

UNION TOOL

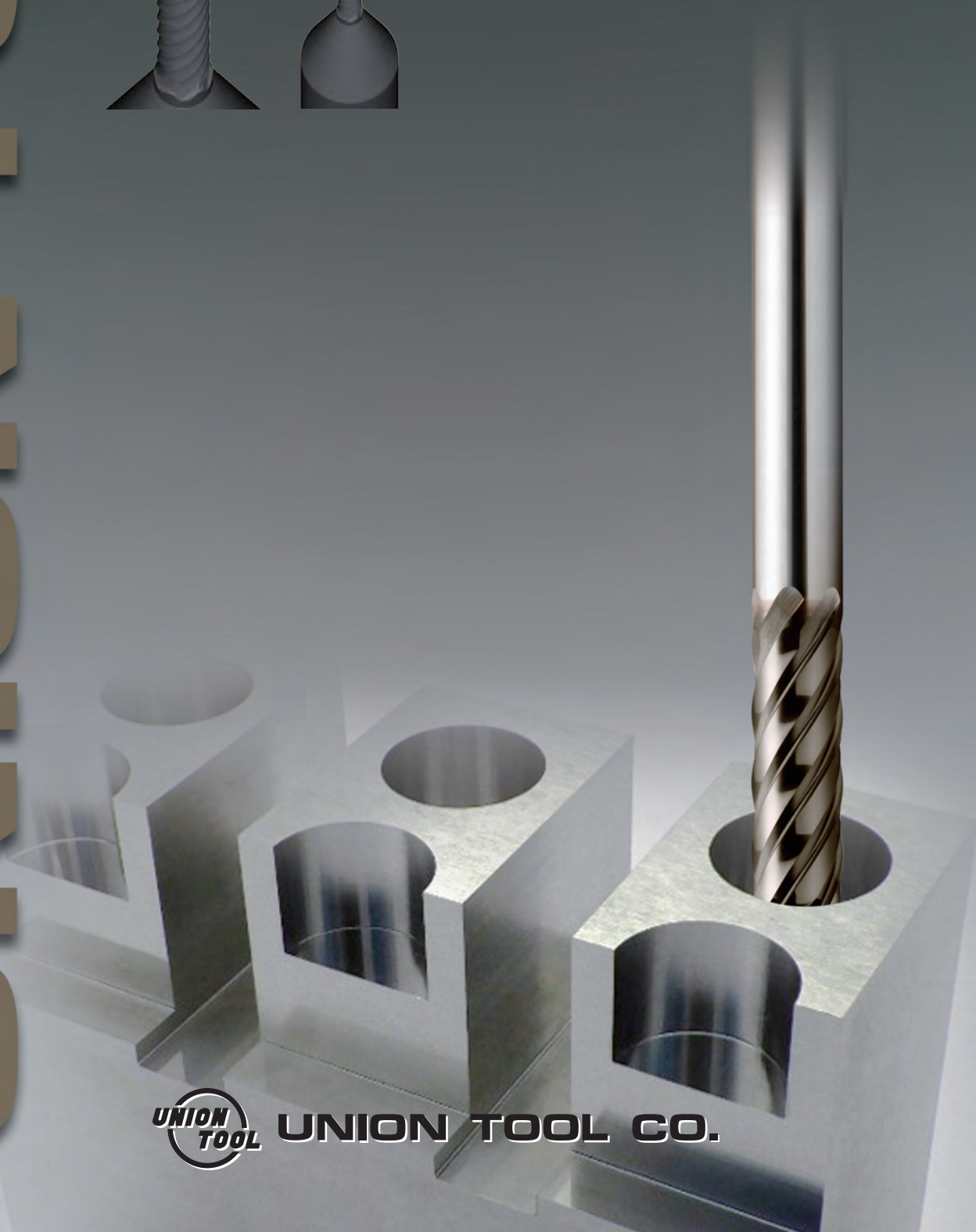
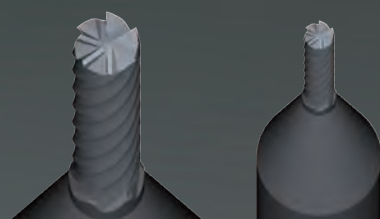
Tungsten Carbide End Mills UNIMAX Series

NEW

Published July 2025

HGS

HMGCOAT 6 Flute Square End Mills for Hard Materials



UNION TOOL CO.

Most effective for hard materials over 60HRC

6 Flute All Flute Square End Mills

HGS

Milling example
HGS Ø 6 × L18

HAP10 (64 HRC)

Helical milling

Ø12 × Depth 9 mm

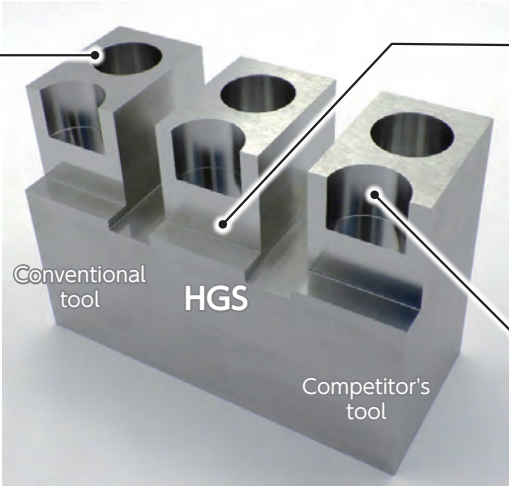
Cycle time : 46 min

Roughing

n=2,100
Vf=90
Inclined angle
0.25° Allowance
0.02

Finishing

n=2,100
Vf=90
ae=0.02
Inclined angle 0.25°



Vertical wall milling

18 mm × 5 mm × Depth 18 mm

Cycle time : 49 min

n=2,100

Vf=150

ap=18

ae=0.02

Trochoidal milling

R6 × Depth 9 mm

Cycle time : 11 min

Roughing

n=4,200
Vf=600
ap=9 ae=0.12
Allowance 0.02

Finishing

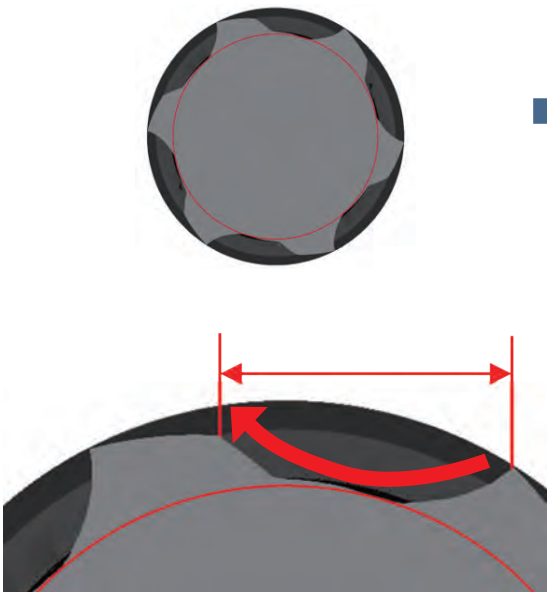
n=2,100
Vf=150
ap=9 ae=0.02

Feature 1
High rigidity

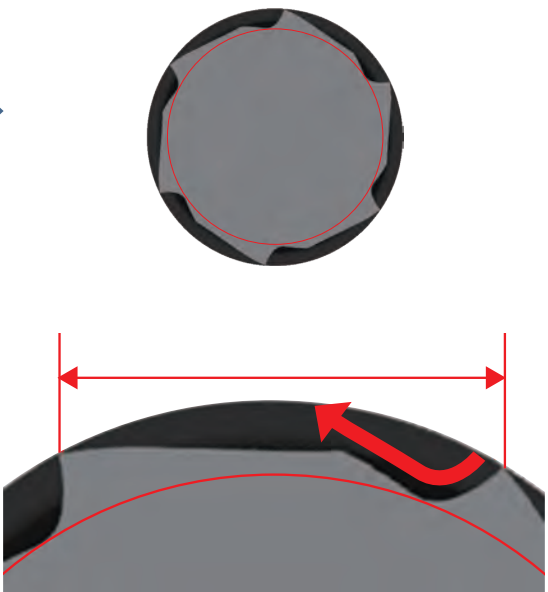
Increased core diameter makes rigidity higher which improves deflection accuracy.

The new flute and peripheral design provides a chip outlet and prevents chips from being stuck inside the flute.

Conventional tool



HGS



Feature 2

Prevention of deflection and waviness

High rigidity prevents deflection.

Helix angle 35° prevents surface waviness.

Conventional helix 45°

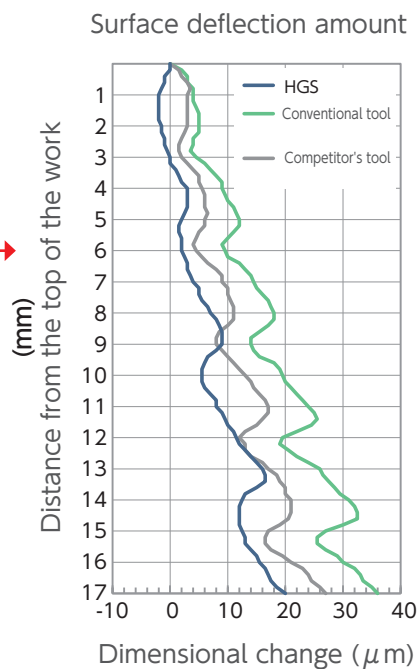
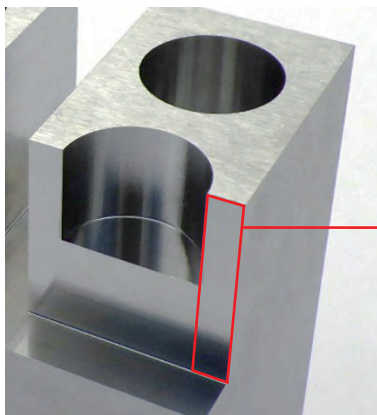


HGS helix 35°

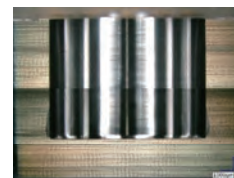


Vertical wall milling

HGS Ø 6 × L18



HGS
Ra0.068



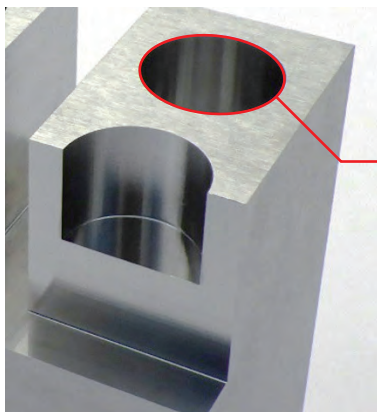
Conventional tool
Ra0.073



Competitor's tool
Ra0.082

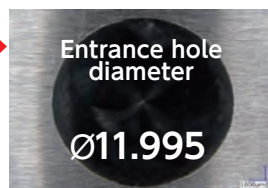
Helical milling

HGS Ø 6 × L18

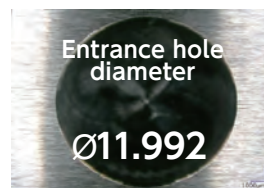


Prevention of deflection enables milling of dimensions close to the target value in hard materials.

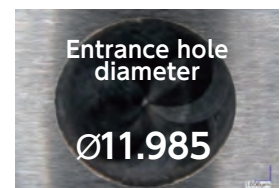
HGS



Conventional tool



Competitor's tool



Targeted hole diameter Ø12mm (helical milling with Ø6mm end mills)
Helical milling after measuring the actual outside diameter and applying the appropriate tool offset.



HMGCOAT 6 Flute Square End Mills for Hard Materials

Ø1~Ø12

Super MG

HMG COAT

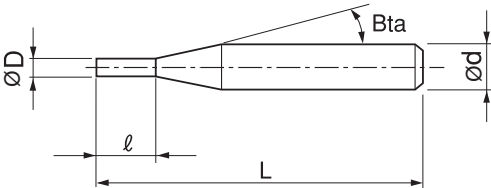
35°

Flatland

Shank Dia 0/-0.004

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										
			○	●	★	★	○										



The shank taper angle shown is not an exact value.

Feature 3

Multi flutes & High accuracy

6 flute design is applied to all sizes. Diameter tolerances have been significantly tightened compared to the conventional models.



Conventional

Outside Diameter	Diameter Tolerance	Number of Flutes
Ø1 ≤ D ≤ Ø3	0/-0.02	3 Flutes
Ø4 ≤ D ≤ Ø5		4 Flutes
D = Ø6		6 Flutes
Ø8 ≤ D ≤ Ø12	0/-0.03	

HGS

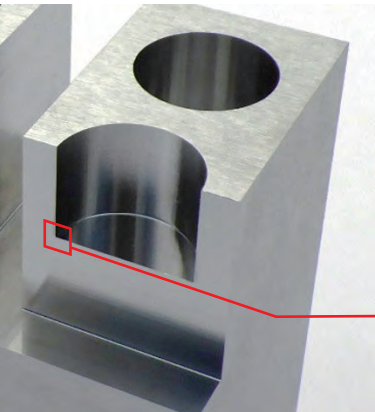
Outside Diameter	Diameter Tolerance	Number of Flutes
Ø1 ≤ D ≤ Ø6	0/-0.01	6 Flutes
Ø8 ≤ D ≤ Ø12	0/-0.015	

Diameter tolerance for L/D=5D
D=Ø6 : -0.005/-0.02
Ø8 ≤ D ≤ Ø12 : -0.005/-0.02

Feature 4

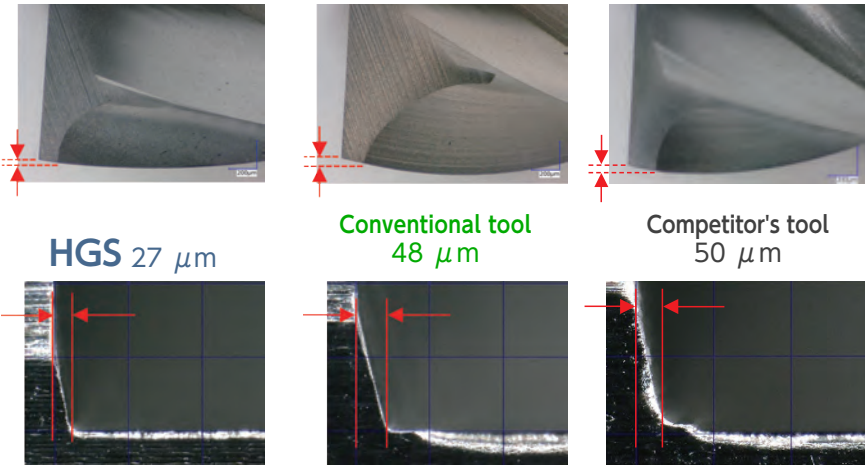
Near right angle corner milling

Micro flatland design enables near right angle corner milling.



Trochoidal semicircular milling

HGS Ø6 × L18



Total 27 models

Unit (mm)

Model Number	Outside Diameter ØD	Length of Cut ℓ	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød	Series
HGS 6010-0200	1	2	16°	45	4	HGS
HGS 6010-0300		3		45	4	HGS
HGS 6015-0300	1.5	3	16°	45	4	HGS
HGS 6015-0450		4.5		45	4	HGS
HGS 6020-0400	2	4	16°	45	4	HGS
HGS 6020-0600		6		45	4	HGS
HGS 6030-0600	3	6	16°	50	6	HGS
HGS 6030-0900		9		60	6	HGS
HGS 6030-1500		15		60	6	HGS
HGS 6040-0800	4	8	16°	50	6	HGS
HGS 6040-1200		12		60	6	HGS
HGS 6040-2000		20		70	6	HGS
HGS 6050-1000	5	10	16°	50	6	HGS
HGS 6050-1500		15		60	6	HGS
HGS 6050-2500		25		70	6	HGS
HGS 6060-1200	6	12	-	50	6	HGS
HGS 6060-1800		18		60	6	HGS
HGS 6060-3000		30		70	6	HGS
HGS 6080-1600	8	16	-	60	8	HGS
HGS 6080-2400		24		70	8	HGS
HGS 6080-4000		40		90	8	HGS
HGS 6100-2000	10	20	-	70	10	HGS
HGS 6100-3000		30		80	10	HGS
HGS 6100-5000		50		100	10	HGS
HGS 6120-2400	12	24	-	75	12	HGS
HGS 6120-3600		36		100	12	HGS
HGS 6120-6000		60		120	12	HGS

Roughing

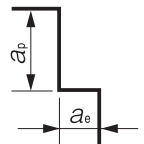
WORK MATERIAL			HARDENED STEELS SKD11 (55~62HRC)				HARDENED STEELS HAP10 (62~66HRC)				HARDENED STEELS HAP72 (66~70HRC)			
Model Number	Outside Diameter (mm)	Length of Cut (mm)	Spindle Speed (min ⁻¹)	Feed Rate (mm/min)	a _p Axial Depth (mm)	a _e Radial Depth (mm)	Spindle Speed (min ⁻¹)	Feed Rate (mm/min)	a _p Axial Depth (mm)	a _e Radial Depth (mm)	Spindle Speed (min ⁻¹)	Feed Rate (mm/min)	a _p Axial Depth (mm)	a _e Radial Depth (mm)
6010-0200	1	2	7,200	930	1.5	0.01	7,000	620	1.5	0.01	6,200	530	1.5	0.005
6010-0300		3	6,600	780	1.5	0.01	6,400	520	1.5	0.01	5,600	440	1.5	0.005
6015-0300	1.5	3	7,000	960	2.25	0.03	6,800	640	2.25	0.03	6,000	540	2.25	0.015
6015-0450		4.5	6,300	800	2.25	0.03	6,200	530	2.25	0.03	5,500	450	2.25	0.015
6020-0400	2	4	6,800	980	3	0.04	6,600	650	3	0.04	5,800	550	3	0.04
6020-0600		6	6,100	810	3	0.04	6,000	540	3	0.04	5,300	460	3	0.04
6030-0600	3	6	6,200	990	4.5	0.06	6,100	660	4.5	0.06	5,400	560	4.5	0.06
6030-0900		9	5,600	830	4.5	0.06	5,500	550	4.5	0.06	4,800	470	4.5	0.06
6030-1500		15	2,900	420	4.5	0.03	2,800	280	4.5	0.03	2,400	80	4.5	0.03
6040-0800	4	8	5,700	1,020	6	0.08	5,600	680	6	0.08	4,900	580	6	0.08
6040-1200		12	5,200	860	6	0.08	5,100	570	6	0.08	4,500	480	6	0.08
6040-2000		20	2,700	430	6	0.04	2,600	290	6	0.04	2,300	80	6	0.04
6050-1000	5	10	5,200	1,050	7.5	0.1	5,100	700	7.5	0.1	4,500	600	7.5	0.1
6050-1500		15	4,700	870	7.5	0.1	4,600	580	7.5	0.1	4,100	490	7.5	0.1
6050-2500		25	2,400	440	7.5	0.05	2,300	290	7.5	0.05	2,100	80	7.5	0.05
6060-1200	6	12	4,700	1,080	9	0.12	4,600	720	9	0.12	4,100	610	9	0.12
6060-1800		18	4,300	900	9	0.12	4,200	600	9	0.12	3,700	510	9	0.12
6060-3000		30	2,200	450	9	0.06	2,100	300	9	0.06	1,900	80	9	0.06
6080-1600	8	16	4,100	920	12	0.16	4,000	880	12	0.16	3,500	750	12	0.16
6080-2400		24	3,700	770	12	0.16	3,600	730	12	0.16	3,200	620	12	0.16
6080-4000		40	1,800	390	12	0.08	1,800	370	12	0.08	530	50	12	0.08
6100-2000	10	20	3,600	1,090	15	0.2	3,500	1,040	15	0.2	3,100	880	15	0.2
6100-3000		30	3,300	910	15	0.2	3,200	870	15	0.2	2,800	740	15	0.2
6100-5000		50	1,600	460	15	0.1	1,600	440	15	0.1	470	60	15	0.1
6120-2400	12	24	3,400	1,260	18	0.24	3,300	1,200	18	0.24	2,900	1,020	18	0.24
6120-3600		36	3,100	1,050	18	0.24	3,000	1,000	18	0.24	2,600	850	18	0.24
6120-6000		60	1,500	530	18	0.12	1,500	500	18	0.12	430	60	18	0.12

Finishing

WORK MATERIAL			HARDENED STEELS SKD11 (55~62HRC)				HARDENED STEELS HAP10 (62~66HRC)				HARDENED STEELS HAP72 (66~70HRC)			
Model Number	Outside Diameter (mm)	Length of Cut (mm)	Spindle Speed (min ⁻¹)	Feed Rate (mm/min)	a _p Axial Depth (mm)	a _e Radial Depth (mm)	Spindle Speed (min ⁻¹)	Feed Rate (mm/min)	a _p Axial Depth (mm)	a _e Radial Depth (mm)	Spindle Speed (min ⁻¹)	Feed Rate (mm/min)	a _p Axial Depth (mm)	a _e Radial Depth (mm)
6010-0200	1	2	3,600	350	2	0.01	3,500	230	2	0.01	3,100	200	2	0.005
6010-0300		3	3,300	200	3	0.01	3,200	130	3	0.01	2,800	110	3	0.005
6015-0300	1.5	3	3,500	360	3	0.01	3,400	240	3	0.01	3,000	200	3	0.005
6015-0450		4.5	3,150	200	4.5	0.01	3,100	130	4.5	0.01	2,750	110	4.5	0.005
6020-0400	2	4	3,400	370	4	0.01	3,300	240	4	0.01	2,900	210	4	0.01
6020-0600		6	3,050	200	6	0.01	3,000	140	6	0.01	2,650	120	6	0.01
6030-0600	3	6	3,100	370	6	0.015	3,050	250	6	0.015	2,700	210	6	0.015
6030-0900		9	2,800	210	9	0.015	2,750	140	9	0.015	2,400	120	9	0.015
6030-1500		15	930	80	15	0.015	920	40	15	0.015	800	40	15	0.015
6040-0800	4	8	2,850	380	8	0.015	2,800	260	8	0.015	2,450	220	8	0.015
6040-1200		12	2,600	220	12	0.015	2,550	140	12	0.015	2,250	120	12	0.015
6040-2000		20	870	80	20	0.015	850	40	20	0.015	750	40	20	0.015
6050-1000	5	10	2,600	390	10	0.015	2,550	260	10	0.015	2,250	230	10	0.015
6050-1500		15	2,350	220	15	0.015	2,300	150	15	0.015	2,050	120	15	0.015
6050-2500		25	780	80	25	0.015	770	40	25	0.015	680	40	25	0.015
6060-1200	6	12	2,350	410	12	0.02	2,300	270	12	0.02	2,050	230	12	0.02
6060-1800		18	2,150	230	18	0.02	2,100	150	18	0.02	1,850	130	18	0.02
6060-3000		30	720	80	30	0.02	700	40	30	0.02	620	40	30	0.02
6080-1600	8	16	2,050	350	16	0.02	2,000	330	16	0.02	1,750	280	16	0.02
6080-2400		24	1,850	190	24	0.02	1,800	180	24	0.02	1,600	160	24	0.02
6080-4000		40	620	100	40	0.02	600	50	40	0.02	530	50	40	0.02
6100-2000	10	20	1,800	410	20	0.02	1,750	390	20	0.02	1,550	330	20	0.02
6100-3000		30	1,650	230	30	0.02	1,600	220	30	0.02	1,400	190	30	0.02
6100-5000		50	550	100	50	0.02	530	50	50	0.02	470	50	50	0.02
6120-2400	12	24	1,700	470	24	0.02	1,650	450	24	0.02	1,450	380	24	0.02
6120-3600		36	1,550	260	36	0.02	1,500	250	36	0.02	1,300	210	36	0.02
6120-6000		60	520	100	60	0.02	500	50	60	0.02	430	50	60	0.02

Note:

- Decrease the feed rate more than 50% from the milling parameters when slot milling.
- Decrease both spindle speed and feed rate proportionally when the milling parameters exceed the machine's maximum spindle speed, or when chattering and red-hot occur.
- Every coolant offers stable milling.





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 $5\mu\text{m}$ 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.

U.S. UNION TOOL, INC.

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<https://www.uniontool.co.jp>



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Price & Specifications are subject to change without notice.