

**UNION TOOL**

# Tungsten Carbide End Mills UNIMAX Series

**NEW**  
Launched November 2025

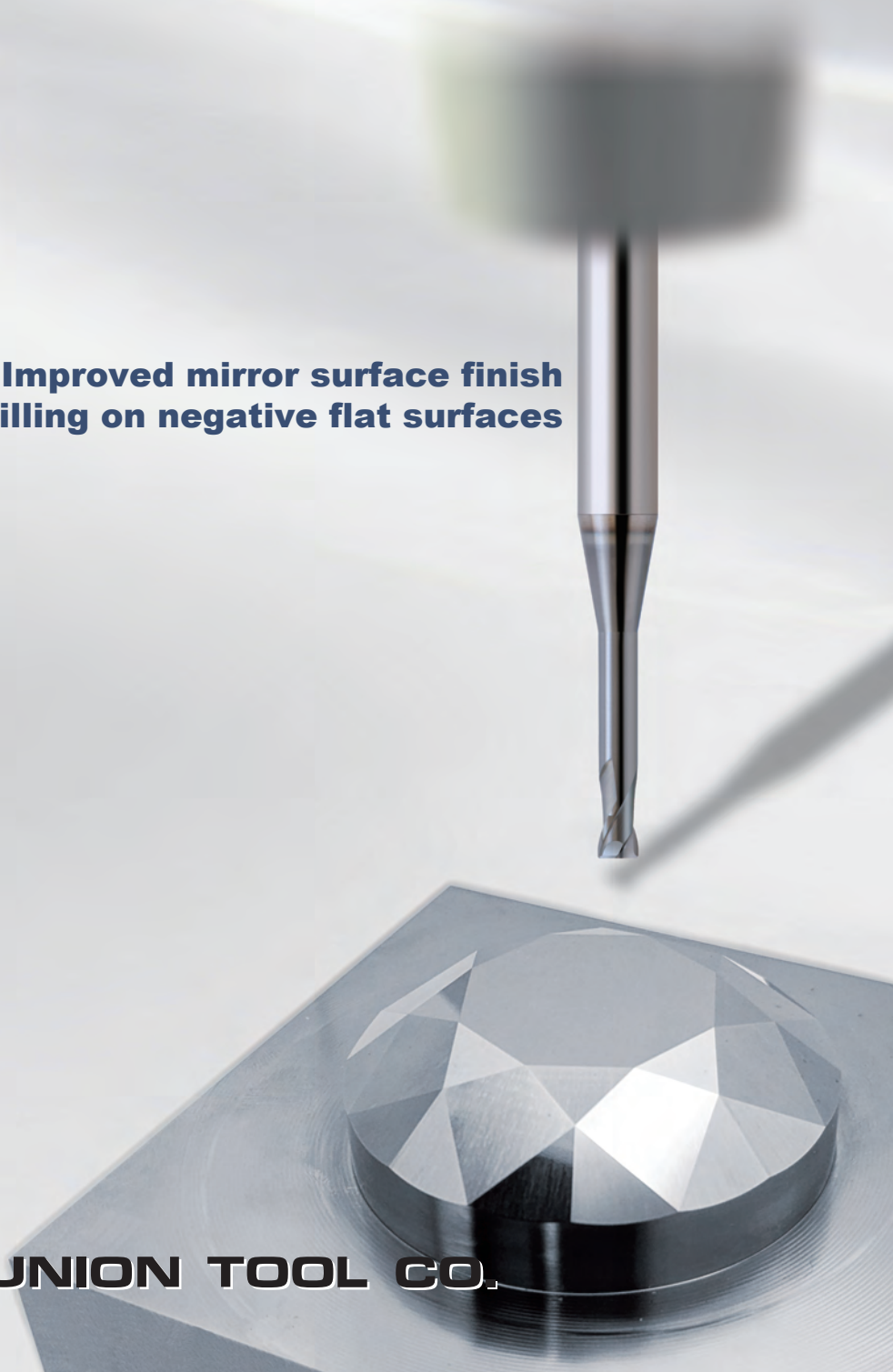
**UTCOAT 2 Flute Long Neck Radius End Mills**

**CLRS**  **Best for soft materials up to 40HRC**

**Improved mirror surface finish  
when flat milling on negative flat surfaces**



**UNION TOOL CO.**



# CLRS

NEW



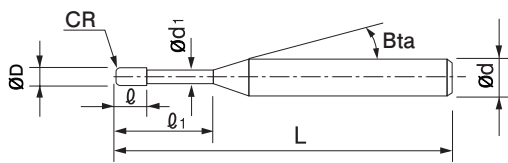
UTCOAT 2 Flute Long Neck Radius End Mills

ø0.2~ø6

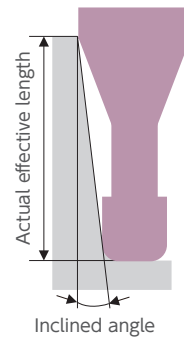


Material Applications (★ Highly Recommended ● Recommended ○ Suggested)

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 1 High precision

Even higher precision milling!

Conventional HLRS standard type Unit (mm)

Outside Diameter	Diameter Tolerance	Radius Accuracy	Shank Diameter Tolerance
$0.2 \leq D \leq 6$	0/-0.015	$\pm 0.005$	0/-0.005

## CLRS

Unit (mm)

Outside Diameter	Diameter Tolerance	Radius Accuracy	Shank Diameter Tolerance
$0.2 \leq D \leq 0.8$	<b>0/-0.008</b>	<b><math>\pm 0.003</math></b>	<b>0/-0.004 (h4 tolerance)</b>
$1 \leq D \leq 6$	<b>0/-0.01</b>		

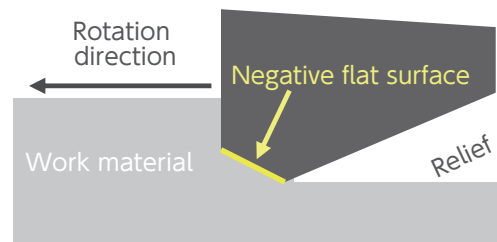
## Feature 2 Negative flat surface

Improved mirror surface finish for flat milling

Conventional tool

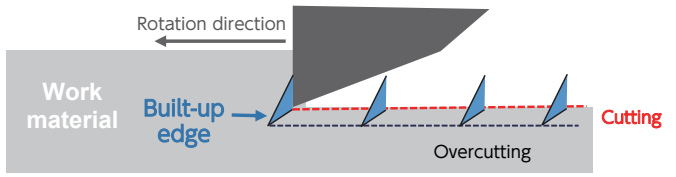
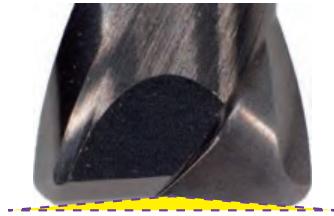
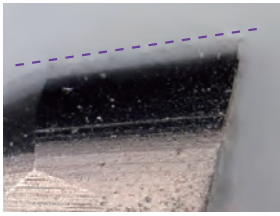


CLRS



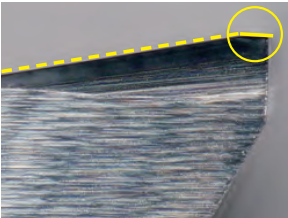
# Key points Tip geometry; Negative flat surface

Conventional tool

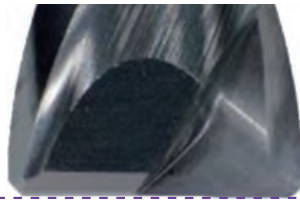


## CLRS

Negative relief angle on cutting edge



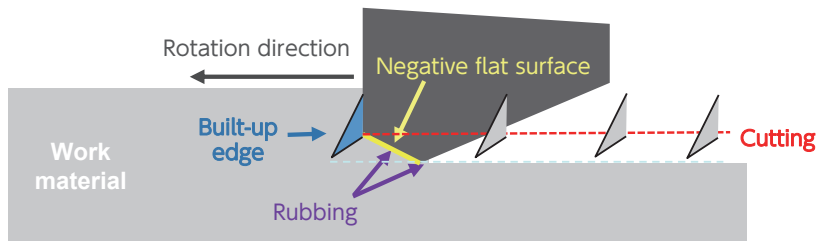
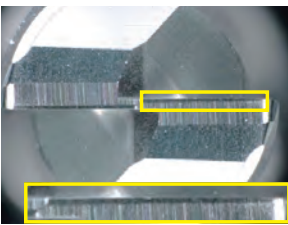
Flat tip outline



Remove cutting marks caused by the built-up edge by rubbing them with a negative flat surface.

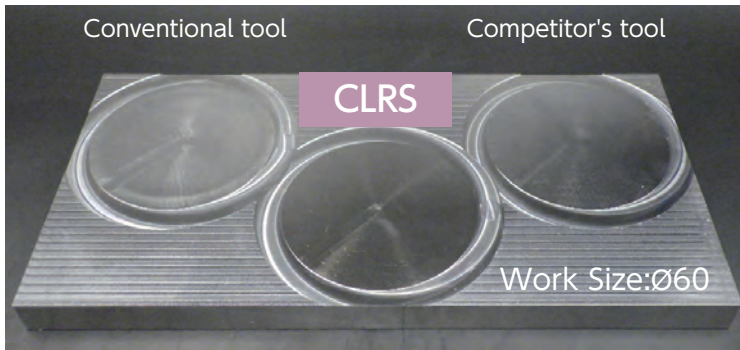
※ An inclined angle of 3° is recommended when approaching.

※ Some materials such as SUS and titanium alloys cannot be polished.



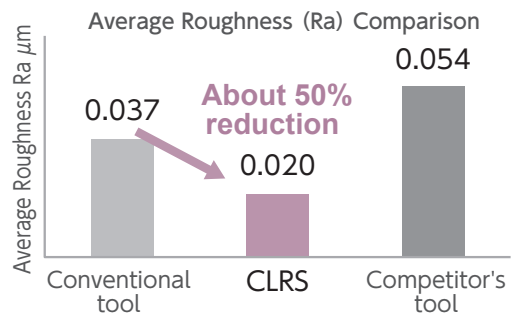
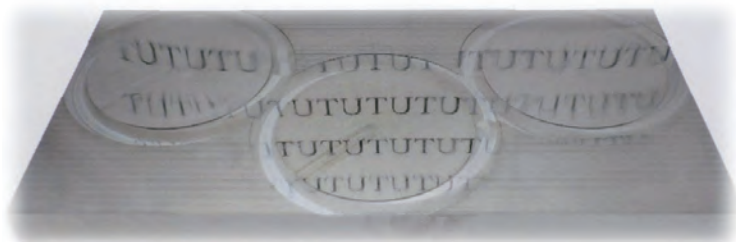
## Flat finishing comparison Ø 6 × CR0.1 × EL12

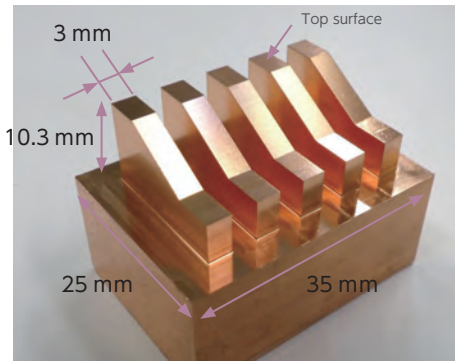
PXA30(30HRC)



Spindle Speed	5,250 min <sup>-1</sup>
Feed Rate	3,600 mm/min
$a_p$ Axial Depth	0.02 mm
$a_e$ Radial Depth	0.15 mm
Cycle Time	7 min 50 s

Coolant : Water Soluble





Process	Spindle Speed (min <sup>-1</sup> )	Feed Rate (mm/min)	a <sub>p</sub> (mm)	a <sub>e</sub> (mm)	Allowance (mm)	Cycle Time (min)
Roughing	10,500	1,600 Groove 800	0.39	0.85	0.08	21
Semi-finishing	10,500	1,600	0.03	0.15	0.03	60
Finishing	10,500	1,600	0	0.15	0.03	90

Total 171 min

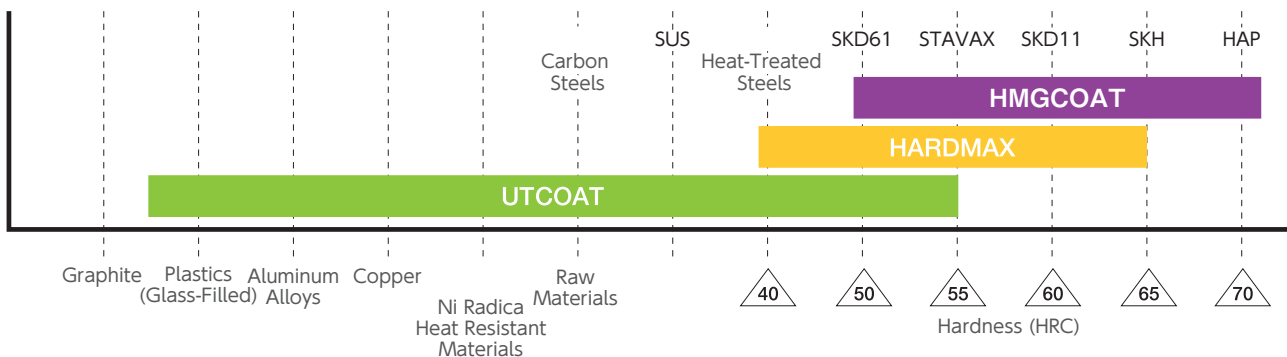
CLRS has a smaller surface roughness than conventional tools for steels.  
 Small burrs on the work surface and good edges.

### Feature 3

### Long tool life with UTCOAT



High lubricity and toughness.  
 Improved surface roughness of low to medium hardness materials and longer tool life.

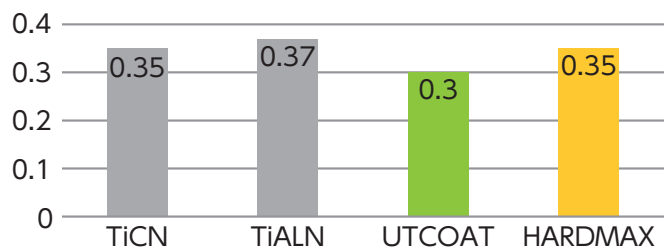


Friction coefficient of coating film

CSM instruments

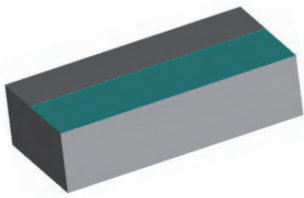
TRIBO METER

20 cm/sec.



Roughing Tool wear comparison (Flat milling)  
 Ø3 × CR0.2 × EL12

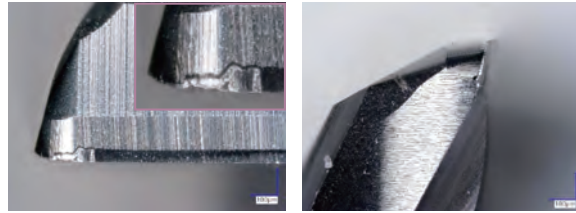
S50C



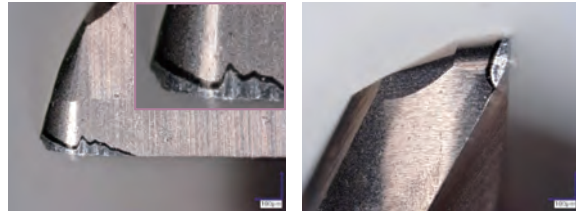
Work Size 200 × 105 mm  
 Coolant: Water Soluble

Spindle Speed	15,000 min <sup>-1</sup>
Feed Rate	1,600 mm/min
<b>a<sub>p</sub></b> Axial Depth	0.2 mm
<b>a<sub>e</sub></b> Radial Depth	0.8 mm
Cycle Time	26 min

CLRS Relief wear width 0.058 mm

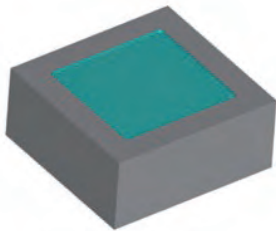


Conventional tool Relief wear width 0.077 mm



Roughing Tool wear comparison (Pocket milling)  
 Ø6 × CR0.1

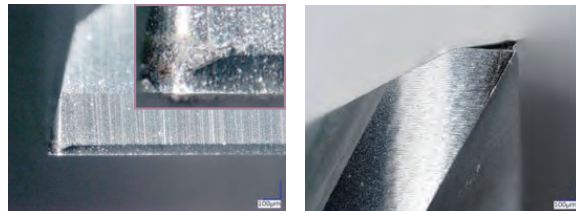
PXA30 (30HRC)



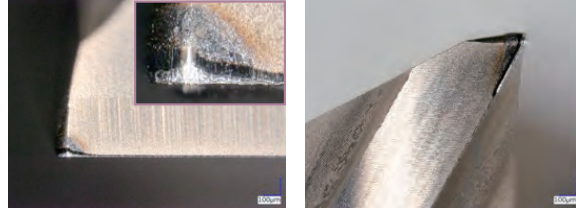
Work Size 80 × 80 × 2 mm  
 Coolant: Water Soluble

Spindle Speed	4,500 min <sup>-1</sup>
Feed Rate	880 mm/min
<b>a<sub>p</sub></b> Axial Depth	0.4 mm
<b>a<sub>e</sub></b> Radial Depth	1.26 mm
Overhang Length	32 mm
Cycle Time	27.5 min

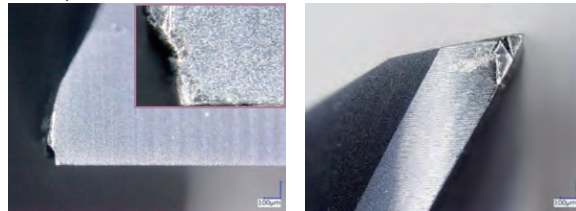
CLRS Relief wear width 0.02 mm



Conventional tool Relief wear width 0.03 mm



Competitor's tool Relief wear width 0.1 mm



Longer tool life with UTCOAT which is suitable for low to medium hardness materials.

Spindle Speed	5,200 min <sup>-1</sup>
Feed Rate	1,000 mm/min
$a_p$ Axial Depth	3 mm
$a_e$ Radial Depth	0.3 mm
Overhang Length	23 mm
Cycle Time	90 min

Coolant : Water Soluble

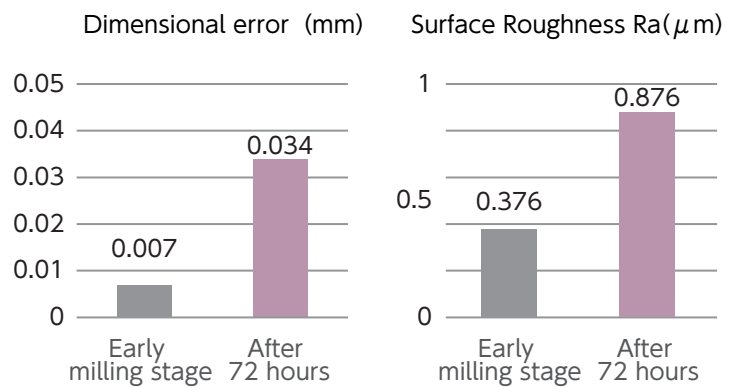
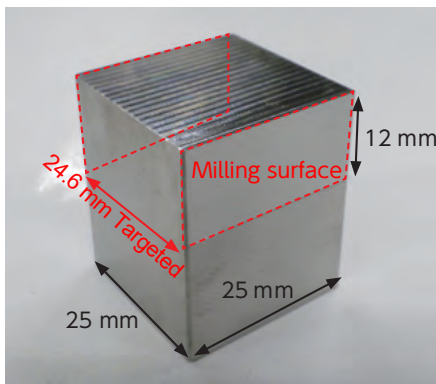
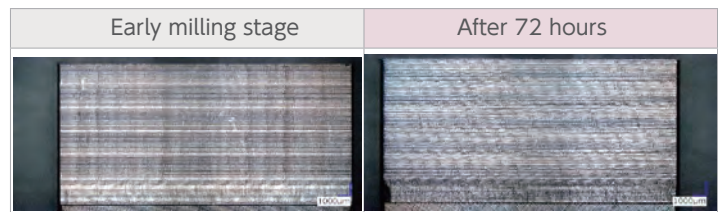


CLRS lasts more than three times longer than conventional tools and can be used continuously.

Spindle Speed	4,000 min <sup>-1</sup>
Feed Rate	500 mm/min
$a_p$ Axial Depth	2 mm
$a_e$ Radial Depth	0.1 mm
Cycle Time	72 h

Coolant : Water Soluble

Milling surface photo



After milling 72 hours, there are no noticeable burrs or roughness on the surface and can be used continuously.

Total 187 models

Unit (mm)

Model Number	Outside Diameter ØD	Corner Radius CR	Effective Length $l_1$	Length of Cut $l$	Neck Diameter $\phi d_1$	Shank Taper Angle Bta	Overall Length L	Shank Diameter $\phi d$	Series	Effective Length by Inclined Angles								
										30°	1°	1°30'	2°	3°				
CLRS 2002-002-005	0.2	R0.02	0.5	0.2	0.19	11°	50	4	CLRS	0.63	0.67	0.70	0.74	0.84				
CLRS 2002-002-010			1				50	4	CLRS	1.16	1.22	1.28	1.35	1.52				
CLRS 2002-002-015			1.5				50	4	CLRS	1.67	1.75	1.84	1.95	2.19				
CLRS 2002-005-005		R0.05	0.5				50	4	CLRS	0.63	0.66	0.70	0.74	0.83				
CLRS 2002-005-010			1				50	4	CLRS	1.16	1.21	1.28	1.35	1.51				
CLRS 2002-005-015			1.5				50	4	CLRS	1.67	1.75	1.84	1.94	2.18				
CLRS 2003-002-010	0.3	R0.02	1	0.3	0.29	11°	50	4	CLRS	1.16	1.22	1.28	1.35	1.52				
CLRS 2003-002-020			2				50	4	CLRS	2.19	2.30	2.42	2.56	2.87				
CLRS 2003-005-010		R0.05	1				50	4	CLRS	1.16	1.21	1.28	1.35	1.51				
CLRS 2003-005-020			2				50	4	CLRS	2.19	2.30	2.42	2.55	2.86				
CLRS 2004-002-010	0.4	R0.02	1	0.4	0.39	11°	50	4	CLRS	1.16	1.22	1.28	1.36	1.53				
CLRS 2004-002-020			2				50	4	CLRS	2.19	2.30	2.42	2.56	2.88				
CLRS 2004-002-030			3				50	4	CLRS	3.24	3.40	3.58	3.78	4.25				
CLRS 2004-005-010		R0.05	1				50	4	CLRS	1.16	1.22	1.28	1.35	1.52				
CLRS 2004-005-020			2				50	4	CLRS	2.19	2.30	2.42	2.55	2.87				
CLRS 2004-005-030			3				50	4	CLRS	3.24	3.40	3.58	3.77	4.24				
CLRS 2004-01-010		R0.1	1				50	4	CLRS	1.16	1.21	1.27	1.34	1.50				
CLRS 2004-01-020			2				50	4	CLRS	2.19	2.29	2.41	2.54	2.85				
CLRS 2004-01-030			3				50	4	CLRS	3.24	3.39	3.57	3.76	4.22				
CLRS 2005-005-010		0.5	R0.05				1	0.5	0.49	11°	50	4	CLRS	1.16	1.22	1.28	1.35	1.52
CLRS 2005-005-020							2				50	4	CLRS	2.19	2.30	2.42	2.55	2.87
CLRS 2005-005-030							3				50	4	CLRS	3.24	3.40	3.58	3.77	4.24
CLRS 2005-005-050	5			50	4	CLRS	5.33				5.60	5.89	6.21	6.97				
CLRS 2005-01-010	R0.1			1	50	4	CLRS				1.16	1.21	1.27	1.34	1.50			
CLRS 2005-01-020			2	50	4	CLRS	2.19				2.29	2.41	2.54	2.85				
CLRS 2005-01-030			3	50	4	CLRS	3.24				3.39	3.57	3.76	4.22				
CLRS 2005-01-050			5	50	4	CLRS	5.33				5.59	5.88	6.20	6.96				
CLRS 2006-005-020			0.6	R0.05	2	0.6	0.59				11°	50	4	CLRS	2.19	2.30	2.42	2.55
CLRS 2006-005-040	4				50							4	CLRS	4.29	4.50	4.73	4.99	5.61
CLRS 2006-005-060	6	50			4			CLRS	6.38	6.69		7.04	7.43	8.34				
CLRS 2006-01-020	R0.1	2		50	4			CLRS	2.19	2.29		2.41	2.54	2.85				
CLRS 2006-01-040		4		50	4			CLRS	4.28	4.49		4.72	4.98	5.59				
CLRS 2006-01-060		6		50	4			CLRS	6.38	6.69		7.03	7.42	8.33				
CLRS 2008-005-020	0.8	R0.05	2	0.8	0.79	11°	50	4	CLRS	2.19	2.30	2.42	2.55	2.87				
CLRS 2008-005-040			4				50	4	CLRS	4.29	4.50	4.73	4.99	5.61				
CLRS 2008-005-060			6				50	4	CLRS	6.38	6.69	7.04	7.43	8.34				
CLRS 2008-005-080			8				50	4	CLRS	8.47	8.89	9.35	9.87	11.08				
CLRS 2008-01-020		R0.1	2				50	4	CLRS	2.19	2.29	2.41	2.54	2.85				
CLRS 2008-01-040			4				50	4	CLRS	4.28	4.49	4.72	4.98	5.59				
CLRS 2008-01-060			6				50	4	CLRS	6.38	6.69	7.03	7.42	8.33				
CLRS 2008-01-080			8				50	4	CLRS	8.47	8.89	9.35	9.86	11.06				
CLRS 2008-02-020		R0.2	2				50	4	CLRS	2.18	2.29	2.40	2.52	2.81				
CLRS 2008-02-040			4				50	4	CLRS	4.28	4.48	4.71	4.96	5.55				
CLRS 2008-02-060			6				50	4	CLRS	6.37	6.68	7.02	7.40	8.29				
CLRS 2008-02-080			8				50	4	CLRS	8.47	8.88	9.33	9.83	11.03				

Model Number	Outside Diameter ØD	Corner Radius CR	Effective Length ℓ <sub>1</sub>	Length of Cut ℓ	Neck Diameter Ød <sub>1</sub>	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød	Series	Effective Length by Inclined Angles								
										30°	1°	1°30'	2°	3°				
CLRS 2010-005-020	1	R0.05	2	1	0.98	11°	50	4	CLRS	2.20	2.31	2.43	2.56	2.88				
CLRS 2010-005-040			4				50	4	CLRS	4.30	4.51	4.74	5.00	5.62				
CLRS 2010-005-060			6				50	4	CLRS	6.39	6.71	7.05	7.44	8.36				
CLRS 2010-005-080			8				50	4	CLRS	8.48	8.90	9.37	9.88	11.10				
CLRS 2010-005-100			10				50	4	CLRS	10.58	11.10	11.68	12.32	13.83				
CLRS 2010-01-020		R0.1	2				50	4	CLRS	2.20	2.31	2.42	2.55	2.86				
CLRS 2010-01-040			4				50	4	CLRS	4.29	4.50	4.74	4.99	5.60				
CLRS 2010-01-060			6				50	4	CLRS	6.39	6.70	7.05	7.43	8.34				
CLRS 2010-01-080			8				50	4	CLRS	8.48	8.90	9.36	9.87	11.08				
CLRS 2010-01-100			10				50	4	CLRS	10.58	11.10	11.67	12.31	13.82				
CLRS 2010-02-020		R0.2	2				50	4	CLRS	2.20	2.30	2.41	2.53	2.83				
CLRS 2010-02-040			4				50	4	CLRS	4.29	4.49	4.72	4.97	5.57				
CLRS 2010-02-060			6				50	4	CLRS	6.38	6.69	7.03	7.41	8.30				
CLRS 2010-02-080			8				50	4	CLRS	8.48	8.89	9.34	9.85	11.04				
CLRS 2010-02-100			10				50	4	CLRS	10.57	11.09	11.65	12.28	13.78				
CLRS 2015-005-040		1.5	R0.05				4	1.5	1.47	11°	50	4	CLRS	4.25	4.46	4.69	4.95	5.56
CLRS 2015-005-060							6				50	4	CLRS	6.34	6.66	7.00	7.39	8.30
CLRS 2015-005-080							8				50	4	CLRS	8.44	8.85	9.31	9.82	11.04
CLRS 2015-01-040			R0.1				4				50	4	CLRS	4.25	4.45	4.68	4.94	5.54
CLRS 2015-01-060							6				50	4	CLRS	6.34	6.65	6.99	7.38	8.28
CLRS 2015-01-080	8			50	4	CLRS	8.43				8.85	9.31	9.81	11.02				
CLRS 2015-01-120	R0.2		12	50	4	CLRS	12.62				13.24	13.93	14.69	16.49				
CLRS 2015-02-040			4	50	4	CLRS	4.24				4.44	4.67	4.92	5.50				
CLRS 2015-02-060			6	50	4	CLRS	6.34				6.64	6.98	7.35	8.24				
CLRS 2015-02-080			8	50	4	CLRS	8.43				8.84	9.29	9.79	10.98				
CLRS 2015-02-120			12	50	4	CLRS	12.62				13.23	13.91	14.67	16.46				
CLRS 2015-03-040	R0.3		4	50	4	CLRS	4.24				4.43	4.65	4.89	5.47				
CLRS 2015-03-060			6	50	4	CLRS	6.33				6.63	6.96	7.33	8.21				
CLRS 2015-03-080			8	50	4	CLRS	8.43				8.83	9.28	9.77	10.95				
CLRS 2015-03-120	R0.5		12	50	4	CLRS	12.61				13.22	13.90	14.65	16.42				
CLRS 2015-05-040			4	50	4	CLRS	4.23				4.42	4.62	4.85	5.40				
CLRS 2015-05-060			6	50	4	CLRS	6.32				6.61	6.93	7.29	8.14				
CLRS 2015-05-080			8	50	4	CLRS	8.42				8.81	9.24	9.73	10.87				
CLRS 2015-05-120			12	50	4	CLRS	12.60				13.20	13.87	14.60	16.35				

Model Number	Outside Diameter ØD	Corner Radius CR	Effective Length ℓ <sub>1</sub>	Length of Cut ℓ	Neck Diameter Ød <sub>1</sub>	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød	Series	Effective Length by Inclined Angles				
										30°	1°	1°30'	2°	3°
CLRS 2020-005-040	2	R0.05	4	2	1.98	11°	50	4	CLRS	4.22	4.43	4.66	4.92	5.52
CLRS 2020-005-060			6				50	4	CLRS	6.32	6.63	6.97	7.35	8.26
CLRS 2020-005-080			8				50	4	CLRS	8.41	8.83	9.28	9.79	11.00
CLRS 2020-005-100			10				50	4	CLRS	10.50	11.02	11.60	12.23	13.74
CLRS 2020-01-040		R0.1	4				50	4	CLRS	4.22	4.43	4.65	4.91	5.51
CLRS 2020-01-060			6				50	4	CLRS	6.31	6.62	6.96	7.34	8.24
CLRS 2020-01-080			8				50	4	CLRS	8.41	8.82	9.28	9.78	10.98
CLRS 2020-01-100			10				50	4	CLRS	10.50	11.02	11.59	12.22	13.72
CLRS 2020-01-120			12				50	4	CLRS	12.60	13.22	13.90	14.66	16.46
CLRS 2020-01-160			16				60	4	CLRS	16.78	17.61	18.52	19.53	No Interference
CLRS 2020-02-040		R0.2	4				50	4	CLRS	4.22	4.42	4.64	4.88	5.47
CLRS 2020-02-060			6				50	4	CLRS	6.31	6.61	6.95	7.32	8.21
CLRS 2020-02-080			8				50	4	CLRS	8.40	8.81	9.26	9.76	10.95
CLRS 2020-02-100			10				50	4	CLRS	10.50	11.01	11.57	12.20	13.68
CLRS 2020-02-120			12				50	4	CLRS	12.59	13.21	13.88	14.64	16.42
CLRS 2020-02-160			16				60	4	CLRS	16.78	17.60	18.51	19.51	No Interference
CLRS 2020-03-040		R0.3	4				50	4	CLRS	4.21	4.41	4.62	4.86	5.43
CLRS 2020-03-060			6				50	4	CLRS	6.30	6.60	6.93	7.30	8.17
CLRS 2020-03-080			8				50	4	CLRS	8.40	8.80	9.25	9.74	10.91
CLRS 2020-03-100			10				50	4	CLRS	10.49	11.00	11.56	12.18	13.65
CLRS 2020-03-120	12		50	4	CLRS	12.59	13.20	13.87	14.61	16.39				
CLRS 2020-03-160	16		60	4	CLRS	16.77	17.59	18.49	19.49	No Interference				
CLRS 2020-05-040	R0.5	4	50	4	CLRS	4.20	4.39	4.59	4.82	5.36				
CLRS 2020-05-060		6	50	4	CLRS	6.30	6.58	6.90	7.26	8.10				
CLRS 2020-05-080		8	50	4	CLRS	8.39	8.78	9.21	9.70	10.84				
CLRS 2020-05-100		10	50	4	CLRS	10.48	10.98	11.53	12.13	13.58				
CLRS 2020-05-120		12	50	4	CLRS	12.58	13.18	13.84	14.57	16.31				
CLRS 2020-05-160		16	60	4	CLRS	16.77	17.57	18.46	19.45	No Interference				

Model Number	Outside Diameter ØD	Corner Radius CR	Effective Length $l_1$	Length of Cut $l$	Neck Diameter $\phi d_1$	Shank Taper Angle Bta	Overall Length L	Shank Diameter $\phi d$	Series	Effective Length by Inclined Angles				
										30°	1°	1°30'	2°	3°
CLRS 2030-01-060	3	R0.1	6	3	2.95	11°	50	6	CLRS	6.39	6.71	7.05	7.44	8.35
CLRS 2030-01-100			10				50	6	CLRS	10.58	11.10	11.68	12.31	13.83
CLRS 2030-01-120			12				60	6	CLRS	12.68	13.30	13.99	14.75	16.56
CLRS 2030-01-160			16				60	6	CLRS	16.86	17.69	18.61	19.63	22.04
CLRS 2030-01-200			20				60	6	CLRS	21.05	22.09	23.23	24.50	27.52
CLRS 2030-01-250			25				70	6	CLRS	26.29	27.58	29.01	30.60	No Interference
CLRS 2030-02-060		R0.2	6				50	6	CLRS	6.39	6.70	7.04	7.42	8.31
CLRS 2030-02-100			10				50	6	CLRS	10.58	11.09	11.66	12.29	13.79
CLRS 2030-02-120			12				60	6	CLRS	12.67	13.29	13.97	14.73	16.53
CLRS 2030-02-160			16				60	6	CLRS	16.86	17.68	18.60	19.61	22.00
CLRS 2030-02-200			20				60	6	CLRS	21.05	22.08	23.22	24.48	27.48
CLRS 2030-02-250			25				70	6	CLRS	26.28	27.57	29.00	30.58	No Interference
CLRS 2030-03-060		R0.3	6				50	6	CLRS	6.39	6.69	7.02	7.40	8.28
CLRS 2030-03-100			10				50	6	CLRS	10.57	11.08	11.65	12.27	13.75
CLRS 2030-03-120			12				60	6	CLRS	12.67	13.28	13.96	14.71	16.49
CLRS 2030-03-160			16				60	6	CLRS	16.86	17.68	18.58	19.59	21.97
CLRS 2030-03-200			20				60	6	CLRS	21.04	22.07	23.20	24.46	27.45
CLRS 2030-03-250			25				70	6	CLRS	26.28	27.56	28.98	30.56	No Interference
CLRS 2030-05-060		R0.5	6				50	6	CLRS	6.38	6.67	6.99	7.35	8.21
CLRS 2030-05-100			10				50	6	CLRS	10.56	11.06	11.62	12.23	13.68
CLRS 2030-05-120			12				60	6	CLRS	12.66	13.26	13.93	14.67	16.42
CLRS 2030-05-160			16				60	6	CLRS	16.85	17.66	18.55	19.54	21.90
CLRS 2030-05-200			20				60	6	CLRS	21.03	22.05	23.17	24.42	27.37
CLRS 2030-05-250			25				70	6	CLRS	26.27	27.54	28.95	30.51	No Interference
CLRS 2030-10-060		R1	6				50	6	CLRS	6.35	6.62	6.92	7.24	8.03
CLRS 2030-10-100			10				50	6	CLRS	10.54	11.01	11.54	12.12	13.50
CLRS 2030-10-120			12				60	6	CLRS	12.63	13.21	13.85	14.56	16.24
CLRS 2030-10-160			16				60	6	CLRS	16.82	17.61	18.47	19.43	21.72
CLRS 2030-10-200			20				60	6	CLRS	21.01	22.00	23.10	24.31	27.19
CLRS 2030-10-250			25				70	6	CLRS	26.25	27.49	28.87	30.41	No Interference

Model Number	Outside Diameter ØD	Corner Radius CR	Effective Length $l_1$	Length of Cut $l$	Neck Diameter Ød <sub>1</sub>	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød	Series	Effective Length by Inclined Angles				
										30°	1°	1° 30'	2°	3°
CLRS 2040-01-080	4	R0.1	8	4	3.96	11°	60	6	CLRS	8.48	8.90	9.36	9.87	11.08
CLRS 2040-01-120			12				60	6	CLRS	12.67	13.29	13.98	14.74	16.55
CLRS 2040-01-160			16				60	6	CLRS	16.86	17.69	18.60	19.62	No Interference
CLRS 2040-01-200			20				70	6	CLRS	21.04	22.08	23.22	24.49	No Interference
CLRS 2040-01-250			25				70	6	CLRS	26.28	27.57	29.00	No Interference	No Interference
CLRS 2040-01-300			30				80	6	CLRS	31.51	33.07	34.78	No Interference	No Interference
CLRS 2040-02-080		R0.2	8				60	6	CLRS	8.48	8.89	9.34	9.85	11.04
CLRS 2040-02-120			12				60	6	CLRS	12.66	13.28	13.96	14.72	16.52
CLRS 2040-02-160			16				60	6	CLRS	16.85	17.68	18.59	19.60	No Interference
CLRS 2040-02-200			20				70	6	CLRS	21.04	22.07	23.21	24.47	No Interference
CLRS 2040-02-250			25				70	6	CLRS	26.28	27.56	28.99	No Interference	No Interference
CLRS 2040-02-300			30				80	6	CLRS	31.51	33.06	34.77	No Interference	No Interference
CLRS 2040-03-080		R0.3	8				60	6	CLRS	8.47	8.88	9.33	9.82	11.01
CLRS 2040-03-120			12				60	6	CLRS	12.66	13.27	13.95	14.70	16.48
CLRS 2040-03-160			16				60	6	CLRS	16.85	17.67	18.57	19.58	No Interference
CLRS 2040-03-200			20				70	6	CLRS	21.04	22.06	23.19	24.45	No Interference
CLRS 2040-03-250			25				70	6	CLRS	26.27	27.55	28.97	No Interference	No Interference
CLRS 2040-03-300			30				80	6	CLRS	31.51	33.05	34.75	No Interference	No Interference
CLRS 2040-05-080		R0.5	8				60	6	CLRS	8.46	8.86	9.30	9.78	10.93
CLRS 2040-05-120			12				60	6	CLRS	12.65	13.25	13.92	14.66	16.41
CLRS 2040-05-160			16				60	6	CLRS	16.84	17.65	18.54	19.53	No Interference
CLRS 2040-05-200			20				70	6	CLRS	21.03	22.04	23.16	24.41	No Interference
CLRS 2040-05-250			25				70	6	CLRS	26.26	27.53	28.94	No Interference	No Interference
CLRS 2040-05-300			30				80	6	CLRS	31.50	33.03	34.72	No Interference	No Interference
CLRS 2040-10-080		R1	8				60	6	CLRS	8.44	8.81	9.22	9.67	10.75
CLRS 2040-10-120			12				60	6	CLRS	12.63	13.20	13.84	14.55	16.23
CLRS 2040-10-160			16				60	6	CLRS	16.81	17.60	18.46	19.43	No Interference
CLRS 2040-10-200			20				70	6	CLRS	21.00	21.99	23.09	24.30	No Interference
CLRS 2040-10-250			25				70	6	CLRS	26.24	27.49	28.86	No Interference	No Interference
CLRS 2040-10-300			30				80	6	CLRS	31.47	32.98	34.64	No Interference	No Interference

UTCOAT 2 Flute Long Neck Radius End Mills

Model Number	Outside Diameter ØD	Corner Radius CR	Effective Length ℓ <sub>1</sub>	Length of Cut ℓ	Neck Diameter Ød <sub>1</sub>	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød	Series	Effective Length by Inclined Angles				
										30°	1°	1° 30'	2°	3°
CLRS 2060-01-150	6	R0.1	15	6	5.86	—	60	6	CLRS	No Interference	No Interference	No Interference	No Interference	No Interference
CLRS 2060-01-200			20				70	6	CLRS	No Interference	No Interference	No Interference	No Interference	No Interference
CLRS 2060-01-300			30				80	6	CLRS	No Interference	No Interference	No Interference	No Interference	No Interference
CLRS 2060-01-400			40				90	6	CLRS	No Interference	No Interference	No Interference	No Interference	No Interference
CLRS 2060-02-150		R0.2	15				60	6	CLRS	No Interference	No Interference	No Interference	No Interference	No Interference
CLRS 2060-02-200			20				70	6	CLRS	No Interference	No Interference	No Interference	No Interference	No Interference
CLRS 2060-02-300			30				80	6	CLRS	No Interference	No Interference	No Interference	No Interference	No Interference
CLRS 2060-02-400			40				90	6	CLRS	No Interference	No Interference	No Interference	No Interference	No Interference
CLRS 2060-03-150		R0.3	15				60	6	CLRS	No Interference	No Interference	No Interference	No Interference	No Interference
CLRS 2060-03-200			20				70	6	CLRS	No Interference	No Interference	No Interference	No Interference	No Interference
CLRS 2060-03-300			30				80	6	CLRS	No Interference	No Interference	No Interference	No Interference	No Interference
CLRS 2060-03-400			40				90	6	CLRS	No Interference	No Interference	No Interference	No Interference	No Interference
CLRS 2060-05-150		R0.5	15				60	6	CLRS	No Interference	No Interference	No Interference	No Interference	No Interference
CLRS 2060-05-200			20				70	6	CLRS	No Interference	No Interference	No Interference	No Interference	No Interference
CLRS 2060-05-300			30				80	6	CLRS	No Interference	No Interference	No Interference	No Interference	No Interference
CLRS 2060-05-400			40				90	6	CLRS	No Interference	No Interference	No Interference	No Interference	No Interference
CLRS 2060-10-150		R1	15				60	6	CLRS	No Interference	No Interference	No Interference	No Interference	No Interference
CLRS 2060-10-200			20				70	6	CLRS	No Interference	No Interference	No Interference	No Interference	No Interference
CLRS 2060-10-300			30				80	6	CLRS	No Interference	No Interference	No Interference	No Interference	No Interference
CLRS 2060-10-400			40				90	6	CLRS	No Interference	No Interference	No Interference	No Interference	No Interference

## CLRS Milling Conditions for CLRS (2 Flutes)

### Z-Level Milling

WORK MATERIAL			COPPER / ALUMINUM ALLOYS C1100 / A5052 / A7075				CARBON STEELS / ALLOY STEELS / PREHARDENED STEELS / TITANIUM ALLOYS S50C / SCM / SUS / PXA30 / NAK / Ti-6AL-4V (~40HRC)				HARDENED STEELS STAVAX / SKD61 (~55HRC)			
Model Number	Outside Diameter (mm)	Effective Length (mm)	Spindle Speed (min <sup>-1</sup> )	Feed Rate (mm/min)	a <sub>p</sub> Axial Depth (mm)	a <sub>e</sub> Radial Depth (mm)	Spindle Speed (min <sup>-1</sup> )	Feed Rate (mm/min)	a <sub>p</sub> Axial Depth (mm)	a <sub>e</sub> Radial Depth (mm)	Spindle Speed (min <sup>-1</sup> )	Feed Rate (mm/min)	a <sub>p</sub> Axial Depth (mm)	a <sub>e</sub> Radial Depth (mm)
2002	0.2	0.5	40,000	230	0.027	0.02	40,000	240	0.006	0.02	40,000	240	0.005	0.02
		1	40,000	200	0.027	0.02	40,000	200	0.006	0.02	35,000	150	0.004	0.02
		1.5	40,000	180	0.017	0.01	40,000	180	0.005	0.01	27,000	100	0.003	0.01
2003	0.3	1	40,000	500	0.03	0.02	40,000	500	0.007	0.02	35,000	350	0.005	0.02
		2	40,000	400	0.03	0.02	40,000	400	0.007	0.02	33,200	250	0.005	0.015
2004	0.4	1	40,000	610	0.048	0.063	40,000	510	0.013	0.072	40,000	370	0.011	0.072
		2	40,000	580	0.042	0.054	40,000	450	0.011	0.045	32,300	290	0.009	0.045
		3	33,900	460	0.027	0.054	33,900	390	0.008	0.027	27,100	280	0.007	0.027
2005	0.5	1	40,000	1,370	0.081	0.117	40,000	1,140	0.034	0.122	40,000	860	0.03	0.122
		2	39,900	1,000	0.075	0.108	39,900	830	0.029	0.117	32,500	630	0.026	0.117
		3	31,900	770	0.057	0.09	31,900	640	0.023	0.113	26,000	480	0.02	0.113
		5	26,400	570	0.027	0.045	26,400	470	0.011	0.099	21,500	360	0.01	0.099
2006	0.6	2	28,600	610	0.114	0.162	28,600	510	0.01	0.219	23,700	390	0.01	0.219
		4	20,400	400	0.063	0.108	20,400	330	0.005	0.104	16,800	250	0.005	0.104
		6	16,800	300	0.036	0.045	16,800	250	0.003	0.099	13,900	190	0.003	0.099
2008	0.8	2	22,000	600	0.14	0.22	22,000	500	0.016	0.117	19,000	400	0.017	0.12
		4	17,500	540	0.132	0.198	17,500	450	0.014	0.117	15,000	360	0.015	0.117
		6	14,600	410	0.075	0.144	14,600	340	0.008	0.117	12,500	270	0.008	0.108
		8	12,800	310	0.03	0.1	12,800	270	0.008	0.117	11,000	185	0.004	0.09
2010	1	2	17,600	1,100	0.21	0.45	17,600	920	0.035	0.27	15,300	750	0.04	0.27
		4	13,800	980	0.201	0.405	13,800	820	0.03	0.27	12,000	670	0.035	0.27
		6	11,300	790	0.117	0.387	11,300	650	0.021	0.216	9,800	540	0.024	0.216
		8	9,800	590	0.072	0.36	9,800	490	0.016	0.189	8,500	400	0.018	0.189
		10	8,800	390	0.048	0.315	8,800	320	0.011	0.126	7,600	270	0.013	0.126
2015	1.5	4	13,200	1,310	0.3	0.675	13,200	1,090	0.06	0.45	12,000	950	0.06	0.45
		6	10,600	1,240	0.282	0.63	10,600	1,030	0.055	0.405	9,700	900	0.055	0.405
		8	9,300	1,050	0.204	0.612	9,300	870	0.045	0.315	8,500	760	0.045	0.315
		12	7,800	800	0.114	0.54	7,800	670	0.038	0.27	7,100	580	0.038	0.27
2020	2	4	15,300	1,500	0.33	0.9	15,300	1,250	0.065	0.9	14,300	1,130	0.065	0.9
		6	12,800	1,220	0.321	0.855	12,800	1,020	0.06	0.81	12,000	930	0.06	0.81
		8	11,200	1,120	0.267	0.81	11,200	930	0.055	0.72	10,400	850	0.055	0.72
		10	10,000	1,050	0.225	0.765	10,000	870	0.047	0.585	9,300	790	0.047	0.585
		12	9,100	980	0.186	0.72	9,100	820	0.044	0.45	8,500	740	0.044	0.45
		16	7,800	830	0.132	0.702	7,800	690	0.039	0.315	7,300	630	0.039	0.315
2030	3	6	14,000	2,700	0.5	0.9	14,000	1,510	0.15	0.72	13,300	1,140	0.15	0.72
		10	11,800	1,700	0.4	0.88	11,800	1,200	0.135	0.77	11,500	930	0.125	0.69
		12	10,500	1,600	0.39	0.85	10,500	1,150	0.105	0.67	10,000	890	0.105	0.67
		16	9,200	1,160	0.321	0.81	9,200	960	0.081	0.63	8,800	730	0.081	0.63
		20	8,400	1,050	0.26	0.78	8,400	880	0.073	0.58	7,900	680	0.073	0.58
		25	7,500	980	0.18	0.72	7,500	820	0.065	0.495	7,100	620	0.065	0.495
2040	4	8	10,200	1,340	0.42	1.62	10,200	1,110	0.095	1.35	8,500	970	0.095	1.35
		12	8,900	1,300	0.41	1.56	8,900	1,080	0.083	1.15	7,600	950	0.083	1.15
		16	7,900	1,250	0.4	1.5	7,900	1,030	0.065	1	6,600	910	0.065	1
		20	6,900	1,190	0.384	1.44	6,900	990	0.054	0.9	5,800	860	0.054	0.9
		25	6,200	1,100	0.31	1.38	6,200	900	0.043	0.8	5,200	770	0.043	0.8
		30	5,500	860	0.189	1.26	5,500	720	0.027	0.648	4,600	630	0.027	0.648
2060	6	15	6,900	1,570	0.59	2.18	6,900	1,400	0.48	1.33	4,100	1,180	0.19	1.35
		20	5,800	1,350	0.58	2.12	5,800	1,180	0.46	1.31	3,500	1,000	0.18	1.31
		30	4,500	1,060	0.546	1.98	4,500	880	0.396	1.26	2,600	740	0.158	1.26
		40	3,900	880	0.416	1.86	3,900	730	0.301	1.17	2,200	610	0.12	1.17

## CLRS Milling Conditions for CLRS (2 Flutes)

### Side Milling

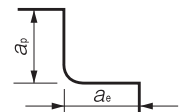
WORK MATERIAL			COPPER / ALUMINUM ALLOYS C1100 / A5052 / A7075				CARBON STEELS / STAINLESS STEELS S50C / SUS				ALLOY STEELS / PREHARDENED STEELS / HARDENED STEELS SCM / PXA30 / NAK / STAVAX (30~55HRC)				TITANIUM ALLOYS Ti-6Al-4V			
Model Number	Outside Diameter (mm)	Effective Length (mm)	Spindle Speed (min <sup>-1</sup> )	Feed Rate (mm/min)	a <sub>p</sub> Axial Depth (mm)	a <sub>e</sub> Radial Depth (mm)	Spindle Speed (min <sup>-1</sup> )	Feed Rate (mm/min)	a <sub>p</sub> Axial Depth (mm)	a <sub>e</sub> Radial Depth (mm)	Spindle Speed (min <sup>-1</sup> )	Feed Rate (mm/min)	a <sub>p</sub> Axial Depth (mm)	a <sub>e</sub> Radial Depth (mm)	Spindle Speed (min <sup>-1</sup> )	Feed Rate (mm/min)	a <sub>p</sub> Axial Depth (mm)	a <sub>e</sub> Radial Depth (mm)
2002	0.2	0.5	40,000	170	0.1	0.01	40,000	170	0.1	0.01	40,000	120	0.1	0.01	40,000	85	0.1	0.01
		1	40,000	170	0.1	0.005	40,000	170	0.1	0.005	40,000	120	0.1	0.005	40,000	85	0.1	0.005
		1.5	40,000	130	0.1	0.003	40,000	130	0.1	0.003	40,000	60	0.1	0.003	40,000	25	0.1	0.003
2003	0.3	1	40,000	290	0.15	0.015	40,000	290	0.15	0.015	40,000	260	0.15	0.015	40,000	230	0.15	0.015
		2	40,000	220	0.15	0.005	40,000	220	0.15	0.005	40,000	120	0.15	0.005	40,000	60	0.15	0.005
2004	0.4	1	40,000	400	0.2	0.02	40,000	400	0.2	0.02	40,000	400	0.2	0.02	40,000	400	0.2	0.02
		2	40,000	340	0.2	0.013	40,000	340	0.2	0.013	40,000	230	0.2	0.013	40,000	170	0.2	0.013
		3	40,000	270	0.2	0.006	40,000	270	0.2	0.006	40,000	130	0.2	0.006	40,000	50	0.2	0.006
2005	0.5	1	40,000	520	0.25	0.025	40,000	520	0.25	0.025	40,000	400	0.25	0.025	40,000	520	0.25	0.025
		2	40,000	520	0.25	0.015	40,000	520	0.25	0.015	40,000	370	0.25	0.015	40,000	310	0.25	0.015
		3	40,000	390	0.25	0.008	40,000	390	0.25	0.008	40,000	230	0.25	0.008	40,000	130	0.25	0.008
		5	40,000	250	0.25	0.008	40,000	250	0.25	0.008	40,000	120	0.25	0.008	40,000	60	0.25	0.008
2006	0.6	2	40,000	570	0.3	0.03	40,000	570	0.3	0.03	33,000	400	0.3	0.03	40,000	470	0.3	0.03
		4	40,000	440	0.3	0.01	40,000	440	0.3	0.01	33,000	190	0.3	0.01	40,000	120	0.3	0.01
		6	40,000	300	0.3	0.01	40,000	300	0.3	0.01	33,000	120	0.3	0.01	40,000	75	0.3	0.01
2008	0.8	2	40,000	800	0.4	0.04	40,000	800	0.4	0.04	25,000	400	0.4	0.04	40,000	800	0.4	0.04
		4	40,000	680	0.4	0.025	40,000	670	0.4	0.025	25,000	290	0.4	0.025	40,000	340	0.4	0.025
		6	40,000	540	0.4	0.013	40,000	540	0.4	0.013	25,000	160	0.4	0.013	40,000	100	0.4	0.013
		8	40,000	400	0.4	0.013	40,000	400	0.4	0.013	25,000	120	0.4	0.013	40,000	90	0.4	0.013
2010	1	2	30,000	800	0.5	0.05	30,000	800	0.5	0.05	20,000	400	0.5	0.05	30,000	800	0.5	0.05
		4	30,000	680	0.5	0.03	30,000	680	0.5	0.03	20,000	370	0.5	0.03	30,000	470	0.5	0.03
		6	30,000	590	0.5	0.015	30,000	590	0.5	0.015	20,000	230	0.5	0.015	30,000	200	0.5	0.015
		8	30,000	480	0.5	0.015	30,000	480	0.5	0.015	20,000	150	0.5	0.015	30,000	80	0.5	0.015
		10	30,000	380	0.5	0.015	30,000	400	0.5	0.015	20,000	100	0.5	0.015	30,000	100	0.5	0.015
2015	1.5	4	30,000	1,120	0.75	0.075	21,000	790	0.75	0.075	14,000	510	0.75	0.075	21,000	760	0.75	0.075
		6	30,000	1,020	0.75	0.05	21,000	720	0.75	0.05	14,000	390	0.75	0.05	21,000	490	0.75	0.05
		8	30,000	920	0.75	0.05	21,000	650	0.75	0.05	14,000	280	0.75	0.05	21,000	290	0.75	0.05
		12	30,000	720	0.75	0.025	21,000	510	0.75	0.025	14,000	150	0.75	0.025	21,000	80	0.75	0.025
2020	2	4	30,000	1,580	1	0.1	15,750	800	1	0.1	11,000	620	1	0.1	15,750	800	1	0.1
		6	30,000	1,480	1	0.1	15,750	780	1	0.1	11,000	500	1	0.1	15,750	690	1	0.1
		8	30,000	1,370	1	0.06	15,750	720	1	0.06	11,000	410	1	0.06	15,750	490	1	0.06
		10	30,000	1,270	1	0.06	15,750	670	1	0.06	11,000	320	1	0.06	15,750	340	1	0.06
		12	30,000	1,180	1	0.03	15,750	620	1	0.03	11,000	250	1	0.03	15,750	210	1	0.03
		16	30,000	970	1	0.03	15,750	510	1	0.03	11,000	160	1	0.03	15,750	80	1	0.03
2030	3	6	21,000	1,600	1.5	0.15	10,500	800	1.5	0.15	8,100	690	1.5	0.15	10,500	800	1.5	0.15
		10	21,000	1,520	1.5	0.15	10,500	760	1.5	0.15	8,100	520	1.5	0.15	10,500	620	1.5	0.15
		12	21,000	1,440	1.5	0.1	10,500	720	1.5	0.1	8,100	450	1.5	0.1	10,500	490	1.5	0.1
		16	21,000	1,300	1.5	0.1	10,500	650	1.5	0.1	8,100	330	1.5	0.1	10,500	290	1.5	0.1
		20	21,000	1,160	1.5	0.05	10,500	580	1.5	0.05	8,100	230	1.5	0.05	10,500	150	1.5	0.05
		25	21,000	980	1.5	0.05	10,500	490	1.5	0.05	8,100	160	1.5	0.05	10,500	75	1.5	0.05
2040	4	8	15,600	1,600	2	0.2	7,800	800	2	0.2	6,700	770	2	0.2	7,800	800	2	0.2
		12	15,600	1,560	2	0.2	7,800	780	2	0.2	6,700	620	2	0.2	7,800	690	2	0.2
		16	15,600	1,440	2	0.13	7,800	720	2	0.13	6,700	500	2	0.13	7,800	490	2	0.13
		20	15,600	1,340	2	0.13	7,800	670	2	0.13	6,700	390	2	0.13	7,800	340	2	0.13
		25	15,600	1,200	2	0.06	7,800	600	2	0.06	6,700	290	2	0.06	7,800	190	2	0.06
		30	15,600	1,080	2	0.06	7,800	540	2	0.06	6,700	220	2	0.06	7,800	100	2	0.06
2060	6	15	10,500	1,600	3	0.3	5,250	800	3	0.3	5,250	800	3	0.3	5,250	800	3	0.3
		20	10,500	1,500	3	0.3	5,250	760	3	0.3	5,250	700	3	0.3	5,250	620	3	0.3
		30	10,500	1,400	3	0.2	5,250	680	3	0.2	5,250	480	3	0.2	5,250	350	3	0.2
		40	10,500	1,200	3	0.15	5,250	600	3	0.15	5,250	300	3	0.15	5,250	150	3	0.15

# CLRS Milling Conditions for CLRS (2 Flutes)

## Flat Finishing

WORK MATERIAL			COPPER / ALUMINUM ALLOYS / CARBON STEELS / ALLOY STEELS / PREHARDENED STEELS C1100 / A5052 / A7075 / S50C / SCM / PXA30 / NAK (~40HRC)								HARDENED STEELS STAVAX / SKD61 (~55HRC)				STAINLESS STEELS SUS				TITANIUM ALLOYS Ti-6Al-4V			
Model Number	Outside Diameter (mm)	Effective Length (mm)	Spindle Speed (min <sup>-1</sup> )	Feed Rate (mm/min)	a <sub>p</sub> Axial Depth (mm)	a <sub>e</sub> Radial Depth (mm)	Spindle Speed (min <sup>-1</sup> )	Feed Rate (mm/min)	a <sub>p</sub> Axial Depth (mm)	a <sub>e</sub> Radial Depth (mm)	Spindle Speed (min <sup>-1</sup> )	Feed Rate (mm/min)	a <sub>p</sub> Axial Depth (mm)	a <sub>e</sub> Radial Depth (mm)	Spindle Speed (min <sup>-1</sup> )	Feed Rate (mm/min)	a <sub>p</sub> Axial Depth (mm)	a <sub>e</sub> Radial Depth (mm)				
2002	0.2	0.5	40,000	400	0.004	0.01	40,000	200	0.004	0.01	40,000	400	0.004	0.01	40,000	400	0.004	0.02				
		1	40,000	300	0.004	0.01	40,000	150	0.002	0.01	40,000	300	0.004	0.01	40,000	300	0.004	0.02				
		1.5	40,000	150	0.003	0.01	40,000	80	0.002	0.007	40,000	150	0.003	0.01	40,000	150	0.004	0.02				
2003	0.3	1	40,000	500	0.005	0.015	40,000	250	0.003	0.015	40,000	500	0.005	0.015	40,000	600	0.005	0.03				
		2	40,000	300	0.005	0.015	40,000	100	0.003	0.015	40,000	300	0.005	0.015	40,000	300	0.005	0.03				
2004	0.4	1	40,000	850	0.006	0.02	40,000	425	0.006	0.02	40,000	850	0.006	0.02	40,000	850	0.006	0.05				
		2	40,000	700	0.006	0.02	40,000	350	0.006	0.02	40,000	700	0.006	0.02	40,000	700	0.006	0.05				
		3	40,000	400	0.006	0.02	40,000	170	0.006	0.02	40,000	400	0.006	0.02	40,000	400	0.006	0.05				
2005	0.5	1	40,000	1,000	0.007	0.025	40,000	500	0.007	0.025	40,000	1,000	0.007	0.025	40,000	1,000	0.007	0.07				
		2	40,000	1,000	0.007	0.025	40,000	500	0.007	0.025	40,000	1,000	0.007	0.025	40,000	1,000	0.007	0.07				
		3	40,000	500	0.007	0.025	40,000	250	0.007	0.025	40,000	500	0.007	0.025	40,000	500	0.007	0.07				
		5	40,000	250	0.007	0.025	40,000	125	0.007	0.025	40,000	250	0.007	0.025	40,000	250	0.007	0.07				
2006	0.6	2	40,000	1,250	0.008	0.03	40,000	625	0.008	0.03	40,000	1,250	0.008	0.03	40,000	1,250	0.008	0.09				
		4	40,000	600	0.008	0.03	40,000	300	0.005	0.03	40,000	600	0.008	0.03	40,000	600	0.008	0.09				
		6	40,000	250	0.008	0.03	40,000	150	0.005	0.03	40,000	250	0.008	0.03	40,000	300	0.008	0.09				
2008	0.8	2	37,500	1,600	0.01	0.04	37,500	800	0.01	0.04	37,500	1,600	0.01	0.04	37,500	1,600	0.01	0.14				
		4	37,500	1,200	0.01	0.04	37,500	600	0.01	0.04	37,500	1,200	0.01	0.04	37,500	1,200	0.01	0.14				
		6	37,500	650	0.01	0.04	37,500	250	0.01	0.04	37,500	650	0.01	0.04	37,500	800	0.01	0.14				
		8	37,500	400	0.01	0.04	37,500	130	0.007	0.03	37,500	400	0.01	0.04	37,500	400	0.01	0.14				
2010	1	2	30,000	1,600	0.015	0.05	30,000	1,600	0.015	0.05	30,000	1,600	0.015	0.05	30,000	1,600	0.015	0.2				
		4	30,000	1,600	0.015	0.05	30,000	1,600	0.015	0.05	30,000	1,600	0.015	0.05	30,000	1,600	0.015	0.2				
		6	30,000	1,200	0.015	0.05	30,000	1,200	0.015	0.05	30,000	1,200	0.015	0.05	30,000	1,200	0.015	0.2				
		8	30,000	800	0.015	0.05	30,000	800	0.015	0.05	30,000	800	0.015	0.05	30,000	800	0.015	0.2				
		10	30,000	400	0.015	0.05	30,000	300	0.01	0.05	30,000	400	0.015	0.05	30,000	400	0.015	0.2				
2015	1.5	4	20,000	1,600	0.02	0.075	20,000	1,600	0.02	0.075	19,000	1,600	0.02	0.075	20,000	1,600	0.02	0.3				
		6	20,000	1,600	0.02	0.075	20,000	1,600	0.02	0.075	19,000	1,600	0.02	0.075	20,000	1,600	0.02	0.3				
		8	20,000	1,200	0.02	0.075	20,000	1,200	0.02	0.075	19,000	1,200	0.02	0.075	20,000	1,200	0.02	0.3				
		12	20,000	800	0.02	0.075	20,000	800	0.02	0.075	19,000	800	0.02	0.075	20,000	800	0.02	0.3				
2020	2	4	15,000	1,600	0.025	0.1	15,000	1,600	0.025	0.1	13,500	1,600	0.025	0.1	15,000	1,600	0.025	0.4				
		6	15,000	1,600	0.025	0.1	15,000	1,600	0.025	0.1	13,500	1,600	0.025	0.1	15,000	1,600	0.025	0.4				
		8	15,000	1,600	0.025	0.1	15,000	1,600	0.025	0.1	13,500	1,600	0.025	0.1	15,000	1,600	0.025	0.4				
		10	15,000	1,400	0.025	0.1	15,000	1,400	0.025	0.1	13,500	1,400	0.025	0.1	15,000	1,400	0.025	0.4				
		12	15,000	1,200	0.025	0.1	15,000	1,200	0.025	0.1	13,500	1,200	0.025	0.1	15,000	1,200	0.025	0.4				
		16	15,000	800	0.025	0.1	15,000	800	0.025	0.1	13,500	800	0.025	0.1	15,000	800	0.025	0.4				
2030	3	6	10,500	1,600	0.03	0.15	10,500	1,600	0.03	0.15	8,100	1,600	0.03	0.15	10,500	1,600	0.03	0.6				
		10	10,500	1,600	0.03	0.15	10,500	1,600	0.03	0.15	8,100	1,600	0.03	0.15	10,500	1,600	0.03	0.6				
		12	10,500	1,600	0.03	0.15	10,500	1,600	0.03	0.15	8,100	1,600	0.03	0.15	10,500	1,600	0.03	0.6				
		16	10,500	1,200	0.03	0.15	10,500	1,200	0.03	0.15	8,100	1,200	0.03	0.15	10,500	1,200	0.03	0.6				
		20	10,500	800	0.03	0.15	10,500	800	0.03	0.15	8,100	800	0.03	0.15	10,500	800	0.03	0.6				
		25	10,500	400	0.03	0.15	10,500	400	0.03	0.15	8,100	400	0.03	0.15	10,500	400	0.03	0.6				
2040	4	8	7,900	1,600	0.03	0.15	7,900	1,600	0.03	0.15	5,400	1,600	0.03	0.15	7,900	1,600	0.03	0.6				
		12	7,900	1,600	0.03	0.15	7,900	1,600	0.03	0.15	5,400	1,600	0.03	0.15	7,900	1,600	0.03	0.6				
		16	7,900	1,600	0.03	0.15	7,900	1,600	0.03	0.15	5,400	1,600	0.03	0.15	7,900	1,600	0.03	0.6				
		20	7,900	1,200	0.03	0.15	7,900	1,200	0.03	0.15	5,400	1,200	0.03	0.15	7,900	1,200	0.03	0.6				
		25	7,900	800	0.03	0.15	7,900	800	0.03	0.15	5,400	800	0.03	0.15	7,900	800	0.03	0.6				
		30	7,900	400	0.03	0.15	7,900	400	0.03	0.15	5,400	400	0.03	0.15	7,900	400	0.03	0.6				
2060	6	15	5,250	1,600	0.03	0.15	5,250	1,600	0.03	0.15	2,625	1,600	0.03	0.15	5,250	1,600	0.03	0.6				
		20	5,250	1,600	0.03	0.15	5,250	1,600	0.03	0.15	2,625	1,600	0.03	0.15	5,250	1,600	0.03	0.6				
		30	5,250	800	0.03	0.15	5,250	800	0.03	0.15	2,625	800	0.03	0.15	5,250	800	0.03	0.6				
		40	5,250	400	0.03	0.15	5,250	400	0.03	0.15	2,625	400	0.03	0.15	5,250	400	0.03	0.6				

- Note:
- Decrease both spindle speed and feed rate proportionally when the milling parameters exceed the machine's maximum spindle speed.
  - Every coolant offers stable milling.
  - Recommend oil coolant for Stainless Steels and Heat Resistant Alloys.
  - Recommend wet coolant for Copper.





## 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 $\mu$ 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.

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