UNION TOOL

Tungsten Carbide End Mills
UNIMAX Series

Published July 2025

NEW

2 Flute Ball End Mills

HWB HMW COAT — For hard materials from 40HRC to over 60HRC

HWB-S — Short shank series of HWB

CWB UTW COAT — Best for soft materials up to 40 HRC

All flute type has been added to the new coating series.

UNION TOOL CO.

New Coating Series

New coating that exceeds the conventional tools

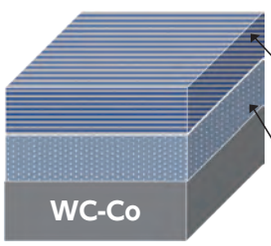
HMG COAT

Suitable for hard materials especially over 65HRC

Developed a hard coating with higher wear resistance than HARDMAX.
Offers longer tool life than conventional tools.

HMW COAT

Upgraded version of HARDMAX coating with improved wear resistance

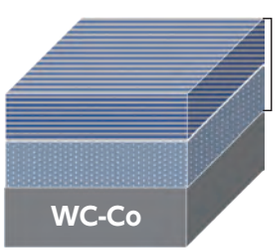


Ultra-high hardness layer
Increased numbers of layers by nano-laminated structure.
Longer tool life due to wear resistance and the suppression of crack propagation.

Shock absorption layer
New nanocomposite structure improves hardness and toughness.

UTW COAT

New coating with the best performance achievable in work materials up to 40HRC



High hardness and high toughness
New nanocomposite structure offers ultra multilayer structure
High toughness and wear resistance provide excellent performance in work materials up to 40HRC

How to find the best series for your material applications

(★ Highly Recommended ● Recommended ○ Suggested)

Model Number			Features	Ball tip design	Copper	Carbon Steels	Prehardened Steels	Hardened Steels				
								~50 HRC	~55 HRC	~60 HRC	~65 HRC	~70 HRC
HMG COAT	HGB		Best suited for Hard Materials	Super Negative 			○	●	●	●	★	★
HMW COAT	HWB		For Hard Materials	Negative 	○	○	●	★	★	★	●	●
UTW COAT	CWB		Multi-purpose Excellent surface quality	Neutral 	●	★	★	●				

CWB

UTWCOAT 2 Flute Ball End Mills

R0.05～R6

Super MG UTW COAT

Material Applications (★ Highly Recommended ● Recommended ○ Suggested)

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

- **Upgrade**

  Wear resistance and tool accuracy have been improved with HWB/HWB-S and CWB series.

		CSEB			HSB			HGB
Copper	Raw Materials	～30 HRC	～40 HRC	～50 HRC	～55 HRC	～60 HRC	～65 HRC	～70 HRC

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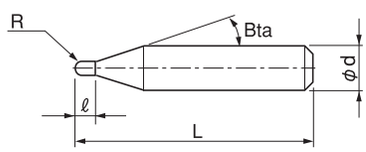
		CWB			HWB			HGB
Copper	Raw Materials	～30 HRC	～40 HRC	～50 HRC	～55 HRC	～60 HRC	～65 HRC	～70 HRC



The shank taper angle shown is not an exact value.

Longer tool life and improved mirror surface finish

Longer tool life and improved mirror surface finish on SCM Prehardened Steels compared to conventional tools.

Longer tool life

UTWCOAT
New Coating

Improved mirror surface finish

Tool tip has a micro flatland design reducing milling surface roughness.

※Micro flatland design at the tip does not apply to below R0.1.

High Precision

Even higher accuracy than before !

Conventional CSEB

Radius of Ball Nose	Ball Radius Accuracy	Diameter Tolerance	Shank Diameter Tolerance
R0.05	± 0.002	0/-0.01	0/-0.005
R0.1 ～ R3	± 0.005	0/-0.015	
R3.25 ～ R6	± 0.007	0/-0.02	

CWB

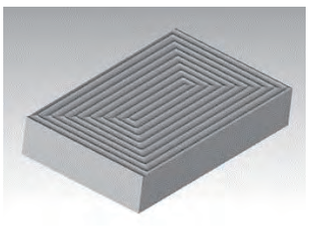
Unit (mm)

Radius of Ball Nose	Ball Radius Accuracy	Diameter Tolerance	Shank Diameter Tolerance	Helix Angle
R0.05	± 0.002	0/-0.006	0/-0.004 (h4)	0°
R0.1 ～ R1.25	± 0.003			30°
R1.5 ～ R2.25	± 0.004	0/-0.009		
R2.5 ～ R3	± 0.005			
R3.25 ～ R6	± 0.007	0/-0.01	0/-0.005(h5)	

Roughing wear comparison

CWB R6 × L18

PXA30 (30HRC)

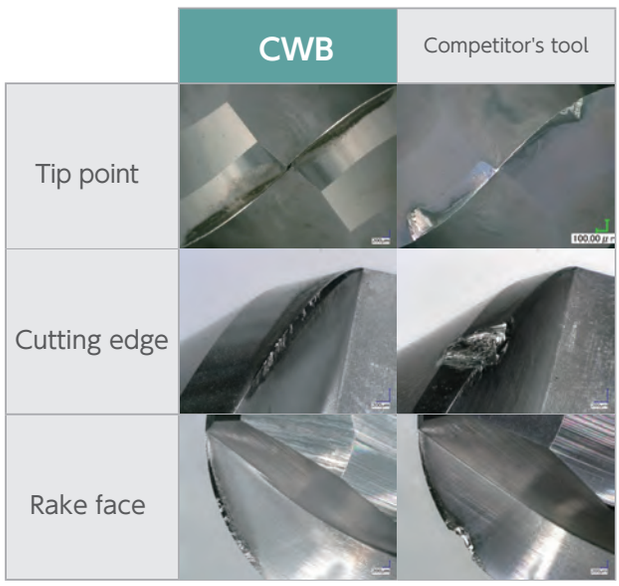


Coolant:
Water Soluble
(Through Spindle)

Overhang Length: 45 mm

Work Size
200 × 100 × 28 mm

Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Cycle Time
8,000	3,200	1.4	4.3	40 min



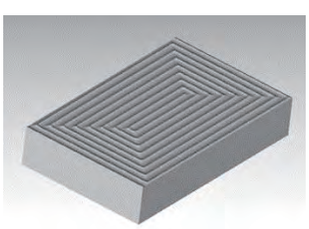
Improved coating performance and the new tool tip design enable higher efficiency milling than the catalog conditions.

Reference: Catalog conditions n =8,400 min^{-1} Vf = 3,300 mm/min a_p = 1.2 mm a_e = 3.6 mm

Roughing wear comparison

CWB R3 × L9

Carbon Steels S50C

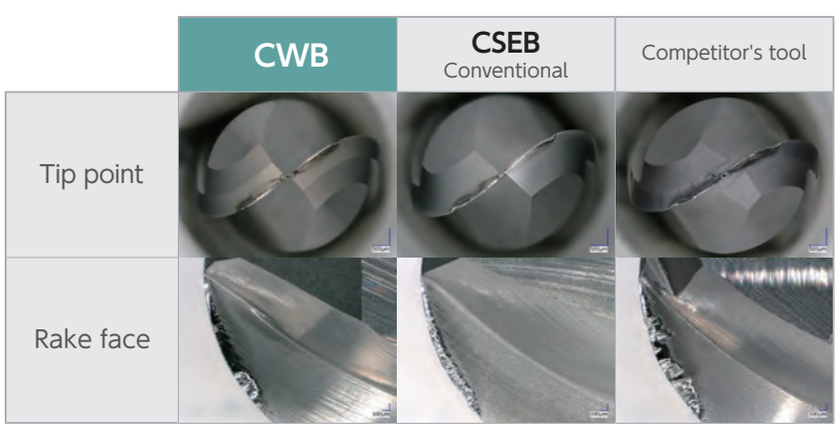


Coolant:
Water Soluble
(Through Spindle)

Overhang Length: 18 mm

Work Size
200 × 100 × 32 mm

Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Cycle Time
14,000	4,000	0.7	2.3	136 min



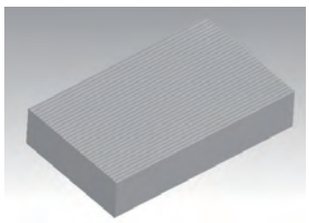
Improved coating performance and the new tool tip design enable higher efficiency milling than the catalog conditions.

Reference: Catalog conditions n =16,000 min^{-1} Vf = 3,100 mm/min a_p = 0.6 mm a_e = 1.8 mm

Flat surface finishing: Milling surface comparison

CWB R6 × L18

PXA30 (30HRC)



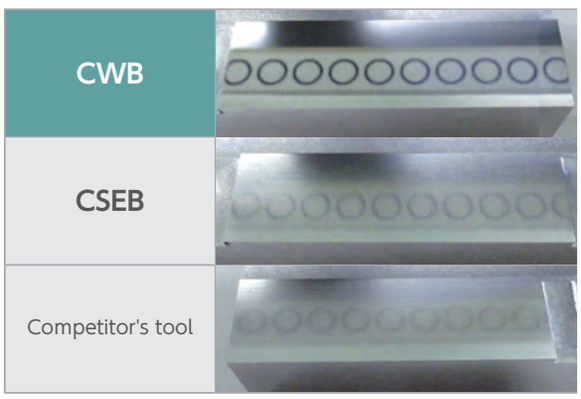
Coolant:
Water Soluble
(Through Spindle)

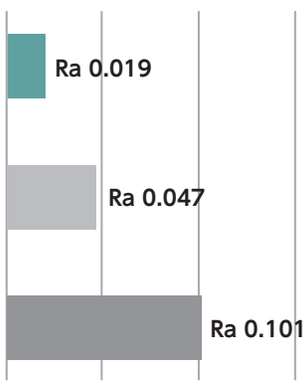
Overhang Length: 45 mm

Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Cycle Time
8,000	800	0.1	0.1	10 min

Work Size
50 × 15 mm

Arithmetic average roughness Ra (μm)



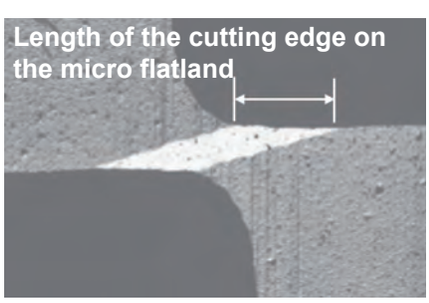


CWB offers better surface roughness and mirror surface finish.

How to achieve an excellent milling surface when finishing flat surface with CWB

Feed per rotation, a_e

By reducing the feed per rotation and a_e to less than the length of the micro flatland, excellent milling surfaces can be obtained consistently.



Recommended conditions
for feed per rotation f and radial depth a_e

Ball R	Feed per rotation f (mm/rev)	a_e Radial Depth (mm)
0.1 ≦ R < 0.25	0.01	0.01
0.25 ≦ R < 0.5	0.015	0.015
0.5 ≦ R < 1	0.03	0.03
1 ≦ R ≦ 3	0.04	0.04
3<R ≦ 4	0.06	0.06
4<R ≦ 5	0.08	0.08
5<R ≦ 6	0.1	0.1

Calculation formula for feed per rotation f

Feed per rotation : f (mm/rev)

$$f = \frac{V_f}{n}$$

V_f = Feed Rate (mm/min)
n = Spindle Speed (min^{-1})

Total 68 models

Unit (mm)

Model Number	Radius of Ball Nose R	Length of Cut ℓ	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød	Series
CWB 2001-0010	**R0.05**	0.1	11°	50	4	CWB
CWB 2002-0020	**R0.1**	0.2	11°	50	4	CWB
CWB 2002-0030		0.3		50	4	CWB
CWB 2003-0030	**R0.15**	0.3	11°	50	4	CWB
CWB 2003-0045		0.45		50	4	CWB
CWB 2004-0040	**R0.2**	0.4	11°	50	4	CWB
CWB 2004-0060		0.6		50	4	CWB
CWB 2005-0050	**R0.25**	0.5	11°	50	4	CWB
CWB 2005-0075		0.75		50	4	CWB
CWB 2006-0060	**R0.3**	0.6	11°	50	4	CWB
CWB 2006-0090		0.9		50	4	CWB
CWB 2007-0100	**R0.35**	1	11°	50	4	CWB
CWB 2008-0080	**R0.4**	0.8	11°	50	4	CWB
CWB 2008-0120		1.2		50	4	CWB
CWB 2009-0130	**R0.45**	1.3	11°	50	4	CWB
CWB 2010-0100	**R0.5**	1	11°	50	4	CWB
CWB 2010-0150		1.5		50	4	CWB
CWB 2010-0250		2.5		50	4	CWB
CWB 2011-0160	**R0.55**	1.6	11°	50	4	CWB
CWB 2012-0180	**R0.6**	1.8	11°	50	4	CWB
CWB 2013-0190	**R0.65**	1.9	11°	50	4	CWB
CWB 2014-0210	**R0.7**	2.1	11°	50	4	CWB
CWB 2015-0150	**R0.75**	1.5	11°	50	4	CWB
CWB 2015-0200		2		50	4	CWB
CWB 2015-0225		2.25		50	4	CWB
CWB 2015-0400		4		50	4	CWB
CWB 2016-0240	**R0.8**	2.4	11°	50	4	CWB
CWB 2017-0250	**R0.85**	2.5	11°	50	4	CWB
CWB 2018-0270	**R0.9**	2.7	11°	50	4	CWB
CWB 2019-0280	**R0.95**	2.8	11°	50	4	CWB
CWB 2020-0200	**R1**	2	11°	50	4	CWB
CWB 2020-0300		3		60	4	CWB
CWB 2020-0600		6		60	4	CWB
CWB 2025-0250	**R1.25**	2.5	11°	50	4	CWB
CWB 2025-0375		3.75		50	4	CWB
CWB 2025-0600		6		60	4	CWB

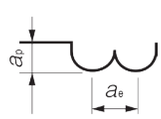
Model Number	Radius of Ball Nose R	Length of Cut ℓ	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød	Series
CWB 2030-0300	**R1.5**	3	11°	50	6	CWB
CWB 2030-0450		4.5		70	6	CWB
CWB 2030-0800		8		70	6	CWB
CWB 2035-0520	**R1.75**	5.2	11°	70	6	CWB
CWB 2040-0400	**R2**	4	11°	50	6	CWB
CWB 2040-0600-4		6	—	70	4	CWB
CWB 2040-0600		6	11°	70	6	CWB
CWB 2040-0800		8		70	6	CWB
CWB 2045-0670	**R2.25**	6.7	11°	70	6	CWB
CWB 2050-0500	**R2.5**	5	11°	50	6	CWB
CWB 2050-0750		7.5		80	6	CWB
CWB 2050-0800		8		80	6	CWB
CWB 2050-1200		12		80	6	CWB
CWB 2055-0820	**R2.75**	8.2	11°	80	6	CWB
CWB 2060-0600	**R3**	6	—	50	6	CWB
CWB 2060-0900		9		80	6	CWB
CWB 2060-1200		12		80	6	CWB
CWB 2065-0970	**R3.25**	9.7	11°	90	8	CWB
CWB 2070-1050	**R3.5**	10.5	11°	90	8	CWB
CWB 2075-1120	**R3.75**	11.2	11°	90	8	CWB
CWB 2080-0800	**R4**	8	—	60	8	CWB
CWB 2080-1200		12		90	8	CWB
CWB 2080-1400		14		90	8	CWB
CWB 2085-1270	**R4.25**	12.7	11°	100	10	CWB
CWB 2090-1350	**R4.5**	13.5	11°	100	10	CWB
CWB 2100-1000	**R5**	10	—	70	10	CWB
CWB 2100-1500		15		100	10	CWB
CWB 2100-1800		18		100	10	CWB
CWB 2110-1650	**R5.5**	16.5	11°	110	12	CWB
CWB 2120-1200	**R6**	12	—	75	12	CWB
CWB 2120-1800		18		110	12	CWB
CWB 2120-2200		22		110	12	CWB

CWB Milling Conditions

WORK MATERIAL			COPPER / ALUMINUM ALLOYS				CARBON STEELS / ALLOY STEELS S45C / S50C / SK / SCM (~325HB)				PREHARDENED STEELS NAK80 / STAVAX / HPM38 (30~45HRC)				HARDENED STEELS STAVAX / HPM38 / SKD61 (45~55HRC)			
Model Number	Radius of Ball Nose (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)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
2001	R0.05	0.1	30,000	200	0.004 or below	0.04	30,000	200	0.004 or below	0.04	30,000	200	0.004 or below	0.04	30,000	200	0.004 or below	0.04
2002	R0.1	0.2	60,000	350	0.008	0.024	60,000	350	0.008	0.016	60,000	300	0.008	0.024	60,000	300	0.006	0.018
		0.3	60,000	350	0.008	0.024	60,000	350	0.008	0.016	60,000	300	0.008	0.024	60,000	300	0.006	0.018
2003	R0.15	0.3	43,000	500	0.012	0.036	43,000	500	0.012	0.024	54,000	450	0.012	0.036	43,000	450	0.008	0.024
		0.45	43,000	500	0.012	0.036	43,000	500	0.012	0.024	54,000	450	0.012	0.036	43,000	450	0.008	0.024
2004	R0.2	0.4	35,000	1,200	0.03	0.09	35,000	1,200	0.02	0.04	50,000	650	0.025	0.075	35,000	650	0.015	0.045
		0.6	35,000	1,200	0.03	0.09	35,000	1,200	0.02	0.04	50,000	650	0.025	0.075	35,000	650	0.015	0.045
2005	R0.25	0.5	34,000	1,300	0.035	0.105	34,000	1,300	0.03	0.06	45,000	900	0.03	0.09	32,000	900	0.02	0.06
		0.75	34,000	1,300	0.035	0.105	34,000	1,300	0.03	0.06	45,000	900	0.03	0.09	32,000	900	0.02	0.06
2006	R0.3	0.6	33,000	1,500	0.05	0.15	33,000	1,500	0.04	0.08	40,000	1,300	0.045	0.09	30,000	1,300	0.04	0.06
		0.9	33,000	1,500	0.05	0.15	33,000	1,500	0.04	0.08	40,000	1,300	0.045	0.09	30,000	1,300	0.04	0.06
2007	R0.35	1	32,000	1,800	0.07	0.21	32,000	1,600	0.05	0.1	38,000	1,600	0.06	0.12	28,000	1,600	0.05	0.075
2008	R0.4	0.8	30,000	2,200	0.1	0.3	30,000	1,800	0.06	0.12	35,000	1,800	0.07	0.14	25,000	1,700	0.07	0.1
		1.2	30,000	2,200	0.1	0.3	30,000	1,800	0.06	0.12	35,000	1,800	0.07	0.14	25,000	1,700	0.07	0.1
2009	R0.45	1.3	30,000	2,100	0.11	0.33	30,000	1,600	0.07	0.14	33,000	1,700	0.08	0.16	24,000	1,600	0.08	0.12
2010	R0.5	1	30,000	2,000	0.12	0.36	30,000	1,600	0.08	0.16	30,000	1,600	0.09	0.18	22,000	1,600	0.09	0.13
		1.5	30,000	2,000	0.12	0.36	30,000	1,600	0.08	0.16	30,000	1,500	0.09	0.18	22,000	1,600	0.09	0.13
		2.5	30,000	1,700	0.09	0.27	24,000	1,400	0.06	0.12	30,000	1,300	0.075	0.15	21,500	1,300	0.075	0.1
2011	R0.55	1.6	30,000	2,000	0.12	0.36	30,000	1,600	0.08	0.16	30,000	1,600	0.09	0.18	20,000	1,600	0.09	0.13
2012	R0.6	1.8	30,000	2,000	0.13	0.39	30,000	1,600	0.09	0.18	30,000	1,600	0.1	0.2	18,000	1,600	0.1	0.15
2013	R0.65	1.9	30,000	2,000	0.13	0.39	30,000	1,600	0.09	0.18	30,000	1,700	0.1	0.2	18,000	1,500	0.1	0.15
2014	R0.7	2.1	30,000	2,000	0.14	0.42	30,000	1,500	0.1	0.2	30,000	1,700	0.11	0.2	18,000	1,500	0.11	0.16
2015	R0.75	1.5	30,000	2,000	0.15	0.45	30,000	1,600	0.12	0.24	30,000	1,700	0.12	0.24	18,000	1,500	0.12	0.18
		2	30,000	2,000	0.15	0.45	30,000	1,600	0.12	0.24	30,000	1,700	0.12	0.24	18,000	1,500	0.12	0.18
		2.25	30,000	2,000	0.15	0.45	30,000	1,600	0.12	0.24	30,000	1,700	0.12	0.24	18,000	1,500	0.12	0.18
		4	30,000	1,800	0.12	0.36	23,000	1,200	0.08	0.16	30,000	1,400	0.1	0.2	15,000	1,200	0.09	0.13
2016	R0.8	2.4	30,000	2,000	0.16	0.48	30,000	1,600	0.12	0.24	30,000	1,800	0.12	0.36	18,000	1,400	0.1	0.2
2017	R0.85	2.5	30,000	2,000	0.17	0.51	30,000	1,700	0.14	0.28	30,000	1,800	0.14	0.42	18,000	1,400	0.12	0.24
2018	R0.9	2.7	30,000	2,000	0.18	0.54	30,000	1,800	0.16	0.32	30,000	1,900	0.16	0.48	16,000	1,300	0.14	0.28
2019	R0.95	2.8	30,000	2,000	0.19	0.57	30,000	1,900	0.18	0.36	30,000	1,900	0.18	0.54	16,000	1,300	0.16	0.32
2020	R1	2	30,000	2,000	0.2	0.6	30,000	2,000	0.21	0.42	30,000	2,000	0.2	0.6	16,000	1,300	0.17	0.5
		3	30,000	2,000	0.2	0.6	30,000	2,000	0.21	0.42	30,000	2,000	0.2	0.6	16,000	1,300	0.17	0.5
		6	30,000	2,000	0.2	0.6	30,000	2,000	0.14	0.42	30,000	2,000	0.13	0.45	10,800	850	0.1	0.4
2025	R1.25	2.5	27,000	2,300	0.28	0.75	27,000	2,300	0.25	0.5	27,000	2,300	0.25	0.75	13,000	1,100	0.21	0.63
		3.75	27,000	2,300	0.28	0.75	27,000	2,300	0.25	0.5	27,000	2,300	0.25	0.75	13,000	1,100	0.21	0.63
		6	25,000	2,100	0.26	0.67	25,000	2,100	0.23	0.46	24,000	2,000	0.2	0.65	11,000	930	0.14	0.44
2030	R1.5	3	24,000	2,500	0.32	0.9	24,000	2,500	0.32	0.9	24,000	2,500	0.3	0.9	14,000	1,400	0.25	0.76
		4.5	24,000	2,500	0.32	0.9	24,000	2,500	0.32	0.9	24,000	2,500	0.3	0.9	14,000	1,400	0.25	0.76
		8	22,000	2,300	0.28	0.7	22,000	2,300	0.28	0.7	20,000	2,000	0.2	0.65	10,700	1,000	0.18	0.54
2035	R1.75	5.2	24,000	2,700	0.35	1	24,000	2,700	0.35	1	21,000	2,400	0.35	1	12,000	1,700	0.3	0.9

CWB Milling Conditions

WORK MATERIAL			COPPER / ALUMINUM ALLOYS				CARBON STEELS / ALLOY STEELS S45C / S50C / SK / SCM (~325HB)				PREHARDENED STEELS NAK80 / STAVAX / HPM38 (30~45HRC)				HARDENED STEELS STAVAX / HPM38 / SKD61 (45~55HRC)			
Model Number	Radius of Ball Nose (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)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
2040	R2	4	24,000	2,900	0.4	1.2	24,000	2,900	0.4	1.2	18,000	2,400	0.4	1.2	11,000	2,000	0.34	1
		6	24,000	2,900	0.4	1.2	24,000	2,900	0.4	1.2	18,000	2,400	0.4	1.2	11,000	2,000	0.34	1
		8	24,000	2,900	0.4	1.2	24,000	2,900	0.4	1.2	18,000	2,400	0.4	1.2	11,000	2,000	0.34	1
2045	R2.25	6.7	21,000	3,000	0.45	1.3	21,000	3,000	0.45	1.3	16,000	2,400	0.42	1.2	10,000	1,900	0.38	1.1
2050	R2.5	5	18,000	3,000	0.5	1.5	18,000	3,000	0.5	1.5	13,000	2,400	0.45	1.4	9,000	1,800	0.42	1.2
		7.5	18,000	3,000	0.5	1.5	18,000	3,000	0.5	1.5	13,000	2,400	0.45	1.4	9,000	1,800	0.42	1.2
		8	18,000	3,000	0.5	1.5	18,000	3,000	0.5	1.5	13,000	2,400	0.45	1.4	9,000	1,800	0.42	1.2
		12	18,000	3,000	0.5	1.5	18,000	3,000	0.5	1.5	13,000	2,400	0.45	1.4	9,000	1,800	0.42	1.2
2055	R2.75	8.2	17,000	3,000	0.55	1.6	17,000	3,000	0.55	1.6	12,000	2,400	0.5	1.5	8,500	1,800	0.45	1.3
2060	R3	6	16,000	3,100	0.6	1.8	16,000	3,100	0.6	1.8	11,000	2,310	0.55	1.7	7,500	1,800	0.5	1.5
		9	16,000	3,100	0.6	1.8	16,000	3,100	0.6	1.8	11,000	2,310	0.55	1.7	7,500	1,800	0.5	1.5
		12	16,000	3,100	0.6	1.8	16,000	3,100	0.6	1.8	11,000	2,310	0.55	1.7	7,500	1,800	0.5	1.5
2065	R3.25	9.7	15,000	3,100	0.65	1.95	15,000	3,100	0.65	1.95	10,000	2,200	0.59	1.8	7,000	1,800	0.54	1.6
2070	R3.5	10.5	14,000	3,200	0.7	2.1	14,000	3,200	0.7	2.1	9,000	2,100	0.63	1.9	6,500	1,800	0.57	1.7
2075	R3.75	11.2	13,000	3,300	0.75	2.25	13,000	3,300	0.75	2.25	8,200	2,000	0.67	2	6,000	1,800	0.6	1.8
2080	R4	8	12,000	3,300	0.8	2.4	12,000	3,300	0.8	2.4	7,400	1,900	0.72	2.2	5,700	1,800	0.65	2
		12	12,000	3,300	0.8	2.4	12,000	3,300	0.8	2.4	7,400	1,900	0.72	2.2	5,700	1,800	0.65	2
		14	12,000	3,300	0.8	2.4	12,000	3,300	0.8	2.4	7,400	1,900	0.72	2.2	5,700	1,800	0.65	2
2085	R4.25	12.7	12,000	3,300	0.85	2.55	12,000	3,300	0.85	2.55	6,800	1,800	0.75	2.3	5,400	1,700	0.7	2.1
2090	R4.5	13.5	11,000	3,400	0.9	2.7	11,000	3,400	0.9	2.7	6,300	1,700	0.8	2.4	5,100	1,600	0.75	2.2
2100	R5	10	10,000	3,500	1	3	10,000	3,500	1	3	5,200	1,650	0.9	2.7	4,600	1,500	0.85	2.5
		15	10,000	3,500	1	3	10,000	3,500	1	3	5,200	1,650	0.9	2.7	4,600	1,500	0.85	2.5
		18	10,000	3,500	1	3	10,000	3,500	1	3	5,200	1,650	0.9	2.7	4,600	1,500	0.85	2.5
2110	R5.5	16.5	9,000	3,400	1.1	3.3	9,000	3,400	1.1	3.3	4,700	1,500	1	3	4,200	1,350	0.9	2.7
2120	R6	12	8,400	3,300	1.2	3.6	8,400	3,300	1.2	3.6	4,300	1,350	1.1	3.2	3,800	1,250	1	3
		18	8,400	3,300	1.2	3.6	8,400	3,300	1.2	3.6	4,300	1,350	1.1	3.2	3,800	1,250	1	3
		22	8,400	3,300	1.2	3.6	8,400	3,300	1.2	3.6	4,300	1,350	1.1	3.2	3,800	1,250	1	3



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.
- 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 5μm or below for the small diameter tools ϕ1 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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Price & Specifications are subject to change without notice.

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