

UNION TOOL

Tungsten Carbide End Mills UNIMAX Series

NEW
Published October 2021

HMGCOAT 4 Flutes Long Neck Radius End Mills

Total 76 Models

HGLRS

4 Flutes For Hard Materials



UNION TOOL CO.

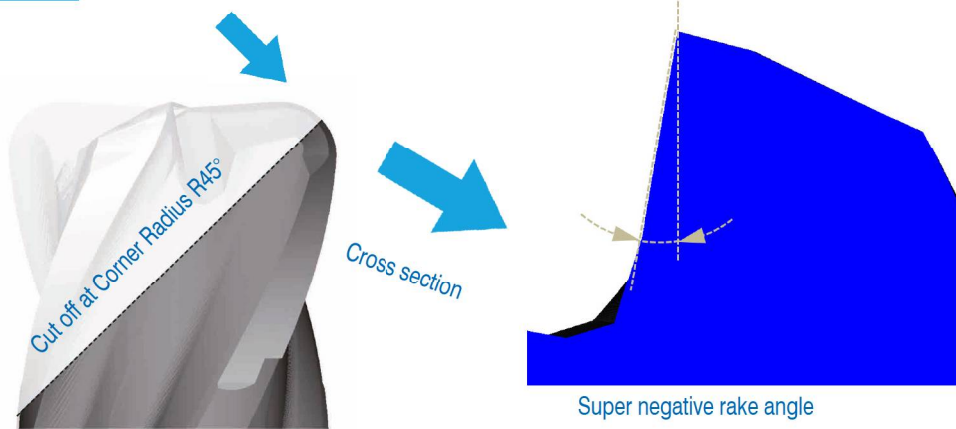
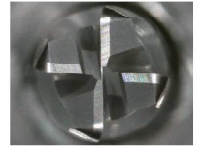
4 Flute Long Neck Radius for Hard Materials

HGLRS



Feature 1
Long tool life

Super negative rake angle is best suited for 60-70 HRC as it greatly reduces the cutting resistance.

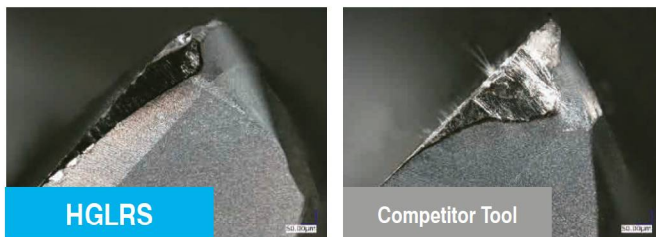


Wear width comparison

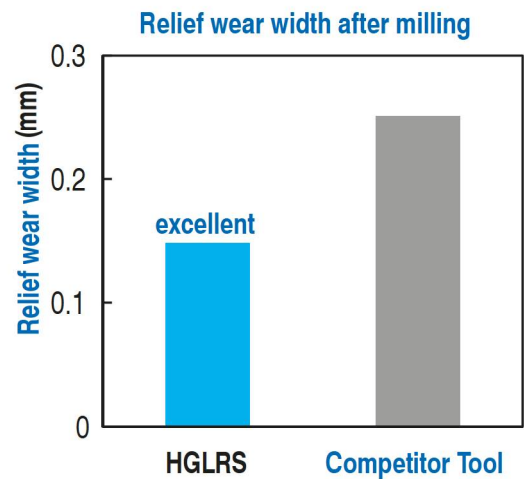
HGLRS $\varnothing 3 \times \text{CR}0.3 \times$ **Effective Length 16**

HAP72 (69HRC)

New generation super hard materials ensure high efficiency milling and long tool life.



Spindle Speed	7,000 min ⁻¹
Feed Rate	900 mm/min
a_p Axial Depth	0.03 mm
a_e Radial Depth	0.6 mm
Coolant	Air Blow
Milling Shape	(10 × 10 × 5 mm) Square Pocket
Cycle Time	68 min



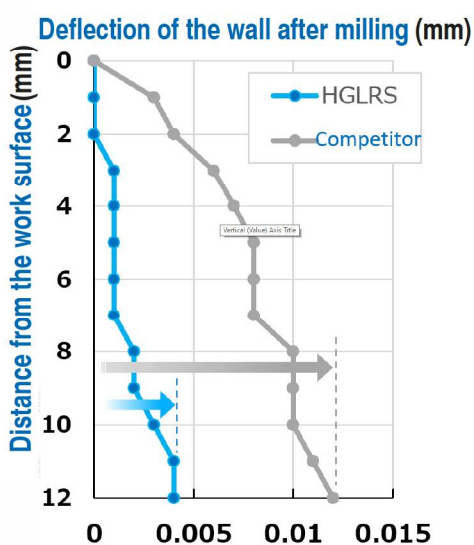
Feature 2
Milling accuracy

Improved milling accuracy and surface quality as a result of the super back taper.

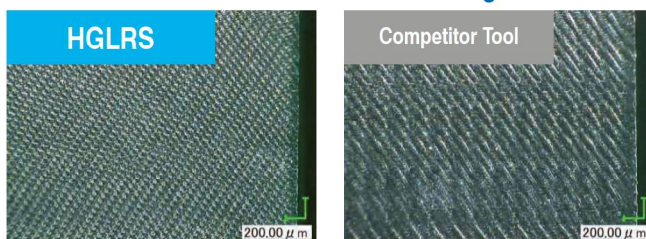
Dimensional accuracy comparison
HGLRS $\varnothing 3 \times CR0.3 \times$ **Effective Length** 16

HAP72 (69HRC)

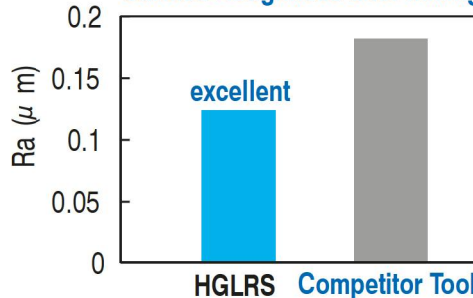
Smaller dimensional change and better milling accuracy with HGLRS



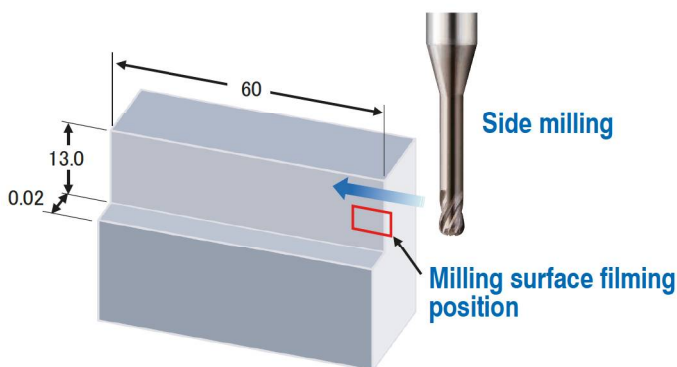
Surface condition after milling



Surface Roughness after milling (Ra)



Spindle Speed	7,000 min ⁻¹
Feed Rate	1,800 mm/min
a_p Axial Depth	0.03 mm
a_e Radial Depth	0.02 mm
Coolant	Air Blow
Cycle Time	15 min



Unit (mm)

Feature 3
High precision

Outside Diameter	Diameter Tolerance	R Radius Accuracy	Shank Diameter Tolerance
$1 \leq D \leq 5$	0/-0.01	± 0.003	0/-0.004 (h4)
D=6	-0.005/-0.02		

HMGCOAT 4 Flute Long Neck Radius End Mills for Hard Materials



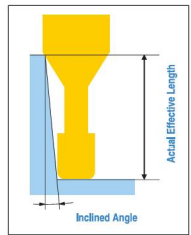
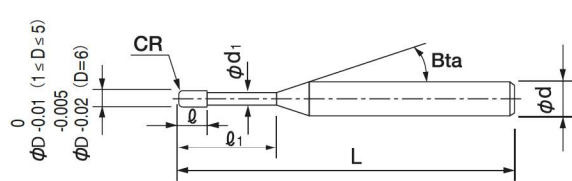
Size \varnothing 1~ \varnothing 6

HGLRS



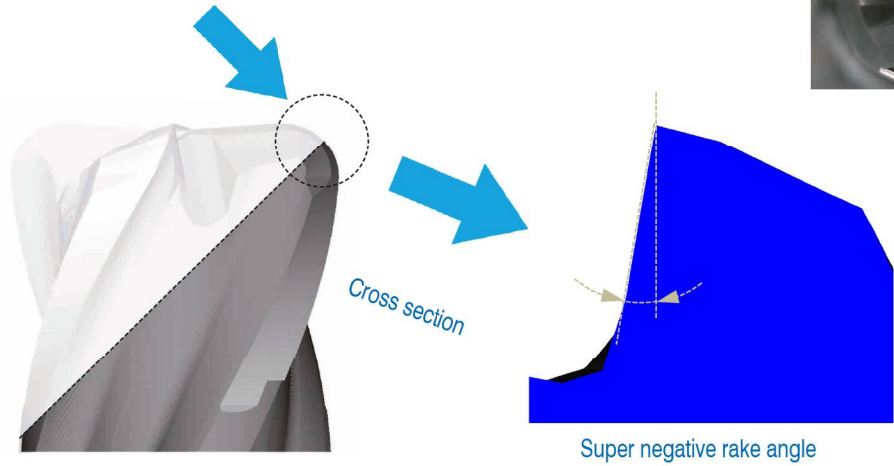
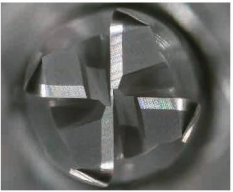
Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

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



The shank taper angle shown is not an exact value and to avoid contact with the work piece, we recommend the user controls the precise value of this angle. Shank taper angle should not make contact with the work piece.

◆ Super negative rake angle is best suited for 60-70 HRC as it greatly reduces the cutting resistance.



◆ High Precision Diameter Tolerance / Radius Accuracy / Shank Diameter Tolerance

HLRS Tolerance Unit (mm)

Outside Diameter	Diameter Tolerance	R Radius Accuracy	Shank Diameter Tolerance
1 ≤ D ≤ 5	0/-0.015	± 0.005	0/-0.005
D=6	-0.005/-0.02		

HGLRS Tolerance Unit (mm)

Outside Diameter	Diameter Tolerance	R Radius Accuracy	Shank Diameter Tolerance
1 ≤ D ≤ 5	0/-0.01	± 0.003	0/-0.004 (h4)
D=6	-0.005/-0.02		

HMGCOAT 4 Flute Long Neck Radius End Mills for Hard Materials

Total 76 models

Unit (mm)

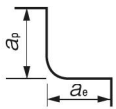
Model Number	Outside Diameter Ø D	Corner Radius CR	Effective Length $ℓ_1$	Length of Cut $ℓ$	Neck Diameter Ø d ₁	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ø d	Suggested Retail Price ¥	Effective Length by Inclined Angles								
										30°	1°	1°30'	2°	3°				
HGLRS 4010-01-020	1	R0.1	2	0.8	0.98	16°	50	4	7,400	2.58	2.75	2.90	3.05	3.31				
HGLRS 4010-01-030			3				50	4	7,400	3.65	3.86	4.05	4.21	4.55				
HGLRS 4010-01-040			4				50	4	7,400	4.71	4.96	5.17	5.36	5.80				
HGLRS 4010-01-050			5				50	4	8,100	5.77	6.05	6.28	6.51	7.04				
HGLRS 4010-02-020		R0.2	2				50	4	7,400	2.57	2.74	2.89	3.03	3.29				
HGLRS 4010-02-030			3				50	4	7,400	3.64	3.85	4.03	4.20	4.53				
HGLRS 4010-02-040			4				50	4	7,400	4.70	4.95	5.16	5.35	5.77				
HGLRS 4010-02-050			5				50	4	8,100	5.76	6.04	6.27	6.50	7.02				
HGLRS 4015-01-030	1.5	R0.1	3	1.2	1.48	16°	50	4	7,900	3.12	3.23	3.34	3.47	3.75				
HGLRS 4015-01-040			4				50	4	7,900	4.16	4.30	4.45	4.62	4.99				
HGLRS 4015-01-060			6				50	4	7,900	6.22	6.44	6.67	6.92	7.48				
HGLRS 4015-01-080			8				50	4	8,200	8.29	8.58	8.89	9.22	9.96				
HGLRS 4015-02-030		R0.2	3				50	4	7,900	3.12	3.22	3.33	3.45	3.72				
HGLRS 4015-02-040			4				50	4	7,900	4.15	4.29	4.44	4.60	4.97				
HGLRS 4015-02-060			6				50	4	7,900	6.22	6.43	6.66	6.90	7.45				
HGLRS 4015-02-080			8				50	4	8,200	8.29	8.57	8.87	9.20	9.94				
HGLRS 4015-05-040		R0.5	4				50	4	7,900	4.14	4.27	4.41	4.56	4.89				
HGLRS 4015-05-060			6				50	4	7,900	6.21	6.41	6.63	6.86	7.38				
HGLRS 4015-05-080			8				50	4	8,200	8.28	8.55	8.84	9.16	9.87				
HGLRS 4020-02-040			2				R0.2	4	1.6	1.96	16°	50	4	7,900	4.19	4.33	4.48	4.65
HGLRS 4020-02-060	6	50		4	7,900	6.26		6.47				6.70	6.95	7.50				
HGLRS 4020-02-080	8	50		4	8,200	8.33		8.61				8.92	9.25	9.98				
HGLRS 4020-02-100	10	50		4	8,200	10.39		10.75				11.13	11.54	12.47				
HGLRS 4020-03-040	R0.3	4		50	4	7,900	4.19	4.32				4.47	4.63	4.99				
HGLRS 4020-03-060		6		50	4	7,900	6.25	6.46				6.69	6.93	7.47				
HGLRS 4020-03-080		8		50	4	8,200	8.32	8.60				8.91	9.23	9.96				
HGLRS 4020-03-100		10		50	4	8,200	10.39	10.74				11.12	11.53	12.45				
HGLRS 4020-05-040	R0.5	4		50	4	7,900	4.18	4.31				4.45	4.60	4.94				
HGLRS 4020-05-060		6		50	4	7,900	6.25	6.45				6.67	6.90	7.43				
HGLRS 4020-05-080		8		50	4	8,200	8.32	8.59				8.88	9.20	9.91				
HGLRS 4020-05-100		10		50	4	8,200	10.38	10.73				11.10	11.50	12.40				
HGLRS 4030-02-040	3	R0.2		4	2.4	2.87	16°	50				6	7,100	4.38	4.53	4.69	4.86	5.24
HGLRS 4030-02-060				6				50				6	7,100	6.45	6.67	6.90	7.16	7.73
HGLRS 4030-02-080				8				50				6	7,100	8.52	8.81	9.12	9.46	10.21
HGLRS 4030-02-100				10				50				6	7,100	10.58	10.95	11.34	11.76	12.70
HGLRS 4030-02-120			12	50				6	8,600	12.65	13.09	13.55	14.06	15.19				
HGLRS 4030-02-160			16	60				6	10,600	16.79	17.37	17.99	18.66	20.16				
HGLRS 4030-03-040			R0.3	4				50	6	7,100	4.38	4.52	4.68	4.84	5.22			
HGLRS 4030-03-060				6				50	6	7,100	6.45	6.66	6.89	7.14	7.70			
HGLRS 4030-03-080		8		50				6	7,100	8.51	8.80	9.11	9.44	10.19				
HGLRS 4030-03-100		10		50				6	7,100	10.58	10.94	11.33	11.74	12.68				
HGLRS 4030-03-120		12		50				6	8,600	12.65	13.08	13.54	14.04	15.16				
HGLRS 4030-03-160		16		60				6	10,600	16.78	17.36	17.98	18.64	20.14				

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Model Number	Outside Diameter Ø D	Corner Radius CR	Effective Length $ℓ_1$	Length of Cut $ℓ$	Neck Diameter Ø d ₁	Shank Taper Angle B _{ta}	Overall Length L	Shank Diameter Ø d	Suggested Retail Price ¥	Effective Length by Inclined Angles				
										30°	1°	1°30'	2°	3°
HGLRS 4030-05-040	3	R0.5	4	2.4	2.87	16°	50	6	7,100	4.37	4.51	4.66	4.81	5.17
HGLRS 4030-05-060			6				50	6	7,100	6.44	6.65	6.87	7.11	7.66
HGLRS 4030-05-080			8				50	6	7,100	8.51	8.79	9.09	9.41	10.14
HGLRS 4030-05-100			10				50	6	7,100	10.57	10.93	11.31	11.71	12.63
HGLRS 4030-05-120			12				50	6	8,600	12.64	13.07	13.52	14.01	15.12
HGLRS 4030-05-160			16				60	6	10,600	16.78	17.34	17.96	18.61	20.09
HGLRS 4030-10-060		R1	6				50	6	7,100	6.42	6.61	6.81	7.04	7.53
HGLRS 4030-10-080			8				50	6	7,100	8.49	8.75	9.03	9.34	10.02
HGLRS 4030-10-100			10				50	6	7,100	10.55	10.89	11.25	11.64	12.51
HGLRS 4030-10-120			12				50	6	8,600	12.62	13.03	13.46	13.94	14.99
HGLRS 4030-10-160			16				60	6	10,600	16.75	17.31	17.90	18.53	19.97
HGLRS 4040-03-080			4				R0.3	8	3.2	3.77	16°	60	6	10,600
HGLRS 4040-03-120	12	60		6	10,600	12.84		13.28				13.75	14.25	15.39
HGLRS 4040-03-160	16	60		6	10,600	16.97		17.56				18.18	18.85	No Interference
HGLRS 4040-03-200	20	70		6	11,800	21.11		21.83				22.61	23.45	No Interference
HGLRS 4040-05-080	R0.5	8		60	6	10,600	8.70	8.98				9.29	9.63	10.37
HGLRS 4040-05-120		12		60	6	10,600	12.83	13.26				13.73	14.23	15.35
HGLRS 4040-05-160		16		60	6	10,600	16.97	17.54				18.16	18.82	No Interference
HGLRS 4040-05-200		20		70	6	11,800	21.10	21.82				22.59	23.42	No Interference
HGLRS 4040-10-080	R1	8		60	6	10,600	8.68	8.95				9.24	9.55	10.25
HGLRS 4040-10-120		12		60	6	10,600	12.81	13.23				13.67	14.15	15.22
HGLRS 4040-10-160		16		60	6	10,600	16.95	17.50				18.10	18.75	20.19
HGLRS 4040-10-200		20		70	6	11,800	21.08	21.78				22.54	23.35	No Interference
HGLRS 4060-05-120	6	R0.5	12	4.8	5.77	—	60	6	15,400	No Interference	No Interference	No Interference	No Interference	No Interference
HGLRS 4060-05-160			16				60	6	15,400	No Interference	No Interference	No Interference	No Interference	No Interference
HGLRS 4060-05-200			20				70	6	15,400	No Interference	No Interference	No Interference	No Interference	No Interference
HGLRS 4060-05-240			24				70	6	15,400	No Interference	No Interference	No Interference	No Interference	No Interference
HGLRS 4060-05-300			30				100	6	18,000	No Interference	No Interference	No Interference	No Interference	No Interference
HGLRS 4060-10-120		R1	12				60	6	15,400	No Interference	No Interference	No Interference	No Interference	No Interference
HGLRS 4060-10-160			16				60	6	15,400	No Interference	No Interference	No Interference	No Interference	No Interference
HGLRS 4060-10-200			20				70	6	15,400	No Interference	No Interference	No Interference	No Interference	No Interference
HGLRS 4060-10-240			24				70	6	15,400	No Interference	No Interference	No Interference	No Interference	No Interference
HGLRS 4060-10-300			30				100	6	18,000	No Interference	No Interference	No Interference	No Interference	No Interference

HGLRS Milling Conditions

WORK MATERIAL			PREHARDENED STEELS / HARDENED STEELS NAK / STAVAX (~55HRC)				HARDENED STEELS SKD11 (55~62HRC)				HARDENED STEELS HAP10 (62~66HRC)				HARDENED STEELS HAP72 (66~70HRC)			
Model Number	Outside Diameter (mm)	Effective Length (mm)	Spindle Speed (min ⁻¹)	Feed Rate (mm/min)	a _p Axial Depth (mm)	a _e Radial Depth (mm)	Spindle Speed (min ⁻¹)	Feed Rate (mm/min)	a _p Axial Depth (mm)	a _e Radial Depth (mm)	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)
4010	1	2	15,300	1,200	0.04	0.27	10,300	710	0.03	0.27	8,900	800	0.02	0.27	8,600	780	0.02	0.26
		3	13,200	1,150	0.04	0.27	9,400	680	0.03	0.27	8,500	770	0.02	0.25	8,300	750	0.02	0.24
		4	12,000	1,070	0.03	0.24	8,500	640	0.02	0.24	8,100	730	0.01	0.23	7,900	710	0.01	0.22
		5	11,000	960	0.03	0.23	7,800	570	0.01	0.14	7,700	700	0.01	0.21	7,500	680	0.01	0.2
4015	1.5	3	14,800	1,330	0.05	0.54	8,900	760	0.02	0.66	8,800	870	0.02	0.41	8,500	840	0.02	0.4
		4	13,200	1,280	0.04	0.5	8,600	740	0.02	0.62	8,500	840	0.02	0.39	8,300	820	0.02	0.38
		6	10,600	1,210	0.04	0.45	8,100	690	0.02	0.56	8,000	790	0.02	0.35	7,800	770	0.02	0.34
		8	9,300	1,020	0.03	0.35	7,600	650	0.02	0.52	7,500	740	0.02	0.31	7,300	720	0.02	0.3
4020	2	4	14,300	1,460	0.07	0.81	8,600	860	0.03	0.9	8,500	930	0.03	0.54	8,300	900	0.03	0.52
		6	12,000	1,200	0.06	0.73	8,300	830	0.02	0.83	8,100	890	0.02	0.49	7,900	860	0.02	0.48
		8	10,400	1,100	0.06	0.65	7,900	790	0.02	0.76	7,800	840	0.02	0.45	7,600	820	0.02	0.44
		10	9,300	1,020	0.05	0.53	7,500	750	0.02	0.69	7,400	800	0.02	0.41	7,200	780	0.02	0.4
4030	3	4	14,000	2,640	0.08	0.72	8,900	1,140	0.04	1.45	8,700	1,110	0.04	0.87	8,400	1,080	0.04	0.84
		6	13,300	2,500	0.08	0.72	8,600	1,110	0.04	1.38	8,400	1,080	0.04	0.82	8,200	1,050	0.04	0.8
		8	11,800	2,200	0.07	0.7	8,400	1,080	0.04	1.31	8,100	1,050	0.04	0.78	7,900	1,020	0.04	0.76
		10	10,500	2,090	0.06	0.7	8,100	1,050	0.04	1.25	7,900	1,020	0.04	0.74	7,700	990	0.04	0.72
		12	10,000	1,950	0.05	0.67	7,900	1,010	0.03	1.18	7,700	990	0.04	0.7	7,500	960	0.03	0.68
		16	8,800	1,600	0.04	0.63	7,400	950	0.03	1	7,200	930	0.03	0.62	7,000	900	0.03	0.6
4040	4	8	8,500	1,420	0.1	1.35	6,200	1,130	0.05	1.8	6,100	1,090	0.05	1.07	5,900	1,060	0.05	1.04
		12	7,600	1,390	0.09	1.15	5,900	1,080	0.05	1.66	5,800	1,040	0.05	0.99	5,600	1,010	0.05	0.96
		16	6,600	1,330	0.07	1	5,700	1,030	0.04	1.52	5,600	1,000	0.05	0.91	5,400	970	0.04	0.88
		20	5,800	1,260	0.06	0.9	5,400	980	0.04	1.38	5,300	950	0.04	0.82	5,100	920	0.04	0.8
4060	6	12	4,700	1,360	0.2	1.35	3,900	1,180	0.07	3.38	3,800	1,150	0.07	2	3,700	1,120	0.07	1.95
		16	4,000	1,150	0.19	1.33	3,800	1,150	0.06	3.21	3,700	1,110	0.06	1.9	3,600	1,080	0.06	1.85
		20	3,500	1,000	0.18	1.31	3,700	1,120	0.06	3	3,600	1,080	0.06	1.8	3,500	1,050	0.06	1.75
		24	3,100	860	0.17	1.29	3,600	1,080	0.06	2.86	3,500	1,050	0.06	1.7	3,400	1,020	0.06	1.65
		30	2,600	740	0.16	1.26	3,400	1,030	0.05	2.6	3,300	1,000	0.05	1.55	3,200	970	0.05	1.5



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 UNIMAX 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 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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