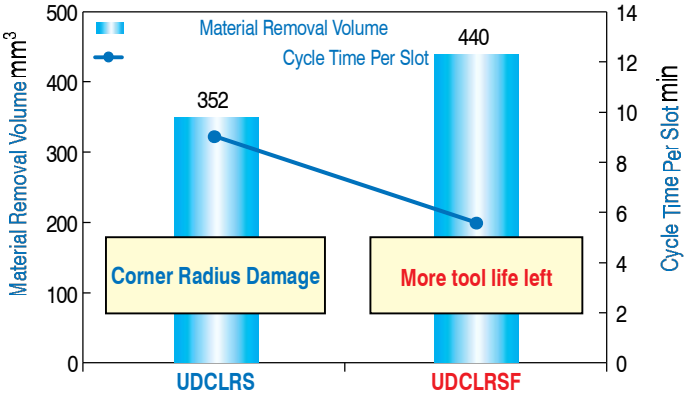
Higher efficiency and longer tool life!

Cemented Carbide Curve slotting example with UDCLRSF Ø2 × CR0.1 × Effective Length 2

VM-40 (90HRA)

	UDCLRS	UDCLRSF
Work Material		
Rake Face	 After 4 slots	 After 5 slots
Relief	 After 4 slots	 After 5 slots

Tool	UDCLRS 2020-0100-020	UDCLRSF 2020-010020
Spindle Speed	20,000 min^{-1}	
Feed Rate	375 mm/min	190 mm/min
Axial Depth a_p	0.02 mm	0.06 mm
Coolant	Nozzle Air Blow	
Cycle Time (Per slot)	9 min 4 sec	5 min 36 sec



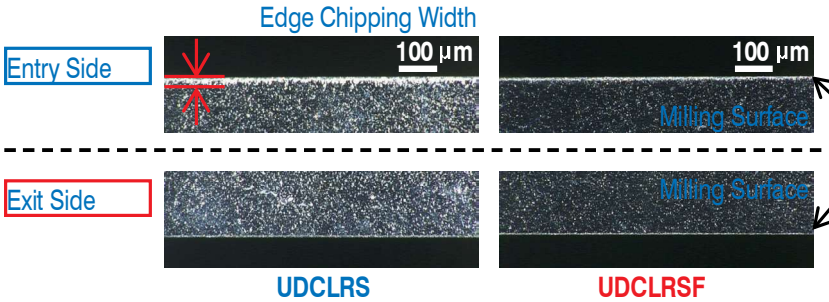
Size : 20 × 20 × 10 mm
Slot Size : Width 2 × Depth 1.99 mm

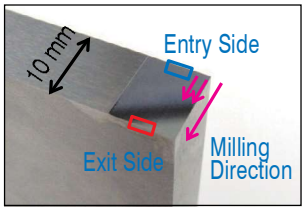
Minimizing Edge Chipping

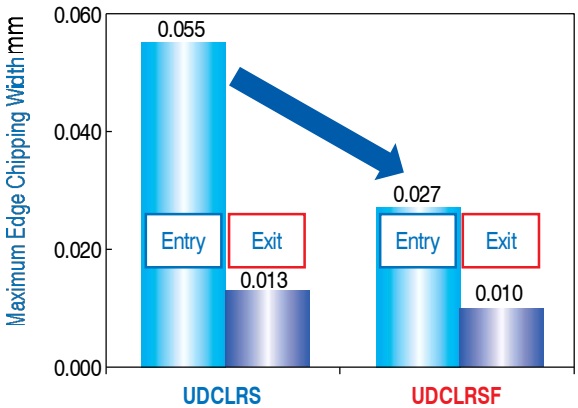
Cemented Carbide Bottom surface milling example with UDCLRSF Ø2 × CR0.03 × Effective Length 2

VM-40 (90HRA)

Edge Chipping Comparison on Work Material







Tool	UDCLRS 2020-003-020 UDCLRSF 2020-003020
Spindle Speed	20,000 min^{-1}
Feed Rate	100 mm/min
Axial Depth a_p	0.01 mm
Radial Depth a_e	0.01 mm
Coolant	Oil Mist
Cycle Time	137 min

Size **R0.1～R3**

UDCB

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

Material Applications （☆ Highly Recommended ◎ Recommended ○ Suggested）

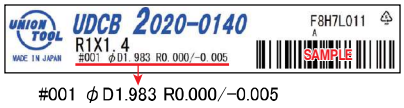
Work Material															
CARBON STEELS S45C S55C	ALLOY STEELS SK / SCM SUS	PREHARDENED STEELS NAK HPM	HARDENED STEELS ～55HRC	～60HRC	～70HRC	CAST IRON	ALUMINUM ALLOYS	GRAPHITE	COPPER	PLASTICS	GLASS FILLED PLASTICS	TITANIUM ALLOYS	HEAT RESISTANT ALLOYS	CEMENTED CARBIDE	HARD BRITTLE (NON-METALLIC) MATERIALS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

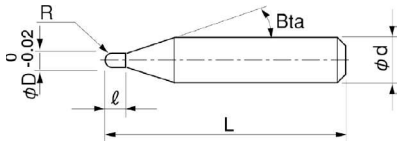
Features

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 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 14 models

Unit （mm）

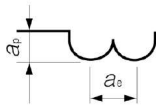
Model Number	Radius of Ball Nose R	Length of Cut ℓ	Shank Taper Angle Bta	Overall Length L	Shank Diameter φd	Price ¥
UDCB 2002-0014	R0.1	0.14	16°	50	4	39,160
UDCB 2003-0021	R0.15	0.21	16°	50	4	39,160
UDCB 2004-0028	R0.2	0.28	16°	50	4	35,660
UDCB 2005-0035	R0.25	0.35	16°	50	4	35,660
UDCB 2006-0042	R0.3	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.
- 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.

Size **R0.1～R3**

UDCLB

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

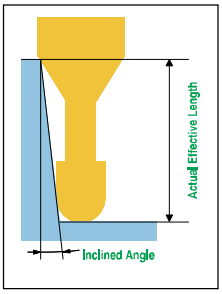
Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

Work Material															
CARBON STEELS S45C S55C	ALLOY STEELS SK / SCM SUS	PREHARDENED STEELS NAK HPM	HARDENED STEELS ～55HRC	～60HRC	～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

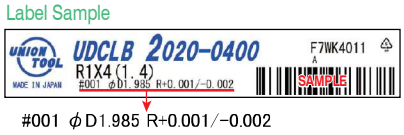
*1 DCB / DCLB series are highly recommended for Glass Filled Plastic milling.
*2 Hard Brittle (Non-Metallic) Materials: Ceramics (Alumina, Zirconia, etc.), Glasses and etc.

Features

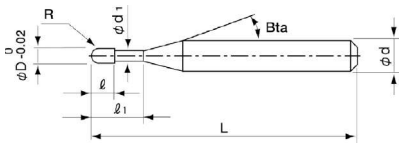
Long Neck Ball End Mills for milling Cemented Carbide and Hard Brittle (Non-Metallic) Materials.
New diamond coating offers excellent hardness, toughness and adhesion.
Achieve remarkable cutting depth with optimum tool geometry.
Leaves a burr and pit free surface finish on semi-roughing & finishing process.



Label Sample



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 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°
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

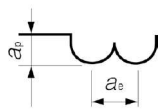
Model Number	Radius of Ball Nose R	Effective Length ℓ_1	Length of Cut ℓ	Neck Diameter ϕd_1	Shank Taper Angle Bta	Overall Length L	Shank Diameter ϕd	Price ¥	Effective Length by Inclined Angles 30′	1°	1°30′	2°	3°
UDCLB 2010-0200	R0.5	2	0.7	0.96	16°	50	4	32,410	2.08	2.13	2.19	2.25	2.38
UDCLB 2010-0250		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.

Size **Ø0.3～Ø2**

UDCLRS

MG UDC 0° R ±0.01 Shank Dia 0/-0.005

Material Applications （☆ Highly Recommended ◎ Recommended ○ Suggested）

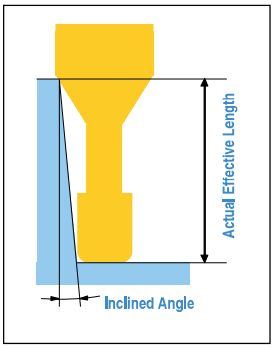
Work Material															
CARBON STEELS S45C S55C	ALLOY STEELS SK / SCM SUS	PREHARDENED STEELS NAK HPM	HARDENED STEELS ～55HRC	HARDENED STEELS ～60HRC	HARDENED STEELS ～70HRC	CAST IRON	ALUMINUM ALLOYS	GRAPHITE	COPPER	PLASTICS	GLASS FILLED PLASTICS	TITANIUM ALLOYS	HEAT RESISTANT ALLOYS	CEMENTED CARBIDE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

*1 UDCLRSF is highly recommended for Glass Filled Plastic milling.

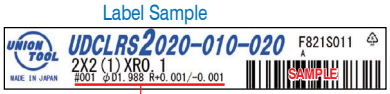
*2 Hard Brittle (Non-Metallic) Materials: Ceramics (Alumina, Zirconia, etc.), Glasses and etc.

Features

Long Neck Radius type End Mills for milling Cemented Carbide and Hard Brittle (Non-Metallic) Materials.
Developed to give improved hardness and durability, new Diamond coating also has outstanding adhesion to the cutting tool.
Achieve remarkable cutting depth with optimum tool geometry.
Leaves a burr and pit free surface finish on semi-roughing & finishing process.

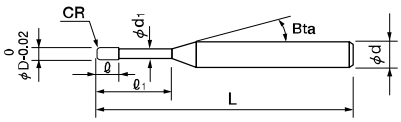


Label Sample



#001 φD1.988 R+0.001/−0.001

Diameter and Corner 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 30 models

Unit （mm）

Model Number	Outside Diameter ØD	Coner Radius CR	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°
UDCLRS 2003-003-006	0.3	R0.03	0.6	0.15	0.28	16°	50	4	45,500	0.61	0.63	0.65	0.67	0.72
UDCLRS 2003-005-006		R0.05	0.6				50	4	45,500	0.61	0.63	0.65	0.67	0.72
UDCLRS 2005-003-005	0.5	R0.03	0.5	0.25	0.46	16°	50	4	43,300	0.55	0.56	0.58	0.60	0.64
UDCLRS 2005-003-010			1				50	4	43,300	1.06	1.10	1.13	1.17	1.25
UDCLRS 2005-005-005		R0.05	0.5				50	4	43,300	0.55	0.56	0.58	0.60	0.64
UDCLRS 2005-005-010			1				50	4	43,300	1.06	1.09	1.13	1.17	1.25
UDCLRS 2008-003-008	0.8	R0.03	0.8	0.4	0.76	16°	50	4	38,900	0.86	0.88	0.91	0.94	1.01
UDCLRS 2008-003-016			1.6				50	4	38,900	1.68	1.73	1.79	1.85	1.99
UDCLRS 2008-005-008		R0.05	0.8				50	4	38,900	0.85	0.88	0.91	0.94	1.01
UDCLRS 2008-005-016			1.6				50	4	38,900	1.68	1.73	1.79	1.85	1.98
UDCLRS 2008-010-008		R0.1	0.8				50	4	38,900	0.85	0.88	0.90	0.93	0.99
UDCLRS 2008-010-016			1.6				50	4	38,900	1.68	1.73	1.78	1.84	1.97
UDCLRS 2010-003-010	1	R0.03	1	0.5	0.96	16°	50	4	38,900	1.06	1.10	1.13	1.17	1.25
UDCLRS 2010-003-020			2				50	4	38,900	2.09	2.16	2.23	2.31	2.48
UDCLRS 2010-005-010		R0.05	1				50	4	38,900	1.06	1.09	1.13	1.17	1.25
UDCLRS 2010-005-020			2				50	4	38,900	2.09	2.16	2.23	2.31	2.47
UDCLRS 2010-010-010		R0.1	1				50	4	38,900	1.06	1.09	1.12	1.16	1.24
UDCLRS 2010-010-020			2				50	4	38,900	2.09	2.16	2.22	2.30	2.46

2 Flutes Long Neck Radius End Mills for Cemented Carbide and Hard Brittle Materials

Model Number	Outside Diameter ØD	Coner Radius CR	Effective Length ℓ_1	Length of Cut ℓ	Neck Diameter $Ød_1$	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød	Price ¥	Effective Length by Inclined Angles				
										30′	1°	1°30′	2°	3°
UDCLRS 2015-003-015	1.5	R0.03	1.5	0.75	1.44	16°	50	4	38,900	1.61	1.66	1.72	1.78	1.91
UDCLRS 2015-003-030			3				50	4	38,900	3.16	3.26	3.37	3.49	3.74
UDCLRS 2015-005-015		R0.05	1.5				50	4	38,900	1.61	1.66	1.72	1.78	1.90
UDCLRS 2015-005-030			3				50	4	38,900	3.16	3.26	3.37	3.48	3.74
UDCLRS 2015-010-015		R0.1	1.5				50	4	38,900	1.61	1.66	1.71	1.77	1.89
UDCLRS 2015-010-030			3				50	4	38,900	3.16	3.26	3.36	3.48	3.73
UDCLRS 2020-003-020	2	R0.03	2	1	1.9	16°	50	4	38,900	2.20	2.27	2.35	2.43	2.61
UDCLRS 2020-003-040			4				50	4	38,900	4.26	4.40	4.55	4.70	5.05
UDCLRS 2020-005-020		R0.05	2				50	4	38,900	2.20	2.27	2.34	2.42	2.60
UDCLRS 2020-005-040			4				50	4	38,900	4.26	4.40	4.55	4.70	5.05
UDCLRS 2020-010-020		R0.1	2				50	4	38,900	2.20	2.27	2.34	2.42	2.59
UDCLRS 2020-010-040			4				50	4	38,900	4.26	4.40	4.54	4.69	5.04

UDCLRS Milling Conditions

Refer to page 38 for UDCLRS note.

WORK MATERIAL	CEMENTED CARBIDE (≧87HRA) / HARD BRITTLE MATERIALS												
Model Number	Spindle Speed (min^{-1})	Z-Level Milling				Flat Milling			Side Milling			Slotting	
		Feed Rate (mm/min)	* Feed Rate 2 (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Feed Rate (mm/min)	a_p Axial Depth (mm)
2003-003-006	30,000	220	50	0.010	0.200	220	0.010	0.200	110	0.050	0.001	110	0.010
2003-005-006	30,000	220	50	0.010	0,200	220	0.010	0.200	110	0.050	0.001	110	0.010
2005-003-005	30,000	185	90	0.010	0.400	185	0.010	0.400	375	0.250	0.005	375	0.010
2005-003-010	30,000	185	90	0.010	0.400	185	0.010	0.400	180	0.125	0.005	375	0.010
2005-005-005	30,000	375	125	0.010	0.400	375	0.010	0.400	375	0.250	0.005	375	0.010
2005-005-010	30,000	375	125	0.010	0.400	375	0.010	0.400	180	0.125	0.005	375	0.010
2008-003-008	30,000	185	90	0.010	0.600	185	0.010	0.600	600	0.400	0.008	375	0.010
2008-003-016	30,000	185	90	0.010	0.600	185	0.010	0.600	300	0.200	0.008	375	0.010
2008-005-008	30,000	375	150	0.010	0.600	375	0.010	0.600	600	0.400	0.008	375	0.010
2008-005-016	30,000	375	150	0.010	0.600	375	0.010	0.600	300	0.200	0.008	375	0.010
2008-010-008	30,000	375	150	0.010	0.600	375	0.010	0.600	600	0.400	0.008	375	0.010
2008-010-016	30,000	375	150	0.010	0.600	375	0.010	0.600	300	0.200	0.008	375	0.010
2010-003-010	30,000	185	90	0.010	0.800	185	0.010	0.800	750	0.500	0.010	375	0.010
2010-003-020	30,000	185	90	0.010	0.800	185	0.010	0.800	375	0.250	0.010	375	0.010
2010-005-010	30,000	375	185	0.010	0.800	375	0.010	0.800	750	0.500	0.010	375	0.010
2010-005-020	30,000	375	185	0.010	0.800	375	0.010	0.800	375	0.250	0.010	375	0.010
2010-010-010	30,000	375	185	0.010	0.800	375	0.010	0.800	750	0.500	0.010	375	0.010
2010-010-020	30,000	375	185	0.010	0.800	375	0.010	0.800	375	0.250	0.010	375	0.010
2015-003-015	25,000	185	90	0.010	1.300	185	0.010	1.300	750	0.750	0.010	375	0.015
2015-003-030	25,000	185	90	0.010	1.300	185	0.010	1.300	375	0.375	0.010	375	0.015
2015-005-015	25,000	375	125	0.015	1.300	375	0.015	1.300	750	0.750	0.010	375	0.015
2015-005-030	25,000	375	125	0.015	1.300	375	0.015	1.300	375	0.375	0.010	375	0.015
2015-010-015	25,000	375	150	0.015	1.300	375	0.015	1.300	750	0.750	0.010	375	0.015
2015-010-030	25,000	375	150	0.015	1.300	375	0.015	1.300	375	0.375	0.010	375	0.015
2020-003-020	20,000	185	90	0.010	1.800	185	0.010	1.800	750	1.000	0.010	375	0.020
2020-003-040	20,000	185	90	0.010	1.800	185	0.010	1.800	375	0.500	0.010	375	0.020
2020-005-020	20,000	375	90	0.020	1.800	375	0.020	1.800	750	1.000	0.010	375	0.020
2020-005-040	20,000	375	90	0.020	1.800	375	0.020	1.800	375	0.500	0.010	375	0.020
2020-010-020	20,000	375	125	0.020	1.800	375	0.020	1.800	750	1.000	0.010	375	0.020
2020-010-040	20,000	375	125	0.020	1.800	375	0.020	1.800	375	0.500	0.010	375	0.020

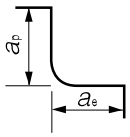
UDCLRS Milling Conditions

Refer to page 38 for UDCLRS note.

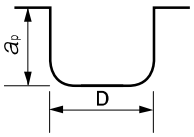
WORK MATERIAL	CEMENTED CARBIDE (<87HRA)												
Model Number	Spindle Speed (min^{-1})	Z-Level Milling				Flat Milling			Side Milling			Slotting	
		Feed Rate (mm/min)	* Feed Rate 2 (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Feed Rate (mm/min)	a_p Axial Depth (mm)
2003-003-006	21,000	220	50	0.010	0.200	220	0.010	0.200	200	0.075	0.003	200	0.010
2003-005-006	21,000	220	50	0.010	0.200	220	0.010	0.200	200	0.075	0.003	200	0.010
2005-003-005	20,000	275	135	0.020	0.400	275	0.020	0.400	800	0.250	0.005	550	0.020
2005-003-010	20,000	275	135	0.020	0.400	275	0.020	0.400	400	0.125	0.005	550	0.020
2005-005-005	20,000	550	180	0.020	0.400	550	0.020	0.400	800	0.250	0.005	550	0.020
2005-005-010	20,000	550	180	0.020	0.400	550	0.020	0.400	400	0.125	0.005	550	0.020
2008-003-008	19,000	290	145	0.020	0.600	290	0.020	0.600	1,200	0.400	0.008	580	0.025
2008-003-016	19,000	290	145	0.020	0.600	290	0.020	0.600	600	0.200	0.008	580	0.025
2008-005-008	19,000	580	190	0.025	0.600	580	0.025	0.600	1,200	0.400	0.008	580	0.025
2008-005-016	19,000	580	190	0.025	0.600	580	0.025	0.600	600	0.200	0.008	580	0.025
2008-010-008	19,000	580	190	0.025	0.600	580	0.025	0.600	1,200	0.400	0.008	580	0.025
2008-010-016	19,000	580	190	0.025	0.600	580	0.025	0.600	600	0.200	0.008	580	0.025
2010-003-010	18,250	300	150	0.020	0.800	300	0.020	0.800	1,440	0.500	0.010	600	0.025
2010-003-020	18,250	300	150	0.020	0.800	300	0.020	0.800	720	0.250	0.010	600	0.025
2010-005-010	18,250	600	200	0.025	0.800	600	0.025	0.800	1,440	0.500	0.010	600	0.025
2010-005-020	18,250	600	200	0.025	0.800	600	0.025	0.800	720	0.250	0.010	600	0.025
2010-010-010	18,250	600	200	0.025	0.800	600	0.025	0.800	1,440	0.500	0.010	600	0.025
2010-010-020	18,250	600	200	0.025	0.800	600	0.025	0.800	720	0.250	0.010	600	0.025
2015-003-015	16,500	325	160	0.020	1.300	325	0.020	1.300	1,440	0.750	0.010	650	0.035
2015-003-030	16,500	325	160	0.020	1.300	325	0.020	1.300	720	0.375	0.010	650	0.035
2015-005-015	16,500	650	210	0.035	1.300	650	0.035	1.300	1,440	0.750	0.010	650	0.035
2015-005-030	16,500	650	210	0.035	1.300	650	0.035	1.300	720	0.375	0.010	650	0.035
2015-010-015	16,500	650	210	0.035	1.300	650	0.035	1.300	1,440	0.750	0.010	650	0.035
2015-010-030	16,500	650	210	0.035	1.300	650	0.035	1.300	720	0.375	0.010	650	0.035
2020-003-020	15,000	360	180	0.020	1.800	360	0.020	1.800	1,440	1.000	0.010	720	0.050
2020-003-040	15,000	360	180	0.020	1.800	360	0.020	1.800	1,440	1.000	0.010	720	0.050
2020-005-020	15,000	720	240	0.050	1.800	720	0.050	1.800	1,440	1.000	0.010	720	0.050
2020-005-040	15,000	720	240	0.050	1.800	720	0.050	1.800	1,440	1.000	0.010	720	0.050
2020-010-020	15,000	720	240	0.050	1.800	720	0.050	1.800	1,440	1.000	0.010	720	0.050
2020-010-040	15,000	720	240	0.050	1.800	720	0.050	1.800	1,440	1.000	0.010	720	0.050

These milling parameters are based on VF-20, VM-40, VU-70 (CIS standard) and 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.



Z-Level / Side / Flat Milling
a_p : Axial Depth (mm)
a_p : Radial Depth (mm)



Slotting
a_p : Axial Depth (mm)
D : Tool Outside Diameter

UDCLRS 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.
- Does not require to be slowed down in the approach sequence when slotting and side milling.
- Use an inclined or helical approach when Z-level milling (Recommended inclination angle: <1 degree).
- For flat and side milling, set the axial depth (ap) and radial depth (ae) to allow for the uncut material of the corner radius.
- 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.

NEXT STAGE

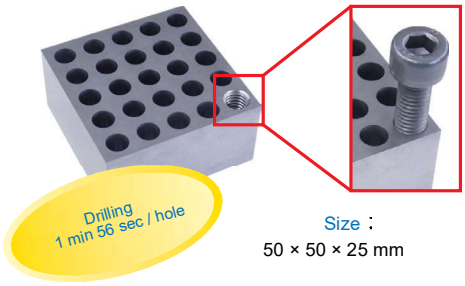
Introducing revolutionary new tools for "Direct Drilling & Thread Milling" on Cemented Carbide !!

New standard for Cemented Carbide Processing

- **Cracks are minimized.**
- **Time and cost savings comparing to EDM process.**
- **Highly precise thread geometry generated by single path threading.**

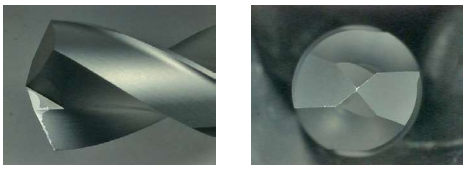
Cemented Carbide UDCMX Ø6.8 (Hole Before Threading) + UDCT M8 (Threading) VM-40 (90HRA)

After drilling & threading　Screw inserted



Size :
50 × 50 × 25 mm

Tool after drilling

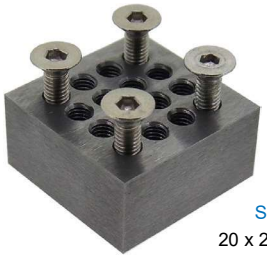


	Single-shot drilling	Threading
Tool	UDCMX 2680-250 (Ø6.8 × Flute Length 25)	UDCT M8-1.25-24 (M8 × Effective Length 24)
Spindle Speed	4,000 min^{-1}	3,500 min^{-1}
Feed Rate	12 mm/min	20 mm/min
Coolant	Air Blow (Nozzle)	
Hole Specification	Blind Hole 20 mm depth x 25 holes	Blind Hole 17.5 mm depth x 1 hole
Cycle Time	1 min 56 sec / per hole	5 min 36 sec / per hole

Cemented Carbide UDCMX Ø2.5 (Hole Before Threading) + UDCT M3 (Thread Milling) VM-40 (90HRA)

After drilling

After threading



Size :
20 x 20 x 10 mm

	Drilling	Threading
Tool	UDCMX 2250-100 (Ø2.5 × Flute Length 10)	UDCT M3-0.5-6 (M3 × Effective Length 6)
Spindle Speed	2,000 min^{-1}	20,000 min^{-1}
Feed Rate	5 mm/min	3 mm/min
Peck Amount	0.5 mm	—
Coolant	Air Blow (Nozzle)	
Hole Specification	Blind Hole 8 mm depth x 16 holes	Blind Hole 6 mm depth x 16 holes
Cycle Time	2 min 2 sec / per hole	9 min 15 sec / per hole

2 Flute Drills for Cemented Carbide and Hard Brittle Materials

Size φ0.3～φ7

UDCMX

MG UDC 30° Thinning Shank Dia 0/-0.005

Material Applications（☆ Highly Recommended ◎ Recommended ○ Suggested）

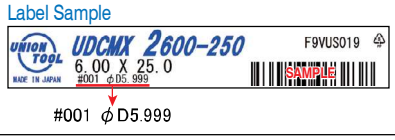
Work Material															
CARBON STEELS S45C S55C	ALLOY STEELS SK / SCM SUS	PREHARDENED STEELS NAK HPM	HARDENED STEELS ～55HRC	HARDENED STEELS ～60HRC	HARDENED STEELS ～70HRC	CAST IRON	ALUMINUM ALLOYS	GRAPHITE	COPPER	PLASTICS	GLASS FILLED PLASTICS	TITANIUM ALLOYS	HEAT RESISTANT ALLOYS	CEMENTED CARBIDE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

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

Features

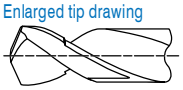
UDC offers excellent drilling performance on Cemented Carbide and Hard Brittle (Non-Metallic) Materials.
By combining the new coating with optimum tool geometry, the tool improves hole quality and longer tool life.
Makes mechanical drilling cost competitive!

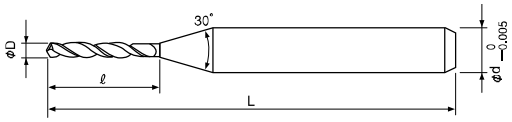
Label Sample



Measured diameter is printed on the label.

Enlarged tip drawing





Point Angle：130°
Diameter Tolerance：0/-0.02（D ≦ 3.5）
0/-0.025（D ≧ 4）

※ **Under-cut type**

Total 35 models

Unit（mm）

Model Number	Diameter φD	Flute Length ℓ	Overall Length L	Shank Diameter φd	Suggested Retail Price ¥	Cemented Carbide Spindle Speed (min⁻¹)	Cemented Carbide Feed Rate (mm/min)	Cemented Carbide Peck Amount (mm)
UDCMX 2030-030	0.3	3	38	3	18,000	28,750	5	0.05
UDCMX 2040-040	0.4	4	38	3	18,000	20,000	5	0.05
UDCMX 2050-050	0.5	5	38	3	18,000	15,000	5	0.05
UDCMX 2060-060	0.6	6	38	3	18,000	11,500	5	0.05
UDCMX 2070-070	0.7	7	38	3	18,000	9,000	5	0.05
UDCMX 2080-080	0.8	8	38	3	18,000	7,300	7.5	0.05
UDCMX 2090-090	0.9	9	38	3	18,000	6,000	7.5	0.05
UDCMX 2100-100	1	10	38	3	18,000	5,000	7.5	0.05
UDCMX 2110-100	1.1	10	38	3	18,000	4,500	7.2	0.06
UDCMX 2120-100	1.2	10	38	3	18,000	4,100	6.8	0.07
UDCMX 2130-100	1.3	10	38	3	18,000	3,750	6.5	0.08
UDCMX 2140-100	1.4	10	38	3	18,000	3,450	6.2	0.09
UDCMX 2150-100	1.5	10	38	3	18,000	3,200	6	0.1
UDCMX 2160-100	1.6	10	38	3	18,000	3,000	6	0.1
UDCMX 2170-100	1.7	10	38	3	18,000	2,850	5.8	0.1
UDCMX 2180-100	1.8	10	38	3	18,000	2,700	5.5	0.1
UDCMX 2190-100	1.9	10	38	3	18,000	2,550	5.3	0.1
UDCMX 2200-100	2	10	38	3	18,000	2,400	5	0.15
UDCMX 2210-100	2.1	10	38	3	18,000	2,300	5	0.15
UDCMX 2220-100	2.2	10	38	3	18,000	2,225	5	0.15
UDCMX 2230-100	2.3	10	38	3	18,000	2,150	5	0.15
UDCMX 2240-100	2.4	10	38	3	18,000	2,075	5	0.15

2 Flute Drills for Cemented Carbide and Hard Brittle Materials

Model Number	Diameter ϕD	Flute Length ℓ	Overall Length L	Shank Diameter ϕd	Suggested Retail Price ¥	Cemented Carbide		
						Spindle Speed (min^{-1})	Feed Rate (mm/min)	Peck Amount (mm)
UDCMX 2250-100	2.5	10	38	3	18,000	2,000	5	0.2
UDCMX 2300-100	3	10	38	3	18,000	1,100	3.7	0.25
UDCMX 2330-120	3.3	12	50	4	20,000	1,000	3.4	0.3
UDCMX 2350-120	3.5	12	50	4	20,000	910	3.3	0.35
UDCMX 2400-160	4	16	60	6	35,500	4,000	6.9	Single-Shot
UDCMX 2420-160	4.2	16	60	6	35,500	4,000	7.3	Single-Shot
UDCMX 2450-200	4.5	20	60	6	35,500	4,000	7.8	Single-Shot
UDCMX 2500-200	5	20	60	6	35,500	4,000	8.7	Single-Shot
UDCMX 2550-250	5.5	25	80	6	38,000	4,000	9.6	Single-Shot
UDCMX 2600-250	6	25	80	6	38,000	4,000	10.5	Single-Shot
UDCMX 2650-250	6.5	25	80	8	48,000	4,000	11.5	Single-Shot
UDCMX 2680-250	6.8	25	80	8	52,000	4,000	12	Single-Shot
UDCMX 2700-250	7	25	80	8	52,000	4,000	12.4	Single-Shot

These milling parameters are based on VM-40 (TAS standard) and are for reference only.
Tool life may differ depending on the type of Cemented Carbide material.
For best results, fine parameter adjustments may be required, depending on the Carbide material; milling shape and strategy; machine rigidity and spindle capability.

Note:
- 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.
- Recommend shallower drilling than flute length to promote good chip evacuation.
- Recommend using peck drilling cycle, but single-shot drilling may extend the tool life in some cases.
- Recommend air blow.
- Recommend water soluble coolant for Hard Brittle (Non-Metallic) Materials.
- 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.
- Peck drilling is required depending on the hole quality & hole-edge chipping.
- We recommend to avoid operating the machine unattended when using large size tools with high MRR (Material Removal Rate) per hole.
  Rapid tool wear, sudden tool damage or breakage might occur depending on the processing environment.
- 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.

2 Flute Thread Mills for Cemented Carbide and Hard Brittle Materials

Size **M2～M8**

UDCT

MG UDC Shank Dia 0/-0.005

Material Applications（☆ Highly Recommended ◎ Recommended ○ Suggested）

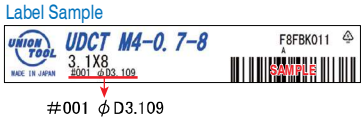
Work Material														
CARBON STEELS S45C S55C	ALLOY STEELS SK / SCM SUS	PREHARDENED STEELS NAK HPM	HARDENED STEELS ～55HRC	HARDENED STEELS ～60HRC	HARDENED STEELS ～70HRC	CAST IRON	ALUMINUM ALLOYS	GRAPHITE	COPPER	PLASTICS	GLASS FILLED PLASTICS	TITANIUM ALLOYS	HEAT RESISTANT ALLOYS	CEMENTED CARBIDE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

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

Features

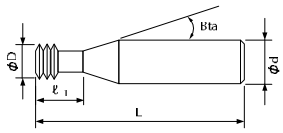
Thread Mills for Cemented Carbide and Hard Brittle (Non-Metallic) Materials.
Direct milling offers higher efficiency and precision comparing to EDM and grinding process.
Developed to give improved hardness and durability, the new Diamond coating also has outstanding adhesion to the tool.
UDC series End Mills and Drills are recommended to drill holes before threading.

Label Sample



#001 φD3.109

Measured diameter is printed on the label.



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 10 models

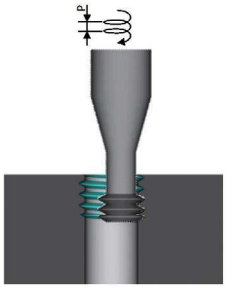
Unit（mm）

Model Number	Thread Diameter M	Pitch P	Tool Diameter φD	Number of Flutes	Effective Length ℓ1	Shank Taper Angle Bta	Overall Length L	Shank Diameter φd	Suggested Retail Price ¥
UDCT M2-0.4-4	M2	0.4	1.5	2	4	16°	50	4	38,900
UDCT M2.5-0.45-5	M2.5	0.45	1.9	2	5	16°	50	4	38,900
UDCT M3-0.5-6	M3	0.5	2.4	2	6	16°	50	4	38,900
UDCT M4-0.7-8	M4	0.7	3.1	2	8	16°	50	4	38,900
UDCT M5-0.8-10	M5	0.8	3.9	2	10	16°	60	6	42,800
UDCT M5-0.8-15					15		60	6	42,800
UDCT M6-1-12	M6	1	4.6	2	12	16°	60	6	42,800
UDCT M6-1-18					18		60	6	42,800
UDCT M8-1.25-16	M8	1.25	5.9	2	16	16°	60	6	42,800
UDCT M8-1.25-24					24		60	6	42,800

UDCT Milling Conditions

WORK MATERIAL					CEMENTED CARBIDE		
Model Number	Thread Diameter M	Pitch P	Tool Diameter ϕD	Effective Length ℓ_1	Recommended Diameter of Hole Before Threading (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)
M2-0.4-4	**M2**	0.4	1.5	4	ϕ1.6	20,000	3
M2.5-0.45-5	**M2.5**	0.45	1.9	5	ϕ2.1	20,000	3
M3-0.5-6	**M3**	0.5	2.4	6	ϕ2.5	20,000	3
M4-0.7-8	**M4**	0.7	3.1	8	ϕ3.3	10,050	30
M5-0.8-10	**M5**	0.8	3.9	10	ϕ4.2	8,000	30
M5-0.8-15				15			
M6-1-12	**M6**	1	4.6	12	ϕ5	6,800	30
M6-1-18				18			
M8-1.25-16	**M8**	1.25	5.9	16	ϕ6.8	3,500	20
M8-1.25-24				24			

These milling parameters are based on VM-40 (TAS standard) and are for reference only.
Tool life may differ depending on the type of Cemented Carbide material.
For best results, fine parameter adjustments may be required, depending on the Carbide material; milling shape and strategy; machine rigidity and spindle capability.



Note:
- This application requires a high cutting force. A machine with poor rigidity and high vibration is not recommended.
- Use a machine equipped with helical interpolating functions.
- 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.
- Decrease both spindle speed and feed rate proportionally.
- The feed rate is measured at the center of the tool.
- The radial cutting depth is recommended to cut all at once. Do not cut several times.
- Adjust turning radius amount to meet required internal thread precision.
- 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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Price & Specifications are subject to change without notice.

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