

UNION TOOL

Tungsten Carbide End Mills UNIMAX Series

For Cemented Carbide and
Hard Brittle Materials



6 Flutes / 10 Flutes Diamond Coated UDC Series

UDCRRS

Add 14

Total 18 Models

Vol.2

Published April 2024

Long Neck Radius End Mills for Roughing Process



UNION TOOL CO.

UDCRRS

Additional 14 models



6 Flute / 10 Flute Long Neck Radius End Mills for Roughing Cemented Carbide and Hard Brittle Materials

Ø1~Ø6
MG
UDC
40°
R
R ±0.01
Shank Dia 0/-0.005

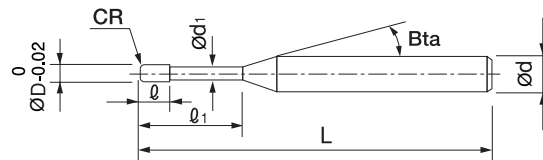
Material Applications (★ Highly Recommended ● Recommended ○ Suggested)

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

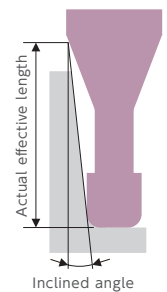
※Hard Brittle (Non-Metallic) Materials: Ceramics (Alumina, Zirconia, etc.), Glasses and etc.

Multi-flute Radius

Deep milling on axial depth



The shank taper angle shown is not an exact value.



High Efficiency

Ø1~Ø4
6 Flutes

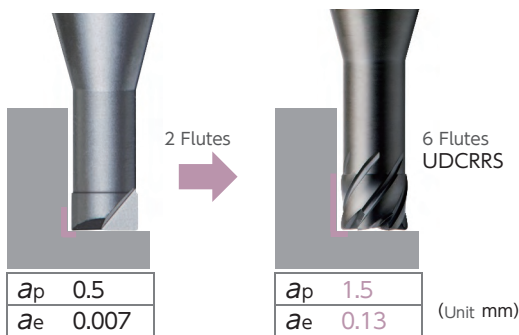


Ø6
10 Flutes



6 Flutes, 10 Flutes with a 40° helix angle help to reduce cutting load allowing for deep milling on axial depth.

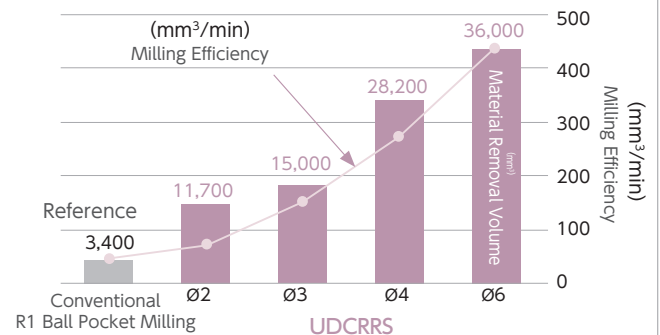
Milling amount compared with 2 Flutes (Ø 2 X EL 6)



Compared to a tool with 2 flutes, the a_p is 3 times and the a_e is 18 times higher.

This shows a significant efficiency improvement.

Cutting material removal volume for each size



Milling efficiency and material removal volume exceeds the conventional tool.

6 Flute / 10 Flute Long Neck Radius End Mills for Roughing Cemented Carbide and Hard Brittle Materials

Total 18 models

Unit (mm)

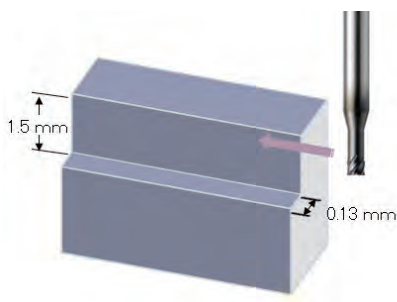
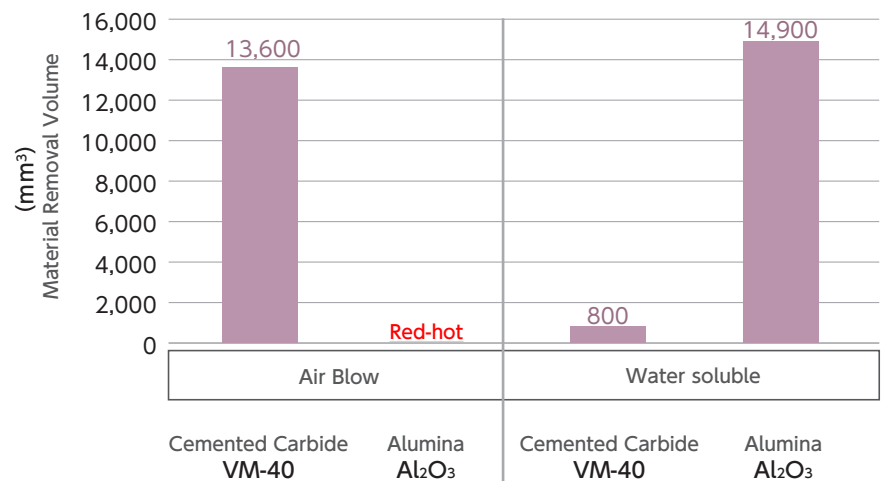
Model Number	Outside Diameter $\varnothing D$	Corner Radius CR	Effective Length ℓ_1	Length of Cut ℓ	Neck Diameter $\varnothing d_1$	Shank Taper Angle Bta	Overall Length L	Shank Diameter $\varnothing d$	Number of Flutes	Series	Effective Length by Inclined Angles				
											30°	1°	1°30'	2°	3°
※ UDCRRS 6010-005-025	1	R0.05	2.5	0.8	0.9	16°	50	4	6	UDCRRS	2.72	2.80	2.89	2.99	3.21
※ UDCRRS 6010-010-025		R0.1					50	4		UDCRRS	2.71	2.80	2.89	2.99	3.20
※ UDCRRS 6010-020-025		R0.2					50	4		UDCRRS	2.71	2.79	2.88	2.97	3.18
※ UDCRRS 6015-005-035	1.5	R0.05	3.5	1.2	1.34	16°	50	4	6	UDCRRS	3.86	3.98	4.11	4.25	4.57
※ UDCRRS 6015-010-035		R0.1					50	4		UDCRRS	3.85	3.98	4.11	4.24	4.55
※ UDCRRS 6015-020-035		R0.2					50	4		UDCRRS	3.85	3.97	4.10	4.23	4.53
※ UDCRRS 6020-010-050	2	R0.1	5	1.6	1.77	16°	50	4	6	UDCRRS	5.53	5.70	5.89	6.09	6.54
※ UDCRRS 6020-020-050		R0.2					50	4		UDCRRS	5.52	5.70	5.88	6.08	6.52
※ UDCRRS 6020-030-050		R0.3					50	4		UDCRRS	5.52	5.69	5.87	6.06	6.50
※ UDCRRS 6030-010-075	3	R0.1	7.5	2.4	2.77	16°	60	6	6	UDCRRS	8.10	8.36	8.64	8.94	9.60
※ UDCRRS 6030-020-075		R0.2					60	6		UDCRRS	8.10	8.36	8.63	8.92	9.58
※ UDCRRS 6030-030-075		R0.3					60	6		UDCRRS	8.10	8.35	8.62	8.91	9.56
UDCRRS 6040-020-100	4	R0.2	10	3.2	3.77	16°	60	6	6	UDCRRS	10.68	11.02	11.38	11.77	12.64
※ UDCRRS 6040-030-100		R0.3					60	6		UDCRRS	10.68	11.01	11.37	11.76	12.61
※ UDCRRS 6040-050-100		R0.5					60	6		UDCRRS	10.67	11.00	11.35	11.73	12.57
UDCRRS 10060-020150	6	R0.2	15	4.8	5.77	16°	60	6	10	UDCRRS	No Interference	No Interference	No Interference	No Interference	No Interference
※ UDCRRS 10060-030150		R0.3					60	6		UDCRRS	No Interference	No Interference	No Interference	No Interference	No Interference
※ UDCRRS 10060-050150		R0.5					60	6		UDCRRS	No Interference	No Interference	No Interference	No Interference	No Interference

※ Additional model

Comparison of material removal volume by coolant UDCRRS $\varnothing 2 \times CR0.2 \times EL5$

VM-40 (90 HRA) Cemented Carbide
 Al_2O_3 Alumina

Spindle Speed	20,000 min ⁻¹
Feed Rate	375 mm/min
a_p Axial Depth	1.5 mm
a_e Radial Depth	0.13 mm
Coolant	Air Blow Water soluble



**We recommend
air blow for cemented carbide
and
water soluble for ceramics.**

UDCRRS Milling Conditions

WORK MATERIAL				CEMENTED CARBIDE (≥87HRA)							
Model Number	Outside Diameter (mm)	Corner Radius (mm)	Effective Length (mm)	Flat milling				Side milling / Trochoidal			
				Spindle Speed (min ⁻¹)	Feed Rate (mm/min)	a _p Axial Depth (mm)	a _e Radial Depth (mm)	Spindle Speed (min ⁻¹)	Feed Rate (mm/min)	a _p Axial Depth (mm)	a _e Radial Depth (mm)
6010-005-025	1	R0.05	2.5	30,000	375	0.05	0.4	30,000	2250	0.8	0.01
6010-010-025		R0.1									
6010-020-025		R0.2									
6015-005-035	1.5	R0.05	3.5	23,400	375	0.05	0.6	30,000	2700	1.2	0.01
6015-010-035		R0.1									
6015-020-035		R0.2									
6020-010-050	2	R0.1	5	20,000	375	0.1	0.8	24,000	2700	1.6	0.02
6020-020-050		R0.2									
6020-030-050		R0.3									
6030-010-075	3	R0.1	7.5	17,500	375	0.1	1.2	17,500	2300	2.4	0.02
6030-020-075		R0.2									
6030-030-075		R0.3									
6040-020-100	4	R0.2	10	15,000	375	0.1	1.6	15,000	1780	3	0.06
6040-030-100		R0.3									
6040-050-100		R0.5									
10060-020150	6	R0.2	15	10,000	375	0.2	1	10,000	1950	3	0.08
10060-030150		R0.3									
10060-050150		R0.5									

UNION TOOL EUROPE S.A.



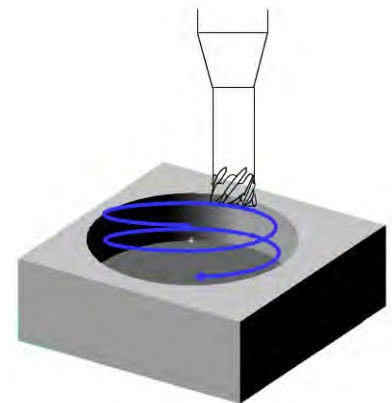
UDCRRS Helical Milling

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Ramping / Helical milling is possible with our UDCRRS Series

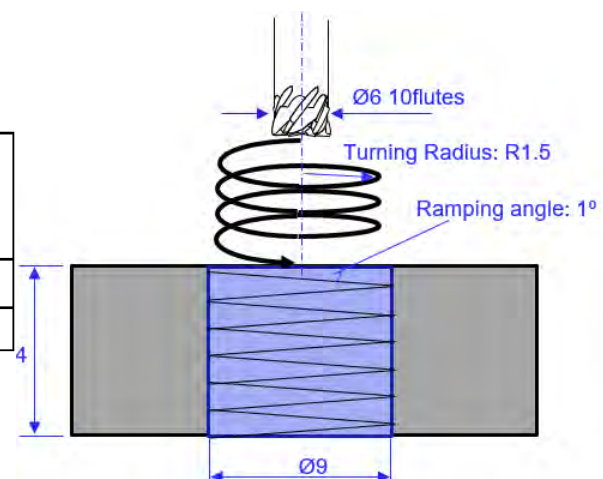
We recommend Feed Rate = 100 mm/min

Ramping angle = 1 degrees



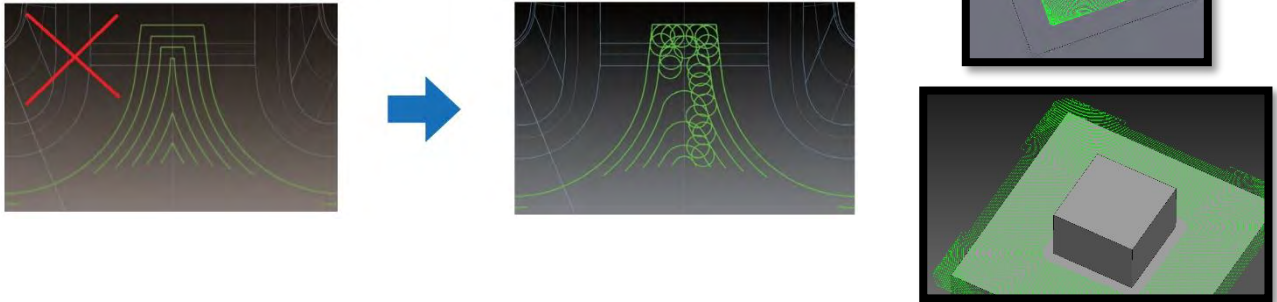
Milling example with UDCRRS 10060-020150

Spindle speed n	Feed rate Vf	Ramping angle	Turning Radius R	Milling time
min ⁻¹	mm/min	°	mm	min
10,000	100	1	1.5	2.3



1. For Cemented carbide side milling, please use circular arc with the right trochoid arc R. Avoid “spiral milling” roughing strategies.

- Trochoid R0.2mm minimum for UDCRRS Ø2, Ø3 and Ø4mm
- Trochoid R0.8mm minimum for UDCRRS Ø6mm



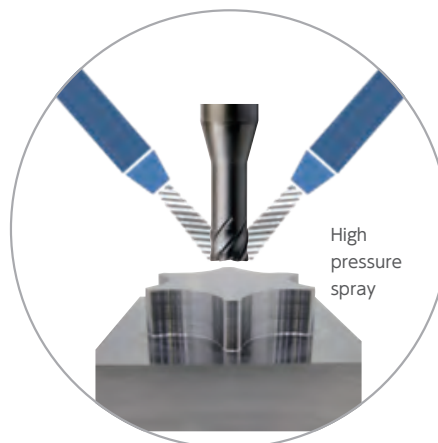
2. Avoid Z movement for noncutting toolpath during Trochoidal milling.

3. Avoid acceleration for noncutting toolpath during Trochoidal milling.

4. Be careful with the spindle expansion:

- Allow few minutes (recommended 10 minutes) spindle warm up when changing a tool and check the Z level of your UDCRRS.
- The spindle, the tool holder and the cutting tool should have the same temperature to avoid expansion during cutting moves.

5. For a good chip evacuation, please use high pressure air blow from multiple direction



UDCRRS Milling Conditions

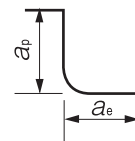
WORK MATERIAL				HARD BRITTLE MATERIALS							
Model Number	Outside Diameter (mm)	Corner Radius (mm)	Effective Length (mm)	Flat milling				Side milling			
				Spindle Speed (min ⁻¹)	Feed Rate (mm/min)	a _p Axial Depth (mm)	a _e Radial Depth (mm)	Spindle Speed (min ⁻¹)	Feed Rate (mm/min)	a _p Axial Depth (mm)	a _e Radial Depth (mm)
6010-005-025	1	R0.05	2.5	30,000	375	0.05	0.4	30,000	280	0.75	0.025
6010-010-025		R0.1			375	0.05	0.4		280	0.75	0.025
6010-020-025		R0.2			375	0.05	0.4		280	0.75	0.025
6015-005-035	1.5	R0.05	3.5	23,400	375	0.05	0.6	23,400	330	1.125	0.05
6015-010-035		R0.1			375	0.05	0.6		330	1.125	0.05
6015-020-035		R0.2			375	0.05	0.6		330	1.125	0.05
6020-010-050	2	R0.1	5	20,000	375	0.1	0.8	20,000	375	1.5	0.05
6020-020-050		R0.2			375	0.1	0.8		375	1.5	0.13
6020-030-050		R0.3			375	0.1	0.8		375	1.5	0.13
6030-010-075	3	R0.1	7.5	17,500	375	0.1	1.2	17,500	375	2.2	0.19
6030-020-075		R0.2			375	0.1	1.2		375	2.2	0.19
6030-030-075		R0.3			375	0.1	1.2		375	2.2	0.19
6040-020-100	4	R0.2	10	15,000	375	0.1	1.6	15,000	375	3	0.25
6040-030-100		R0.3			375	0.12	1.6		375	3	0.25
6040-050-100		R0.5			375	0.2	1.6		375	3	0.25
10060-020150	6	R0.2	15	10,000	375	0.2	1	10,000	375	4	0.3
10060-030150		R0.3			460	0.2	1		375	4	0.3
10060-050150		R0.5			560	0.2	1		375	4	0.3

WORK MATERIAL				CEMENTED CARBIDE (<87HRA)							
Model Number	Outside Diameter (mm)	Corner Radius (mm)	Effective Length (mm)	Flat milling				Side milling			
				Spindle Speed (min ⁻¹)	Feed Rate (mm/min)	a _p Axial Depth (mm)	a _e Radial Depth (mm)	Spindle Speed (min ⁻¹)	Feed Rate (mm/min)	a _p Axial Depth (mm)	a _e Radial Depth (mm)
6010-005-025	1	R0.05	2.5	20,000	375	0.05	0.4	20,000	1,270	0.75	0.01
6010-010-025		R0.1			375	0.05	0.4		1,270	0.75	0.01
6010-020-025		R0.2			375	0.05	0.4		1,270	0.75	0.01
6015-005-035	1.5	R0.05	3.5	13,400	375	0.05	0.6	13,400	1,355	1.125	0.02
6015-010-035		R0.1			375	0.05	0.6		1,355	1.125	0.02
6015-020-035		R0.2			375	0.05	0.6		1,355	1.125	0.02
6020-010-050	2	R0.1	5	10,000	375	0.1	0.8	10,000	1,440	1.5	0.02
6020-020-050		R0.2			375	0.1	0.8		1,440	1.5	0.02
6020-030-050		R0.3			375	0.1	0.8		1,440	1.5	0.02
6030-010-075	3	R0.1	7.5	6,700	375	0.1	1.2	6,700	1,610	2.2	0.02
6030-020-075		R0.2			375	0.1	1.2		1,610	2.2	0.02
6030-030-075		R0.3			375	0.1	1.2		1,610	2.2	0.02
6040-020-100	4	R0.2	10	5,000	375	0.1	1.6	5,000	1,780	3	0.02
6040-030-100		R0.3			375	0.12	1.6		1,780	3	0.02
6040-050-100		R0.5			375	0.2	1.6		1,780	3	0.02
10060-020150	6	R0.2	15	3,300	375	0.2	1	3,300	2,000	4	0.02
10060-030150		R0.3			460	0.2	1		3,500	4	0.02
10060-050150		R0.5			560	0.2	1		5,000	4	0.02

Roughing with
UDCRRS



Finishing with
UDC 2 Flutes



*UDCRRS is designed for roughing, use other UDC 2 flutes when finishing.

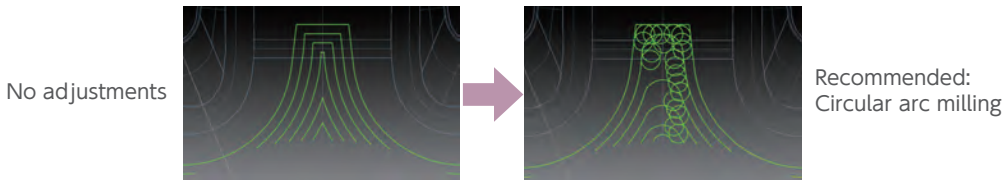
Note:

- Avoid contact with the coated area of the shank. This will prevent tip vibration and tool jamming in the collet holder.
- Use an inclined or helical approach (Recommended inclination angle: <5 degree).
- Air blow offers longer tool life when milling Cemented Carbide.
- Recommend water soluble coolant for Hard Brittle (Non-Metallic) Materials.
- 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 best way to use UDCRRS for high efficiency and long tool life

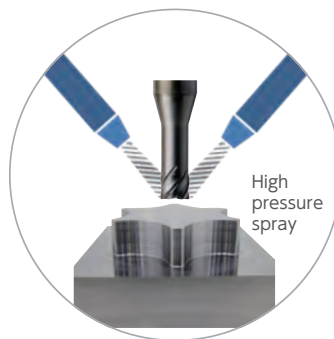
point 1 Circular arc milling

Circular arc milling is recommended so the returning point is not an acute angle. This reduces cutting load on the peripheral cutting edge.



point 2 Chip evacuation

Air blow coolant is recommended. Recommended spraying from multiple directions at high pressure as much as possible.

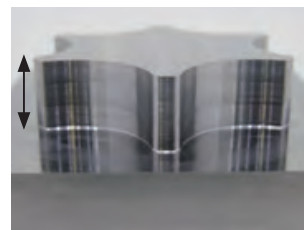


Milling example of punching die
UDCRRS $\varnothing 4 \times \text{CR0.2} \times \text{EL10}$

VM-40 (90 HRA) Cemented Carbide

Spindle Speed	15,000 min ⁻¹
Feed Rate	375 mm/min
a_p Axial Depth	3 mm
a_e Radial Depth	0.25 mm
Coolant	Air Blow
Cycle Time	93 min

Depth 9 mm
 a_p 3 mm \times 3times



Tool after milling



Milling volume 15,953 mm³ with a single tool in 93 min.
Tool damage is limited and continuous cutting is possible.



Advisory for Safe Use of End Mills

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

- Never touch the cutting edge with your bare hands, as this could cause serious injury. Special caution is required when opening the package.
- Dropping the tool could cause breakage or flying debris, leading to serious injury.
- During milling, unexpected impact or shock on the tool could cause breakage or flying debris. Ensure to use protective items such as safety glasses and a face guard.
- For best results, fine parameter adjustment may be required, depending on the materials; milling shape and strategy; machine rigidity and spindle capability.
- Use a machine that has high rigidity and generates a low level of vibration. Recommend setting the runout control value at 5µm or below for the small diameter tools $\phi 1$ or below.
- Do not use flammable cutting oils.

Advisory for Regrinding End Mills

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

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(U.S. HEADQUARTERS)

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Price & Specifications are subject to change without notice.

