UNION TOOL

Tungsten Carbide End Mills

UNIMAX Series Vol. 1

Medical applications

UNION TOOL EUROPE S.A.

Union Tool Presentation

Union Tool CO. is a global based leader in medical technology that consistently delivers exceptional results. We work with respected medical professionals to advance meaningful innovation, improve productivity and performance and supplying quality products time and time again. Our goal is to be the Provider and Partner of choice.

Union Tool Co is known for its world-class products and a leadership team that sets a company standard of excellence.

Union Tool Europe S.A. is a wholly owned subsidiary of Union Tool CO. in Japan. The European office was founded in 1986 in Neuchâtel in Switzerland in the heart of the Swiss watch making industry.

Union Tool Europe S.A. has pan-European distribution network who is committed to offering the best service and support. The objectives of our supply chain partners are:

- To be close to our customers in order to fully understand their needs and requirements.
- To support our customers in improving their productivity by supplying Union Tool's state of the art products.
- To offer world-class logistics and technical support.

Our relationship to our customers:

We foster long-term partnerships with our customers based on openness, honesty and trust. We focus on the needs and wishes of our customers. Our focus is on intense research into new materials, improved coatings and future-oriented technologies. We will perform customer specific tool developments in our technical centre in Japan and then carry out the qualification trials onsite with the customer.

Japanese Precision and Innovation:

At Union Tool CO., everything is "Made in Japan" - starting from research and development all the way to the design and production of our own unique manufacturing machines which are used to manufacture our products. This guarantees the renowned Japanese quality and precision. Quality controls in all phases of the manufacturing process ensure compliance with the strict requirements and guarantee that only products of flawless quality are delivered to our customers.

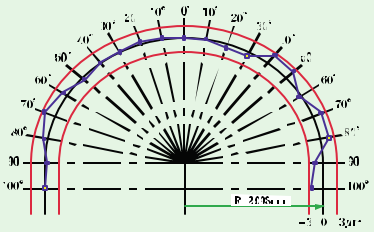
Values that inspire:

- Union Tool design & Japanese precision
- Leadership & Excellence & Innovation
- Worldwide Experience
- ISO 9001 / 14001 certified

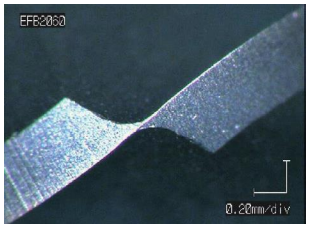
Precision that speaks for itself:

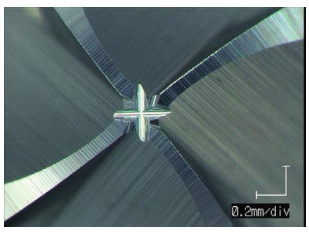
At Union Tool "precision" is in our DNA and is present in everything that we do. We offer standard tools with + -3 micron radius tolerances. We also offer this precision and quality time and time again and batch after batch.

Measurements of Ball R Accuracy
Model: High R Tolerance Ball End Mill
ot. No.:779C01
No.001



Angle	L side	R side
0°	2.998	2.998
10°	2.998	2.998
20°	2.999	2.997
30°	2.998	2.997
40°	2.998	3.000
50°	2.997	3.000
60°	2.999	2.997
70°	3.000	3.000
80°	2.999	3.000
90°	2.997	2.997
100°	2.998	2.996
R Accuracy	R=2.998	+0.002 −0.002
Actual Outer Diameter	φD=5.996	





Exceeding your expectations.

Icons Definitions

unit : mm

Tool Material

Super MG — Super Micro Grain

Shank Diameter Tolerance

Shank Dia 0/-0.005 — Tolerance of Shank Diameter : 0/-0.005

Coating

HARD MAX — HARDMAX

UT COAT — UTCOAT

MICRO COAT — UT MICRO COAT

Ball Radius Tolerance

R ±0.005 — Ball Radius Tolerance : ±0.005

R ±0.007 — Ball Radius Tolerance : ±0.007

R ±0.01 — Ball Radius Tolerance : ±0.01

Helix Angle

24° — Helix Angle 24°

45° — Helix Angle 45°

30° — Helix Angle 30°

30° — Helix Angle 30°

40° — Helix Angle 40°

40° — Helix Angle 40°

Corner Radius Tolerance

R ±0.01 — Corner Radius Tolerance : ±0.01

R ±0.015 — Corner Radius Tolerance : ±0.015

R ±0.005 — Corner Radius Tolerance : ±0.005

Geometry

R — Corner Radius Design

Back Taper Geometry — Back Taper Geometry

Fluteless — Fluteless Design

Variable Pitch — Variable Pitch

X Thinning — X Thinning Design

Index

Alphabetical Order

Tool Type

Model Number	Appearance	Size	Number of Flutes	Process			Work Material		
				Roughing	Semi-Finishing	Finishing	Stainless Steel	Titanium	Chrome Cobalt
Square									
CZS		Ø1 - Ø20	4	■	■	■	●	●	○
Long Neck Square									
HLS 2000		Ø0.1 - Ø6	2	■	■	■	●	○	●
HLS 4000		Ø1 - Ø6	4	■	■	■	●	○	●
Radius & Long Neck Radius									
CNRS		Ø6 - Ø12	4	■	■	■	●	●	○
CRRS		Ø2 - Ø12	4	■	■	■	●	●	○
HRRS-S		Ø2 - Ø12	4	■	■	■	●	○	●
HLRS 4000		Ø0.8 - Ø6	4	■	■	■	●	○	●
Ball									
CSEB		R0.05 - R6	2	■	■	■	●	○	○
CFB		R0.3 - R6	3	■	■	■	●	●	●
HFB-S		R1 - R6	4	■	■	■	●	●	●
Long Neck Ball									
CSELB		R0.05 - R3	2	■	■	■	●	○	○
CFLB		R0.3 - R3	3	■	■	■	●	●	●
Drill									
C-UMD		Ø0.1 - Ø3	2				●	●	
UTDSX		Ø0.3 - Ø2	2				○	○	

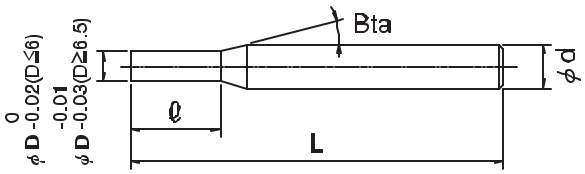
4 Flute

CZS

Square
Size Ø1 - Ø20

Super MG | UT COAT | 40° | Flat Land | Shank Dia 0/-0.005 | Variable Pitch

Number of Flutes	Process			Work Material		
	Roughing	Semi-Finishing	Finishing	Stainless Steel	Titanium	Chrome Cobalt
4	■	■	□	●	●	•



Unit (mm)

Applicable Work Material (● most suitable, • suitable)
Applicable Process (■ most suitable, □ suitable)

The new tip geometry is ideal for vertical milling on horizontal surfaces.
The carbide grade specified offers excellent resistance to chipping.
The low friction characteristics of the coating offers excellent chip evacuation as well as longer tool life.

Model Number	Outside Diameter ØD	Length of Cut ℓ	Shank Taper Angle Bta	Overall Length l	Shank Diameter Ød
CZS 4010-0150	1	1.50	6°	50	4
CZS 4015-0225	1.5	2.25	6°	50	4
CZS 4020-0300	2	3	6°	50	4
CZS 4025-0375	2.5	3.75	6°	50	4
CZS 4030-0450	3	4.50	6°	60	6
CZS 4035-1000	3.5	10	6°	60	6
CZS 4040-0600	4	6	6°	60	6
CZS 4045-1100	4.5	11	6°	60	6
CZS 4050-0750	5	7.50	6°	60	6
CZS 4060-0900	6	9	-	60	6
CZS 4070-1050	7	10.50	6°	70	8
CZS 4080-1200	8	12	-	70	8
CZS 4090-1350	9	13.50	6°	80	10
CZS 4100-1500	10	15	-	80	10
CZS 4110-1650	11	16.50	6°	100	12
CZS 4120-1800	12	18	-	100	12

Work Material			Stainless Steel (SUS304) use water soluble coolant				Titanium (Grade 5)			
Mode Number	Outside Diameter (mm)	Length of Cut (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)			Spindle Speed (min^{-1})	Feed Rate (mm/min)		
				Vertical Milling	Slotting	Side Milling		Vertical Milling	Slotting	Side Milling
CZS 4010-0150	1	1.5	14,500	150	250	1,000*	11,600	120	100	800
CZS 4015-0225	1.5	2.25	13,300	150	270	1,500*	10,400	120	100	1200
CZS 4020-0300	2	3	10,300	100	270	1,500*	9,000	90	150	1200
CZS 4025-0375	2.5	3.75	9,000	100	300	2,000*	5,400	90	150	1600
CZS 4030-0450	3	4.5C	6,800	80	300	2,000*	5,440	60	200	1600
CZS 4035-1000	3.5	10	5,700	90	350	1,150	4,700	70	200	920
CZS 4040-0600	4	6	5,700	90	350	1,150	4,560	70	250	920
CZS 4045-1100	4.5	11	4,800	100	400	1,300	4,200	70	250	960
CZS 4050-0750	5	7.5C	4,800	100	400	1,300	3,840	80	300	1040
CZS 4060-0900	6	9	4,000	100	400	1,300	3,200	80	300	1040
CZS 4070-1050	7	10.50	3,200	100	350	1,300	2,550	90	300	1040
CZS 4080-1200	8	12	2,400	90*	300	1,200	1,920	70	300	960
CZS 4090-1350	9	13.50	1,800	90*	250	1,100	1,440	70	350	880
CZS 4100-1500	10	15	1,400	80*	200	1,300	1,120	80	350	800
CZS 4110-1650	11	16.50	1,250	80*	200	900	1,000	60	350	720
CZS 4120-1800	12	18	1,250	70*	180	900	1,000	60	350	720
Milling Amount (mm)				Depth 0.25D - Max 2mm	a_e 1D	a_p 0.5D		Depth 0.2 D - Max 2mm	a_p 0.5D	a_p 2D

* 49 models available in total from Diameter 1mm to 20mm with various length of cut from 1.5 to 3 X diameter.
For more details please ask your distributor.

4 Flute

4 Flute UTCOAT Square End Mill for Part Milling

CZS The 2 in 1 Advantage

Patented special end profile design

Drilling and Milling with a Single Tool! 1/2 Cycle Time!

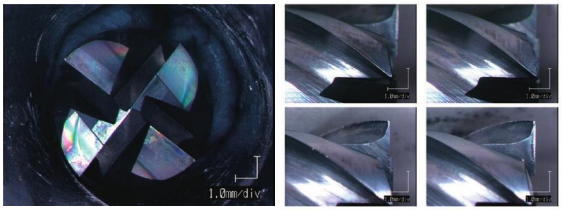
Tool	ϕ8x12mm Length of Cut
Work Material	SCM420-
Spindle Speed	2,700 min-1
Z-Drilling Feed Rate	220 mm/min
X-Y Milling Feed Rate	500 mm/min
Coolant	Water Soluble

Z-drilling: 1mm depth x 4 times Dwell: 0.1sec

Pocket Size:
9mm x 15mm x 4mm

Drilling and Milling: 144min

CZS → 72 min

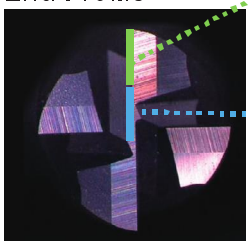


More tool life left after milling 864 holes (32 pieces)!

Drilling Mechanism

Normal 4 Flutes

Conventional End Profile



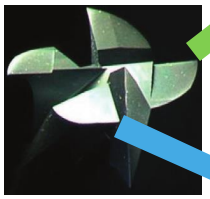
Chips made by the main flutes outer edge → Bigger

Chips made by the inner edge →Trapped

Normal 4 flute end mill easily clogs

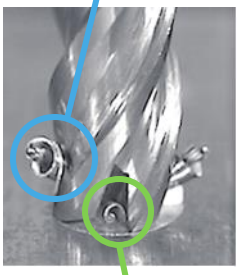
Impossible to Drill

The outer edge of the main flutes are not used in the drilling cycle



Gap on Main Flute

CZS



Chips made by the main flutes inner edge evacuate smoothly

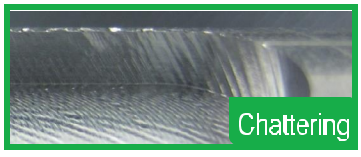
Giving High Speed Drilling

Variable Pitch Prevents Chattering!

Tool	ϕ6.5x76mm Length of Cut
Work Material	S45C (ϕ18)
Spindle Speed	2,200min
Z Drilling Feed Rate	100mm/min
X-Y Milling Feed Rate	400mm/min
Axial Depth a_p	3mm
Overhang	25mm
Coolant	Air Blow (Through Spindle)

CZS

Conventional 4 Flutes



2 Flute

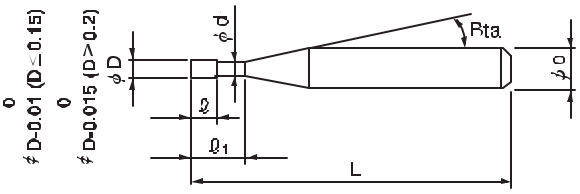
HLS 2000

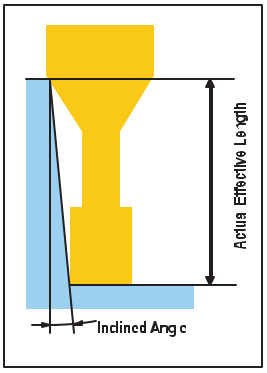
Long Neck Square
Size Ø0.1 - Ø6

Number of Flutes	Process			Work Material		
	Roughing	Semi-Finishing	Finishing	Stainless Steel	Titanium	Chrome Cobalt
2	□	■	■	●	○	●

Applicable Work Material (● most suitable, ○ suitable)

Applicable Process (■ most suitable, □ suitable)





HARDMAX Coating offers outstanding heat resistance and low friction properties for deep milling.
High accuracy : Diameter Tolerance 0 / -0.015 mm.
Longer tool life with HARDMAX Coating.

Unit (mm)

Model Number	Outside Diameter ØD	Effective Length ℓ	Length of Cut ℓ1	Neck Diameter Ød	Shank Taper Angle Rta	Overall Length L	Shank Diameter Ød	Effective Length by Inclined Angles 30'	1°	1°30'	2°	3
HLS 2005-015	0.5	1.5	0.7	0.40	1°6'	45	4	1.83	1.99	2.15	2.95	2.48
HLS 2005-020		2				45	4	2.87	2.56	2.71	2.85	3.09
HLS 2005-025		2.5				45	4	2.99	3.17	3.29	3.43	3.58
HLS 2005-030		3				45	4	3.45	3.62	3.85	4.01	4.28
HLS 2007-020	0.7	2	1	0.68	1°6'	45	4	2.89	2.62	2.80	2.95	3.24
HLS 2007-040		4				45	4	4.57	4.86	5.09	5.29	5.58
HLS 2007-060		6				45	4	6.70	7.06	7.32	7.57	8.14
HLS 2008-030	0.8	3	1.2	0.78	1°6'	45	4	3.49	3.76	3.95	4.14	4.32
HLS 2008-040		4				45	4	4.57	4.86	5.09	5.29	5.58
HLS 2008-060		6				45	4	5.64	5.96	6.21	6.43	6.92
HLS 2008-060		6				45	4	6.70	7.06	7.32	7.57	8.14
HLS 2008-080		8				45	4	8.81	9.20	9.52	9.85	10.59

for Chrome Cobalt Milling Conditions please refer to page 115 : Hardened Steel 45 - 55 HRC in our JAIMAX Series Vol. 16 Catalogue (QR CODE page 26).

Work Material				Stainless Steel			Titanium (Grade 5) Use water soluble coolant.			Radial Depth
Model Number	Outside Diameter (mm)	Effective Length (mm)	L/D	Spindle Speed (min⁻¹)	Feed (mm/min)	Axial Depth a_p (mm)	Spindle Speed (min⁻¹)	Feed (mm/min)	Axial Depth a_p (mm)	Radial Depth a_e (mm)
HLS 2005	0.5	1.5	3	51,000	870	0.017 - 0.027	61,000	670	0.016 - 0.026	0.139
		2	4	54,000	760	0.017 - 0.023	54,000	550	0.017 - 0.020	0.095
		3	6	39,900	530	0.005 - 0.013	39,900	430	0.006 - 0.016	0.076
HLS 2007	0.7	2	2.9	50,200	1,040	0.027 - 0.043	50,200	940	0.025 - 0.04	0.136
		4	5.7	32,700	550	0.015 - 0.025	32,700	530	0.01 - 0.02	0.047
		6	8.6	25,100	460	0.009 - 0.015	25,100	350	0.005 - 0.015	0.07
HLS 2008	0.8	3	3.8	34,500	790	0.029 - 0.049	37,300	690	0.025 - 0.045	0.108
		4	5	31,100	700	0.024 - 0.04	31,100	600	0.02 - 0.04	0.080
		6	7.6	24,200	510	0.015 - 0.025	24,200	410	0.01 - 0.02	0.024

* 184 models available in total from Diameter 0.1 mm to 6mm with various length of cut from 3 to 15 X diameter
For more details please ask your distributor.

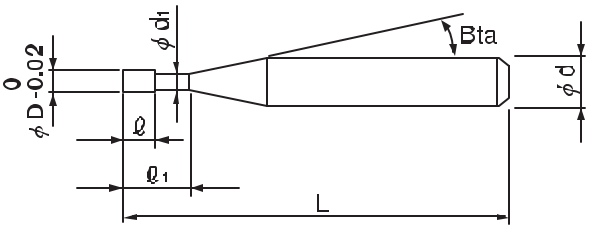
4 Flute

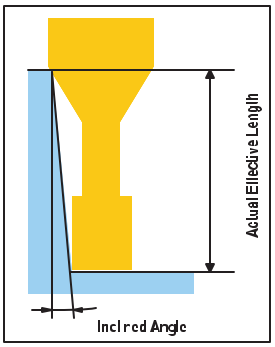
HLS 4000

Long Neck Square
Size Ø1 - Ø6

Number of Flutes	Process			Work Material		
	Roughing	Semi-Finishing	Finishing	Stainless Steel	Titanium	Chrome Cobalt
4	■	■	■	●	○	●

Applicable Work Material (● most suitable, ○ suitable)
Applicable Process (■ most suitable, □ suitable)





- HARDMAX Coating offers outstanding heat resistance and low friction proprerties for deep milling.
- High accuracy : Diameter tolerance 0 / -0.02 mm.
- Longer tool life with HARDMAX Coating.

Unit (mm)

Model Number	Outsice Diameter ØD	Effective Length ℓ1	Length of Cut ℓ	Neck Diameter Ød1	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød	Effective Length by Inclined Angles 30'	1°	1°30	2°	3°
HLS 4010-040	1	4	1	0.95	16°	50	4	4.66	4.93	5.15	5.34	5.74
HLS 4010-060		6				50	4	6.78	7.10	7.36	7.62	8.19
HLS 4010-080		8				50	4	8.88	9.25	9.56	9.90	10.64
HLS 4012-060	1.2	6	1.2	1.14	16°	50	4	6.78	6.38	6.60	6.83	7.34
HLS 4012-080		8				50	4	8.24	8.51	8.80	9.11	9.79
HLS 4012-100		10				50	4	10.31	10.64	11.00	11.38	12.24
HLS 4015-060	1.5	6	1.5	1.44	16°	50	4	6.78	6.38	6.60	6.83	7.34
HLS 4015-080		8				50	4	8.24	8.51	8.80	9.11	9.79
HLS 4015-100		10				50	4	10.31	10.64	11.00	11.38	12.24
HLS 4018-060	1.8	6	1.8	1.71	16°	50	4	6.22	6.42	6.64	6.87	7.39
HLS 4018-080		8				50	4	8.28	8.55	8.84	9.15	9.83
HLS 4018-100		10				50	4	10.34	10.68	11.04	11.42	12.28
HLS 4018-120		12				50	4	12.40	12.81	13.24	13.70	14.73
HLS 4018-160		16				60	4	16.53	17.07	17.64	18.26	19.62
HLS 4020-060	2	6	2	1.91	16°	50	4	6.22	6.42	6.64	6.87	7.39
HLS 4020-080		8				50	4	8.28	8.55	8.84	9.15	9.83
HLS 4020-100		10				50	4	10.34	10.68	11.04	11.42	12.28
HLS 4020-120		12				50	4	12.40	12.81	13.24	13.70	14.73
HLS 4020-160		16				60	4	16.53	17.07	17.64	18.26	No reference
HLS 4025-080	2.5	8	2.5	2.41	16°	50	4	8.28	8.55	8.84	9.15	9.83
HLS 4025-120		12				50	4	12.40	12.81	13.24	13.70	No reference
HLS 4025-160		16				60	4	16.53	17.07	17.64	18.26	No reference
HLS 4025-200		20				60	4	20.66	21.33	22.04	No tolerance	No reference
HLS 4030-080	3	8	3	2.92	16°	50	6	8.28	8.55	8.84	9.15	9.83
HLS 4030-120		12				50	6	12.40	12.81	13.24	13.70	14.73
HLS 4030-160		16				60	6	16.53	17.07	17.64	18.26	19.62
HLS 4030-200		20				60	6	20.66	21.33	22.04	22.81	24.52

*64 models available in total from Diameter 1mm to 6mm with various Effective Length from 4 to 15 X diameter
For more details please ask your distributor.

4 Flute

for Chrome Cobalt Milling Conditions please refer to page 145 : Hardened Steel 45 - 55 HRC in our UNIMAX Series Vol. 16 Catalogue (QR CODE page 26).

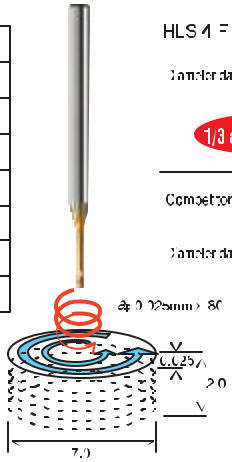
Work Material				Stainless Steel Use oil soluble			Titanium (Grade 5) Use water soluble			Radial Depth
Model Number	Outside Diameter (mm)	Effective Length (mm)	L/D	Spindle Speed (min⁻¹)	Feed Rate (mm/min)	Axial Depth a_p (mm)	Spindle Speed (min⁻¹)	Feed Rate (mm/min)	Axial Depth a_p (mm)	Radial Depth a_e (mm)
HLS 4010	1	4	4	21,000	950	0.036	21,000	850	0.030	0.332
		6	6	19,400	840	0.032	19,400	740	0.020	0.099
		8	8	17,800	740	0.018	17,800	640	0.015	0.041
HLS 4012	1.2	6	5	18,200	1,020	0.034	18,200	920	0.030	0.204
		8	6.7	16,700	890	0.030	16,700	790	0.025	0.087
		10	8.3	15,200	770	0.026	15,200	670	0.02	0.044
HLS 4015	1.5	6	4	16,800	1,200	0.068	16,800	1,100	0.050	0.493
		8	5.3	15,500	930	0.060	15,500	830	0.045	0.211
		10	6.7	14,100	900	0.051	14,100	800	0.040	0.107
HLS 4018	1.8	6	3.3	14,900	1,440	0.068	14,900	1,300	0.060	1.034
		8	4.4	14,600	980	0.060	14,600	800	0.050	0.435
		10	5.6	12,500	950	0.051	12,500	750	0.045	0.223
		12	6.7	11,000	770	0.043	11,000	600	0.040	0.129
		16	8.9	9 000	450	0.026	9,000	350	0.020	0.054
HLS 4020	2	6	3	14,500	1,550	0.0668	14,500	1,400	0.060	1.574
		8	4	11,200	1,000	0.060	11,200	900	0.050	0.665
		10	5	12,000	980	0.051	12,000	880	0.040	0.340
		12	6	10,500	790	0.043	10,500	690	0.035	0.197
		16	8	9 000	500	0.026	9,000	400	0.020	0.083
HLS 4025	2.5	8	3.2	12,800	1,020	0.051	12,800	900	0.075	1.622
		12	4.8	10,000	810	0.056	10,000	710	0.050	0.481
		16	6.4	8 100	590	0.040	8,100	490	0.030	0.202
		20	8	7 300	490	0.030	7.300	390	0.025	0.104
HLS 4030	3	8	2.7	10,900	1,080	0.093	10,900	980	0.085	2.361
		12	4	8 700	830	0.073	8.700	730	0.065	0.996
		16	5.3	7 400	670	0.058	7,100	570	0.055	0.420
		20	6.7	6 600	560	0.045	6.600	460	0.035	0.216

Milling Example: SKD11 (60HRC) Pocket Milling

Tool: HLS φ1.5 X effective length 10mm

Spindle Speed	7,000 min⁻¹
Feed Rate	280 mm/min
Axial Depth a_p	0.025 mm
Radial Depth a_e	1.2 mm
Coolant	Air blow (Nozzle)
Overhang Length	18mm
Pocket Size	ø7X2mm
Cycle Time	17 minutes

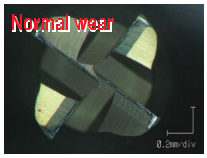
SKD11 (60HRC)

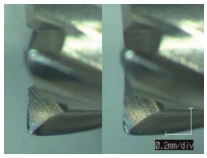


HLS 4 Flutes φ1.5x10

Tool wear damage 0.08 mm

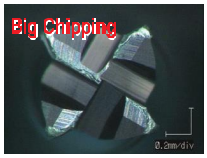
1/3 and under!





Competitor 4 Flutes φ1.5x10

Tool wear damage 0.298mm



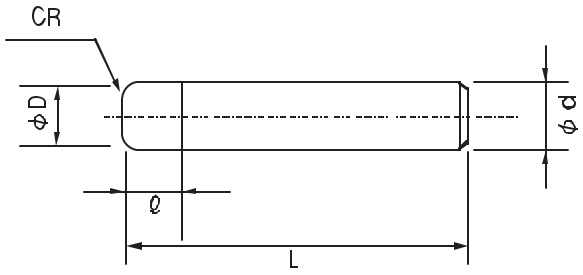
4 Flute

CNRS

Corner Radius
Size Ø6 - Ø12

Number of Flutes	Process			Work Material		
	Roughing	Semi-Finishing	Finishing	Stainless Steel	Titanium	Chrome Cobalt
4	■	■	□	●	●	○

Applicable Work Material (● most suitable, ○ suitable)
Applicable Process (■ most suitable, □ suitable)



4 flute high efficient corner radius designed for Titanium Alloys and Heat Resistant Alloys.
UTCOAT is recommended for heat-resistant hard materials to achieve longer tool life.
Variable pitch, high helix and positive rake angle offer stable milling.
Reduced cutting force when using a helical approach or inclined angles.

Unit (mm)

Model Number	Outside Diameter ØD	Corner Radius CR	Length of Cut ℓ	Overall Length L	Shank Diameter Ød
CNRS 4060-10-06	6	R1	16	90	6
CNRS 4080-10-06	8	R1	16	100	8
CNRS 4100-10-26	10	R1	26	110	10
CNRS 4100-15-26	10	R1.5	26	110	10
CNRS 4100-20-26	10	R2	26	110	10
CNRS 4120-10-26	12	R1	26	120	12
CNRS 4120-15-26	12	R1.5	26	120	12
CNRS 4120-20-26	12	R2	26	120	12

for Chrome Cobalt Milling Conditions please refer to page 161 : Inconnel 718 in our UNIMAX Series Vol. 16 Catalogue (QR CODE page 26).

Work Material			Stainless Steel (SUS304) Use water soluble coolant.				Titanium (Grade 5)			
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)
CNRS 1060-10-06	6	16	3,700	740	4.8	0.3	3,700	740	4.8	0.3
CNRS 4080-10-06	8	16	2,830	700	6.4	0.4	2,800	700	6.4	0.4
CNRS 4100-10-26	10	26	1,980	680	8.0	0.5	1,980	680	8.0	0.5
CNRS 4100-15-26	10	26	2,090	680	8.0	0.5	2,090	680	8.0	0.5
CNRS 1100-20-26	10	26	2,200	680	8.0	0.5	2,200	680	8.0	0.5
CNRS 4120-10-26	12	26	1,665	650	9.6	0.6	1,665	650	9.6	0.6
CNRS 4120-15-26	12	26	1,760	650	9.6	0.6	1,760	650	9.6	0.6
CNRS 1120-20-26	12	26	1,850	650	9.6	0.6	1,850	650	9.6	0.6

*8 models available in total from Diameter 6mm to 18mm with various corner radius from 1mm to 2mm.
For more details please ask your distributor.

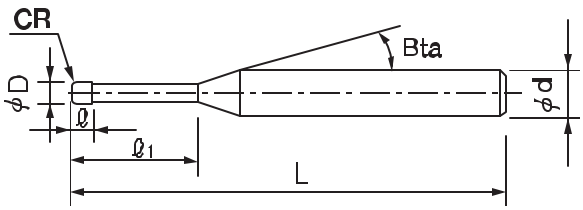
4 Flute

CRRS

Long Neck Radius
Size Ø2 - Ø12

Super MG | UT COAT | 45° | R | R ±0.01 (Ø2 - Ø6) | R ±0.015 (Ø3 - Ø12) | Shank Dia 0/-0.005 | Back Taper Geometry | Variable Pitch

Number of Flutes	Process			Work Material		
	Roughing	Semi-Finishing	Finishing	Stainless Steel	Titanium	Chrome Cobalt
4	■	■	□	●	●	•



Applicable Work Material (● most suitable, • suitable)

Applicable Process (■ most suitable, □ suitable)

UTCOAT offers longer tool life milling Heat Resistant Alloys.
Variable pitch, high helix and positive rake angle offer stable milling.
Reduced cutting force when using a helical approach or inclined angles.

Unit (mm)

Model Number	Outside Diameter ØD	Corner Radius CR	Effective Length ℓ1	Length of Cut ℓ	Neck Diameter Ød1	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød
CRRS 4020-05-06	2	R0.5	6	2	1.91	16°	70	4
CRRS 4030-08-09	3	R0.8	9	3	2.92	16°	70	6
CRRS 4040-05-12	4	R0.5	12	4	3.82	16°	60	6
CRRS 4040-10-12	4	R1	12	4	3.82	16°	70	6
CRRS 4050-12-15	5	R1.2	15	5	4.82	16°	70	6
CRRS 4060-10-18	6	R1	18	6	5.82	-	60	6
CRRS 4060-15-18	6	R1.5	18	6	5.82	-	90	6
CRRS 4080-10-26	8	R1	26	8	7.82	-	70	8
CRRS 4080 20 24	8	R2	24	8	7.82	-	100	8
CRRS 4100-10-30	10	R1	30	10	9.82	-	80	10
CRRS 4100-20-30	10	R2	30	10	9.82	-	110	10
CRRS 4120 20 36	12	R2	36	12	11.82	-	120	12

for Chrome Cobalt Milling Conditions please refer to page 209 : Hardened Steel 45 - 55 HRC in our UNIMAX Series Vol. 16 Catalogue (QR CODE page 26)

Work Material			Stainless Steel (SUS304) Use water soluble coolant.				Titanium (Grade 5) Side milling			
Model Number	Outside Diameter (mm)	Length of Cut (mm)	Spindle Speed (min⁻¹)	Feed (mm/min)	ap Axial Depth (mm)	ae Radial Depth (mm)	Spindle Speed (min⁻¹)	Feed (mm/min)	ap Axial Depth (mm)	ae Radial Depth (mm)
CRRS 4020-05-06	2	2	30,000	7,200	0.01	0.66	7,960	700	0.01	0.66
CRRS 4030-08-09	3	3	20,000	7,200	0.04	1.08	5,300	700	0.04	1.08
CRRS 4040-05-12	4	4	15,000	7,200	0.05	1.35	4,780	750	0.05	1.32
CRRS 4040-10-12	4	4	15,000	7,200	0.05	1.65	4,780	750	0.05	1.32
CRRS 4050-12-15	5	5	12,000	7,200	0.06	1.80	3,820	780	0.06	1.8
CRRS 4060-10-18	6	6	10,000	7,200	0.07	2.16	3,700	710	0.07	1.98
CRRS 4060-15-18	6	6	10,000	7,200	0.08	2.64	3,700	740	0.07	1.98
CRRS 4080-10-26	8	8	7,500	7,200	0.09	2.70	2,800	700	0.08	2.61
CRRS 4080 20 24	8	8	7,500	7,200	0.10	2.79	2,800	700	0.09	2.61
CRRS 4100-10-30	10	10	5,000	5,100	0.14	2.97	1,980	580	0.14	2.68
CRRS 4100-20-30	10	10	5,000	5,400	0.14	3.06	1,980	580	0.14	2.68
CRRS 4120-20-36	12	12	3,000	4,300	0.18	3.15	1,665	550	0.18	3.15

*17 models available in total from Diameter 2mm to 12mm with various corner radius from 0.5mm to 2mm.
For more details please ask your distributor.

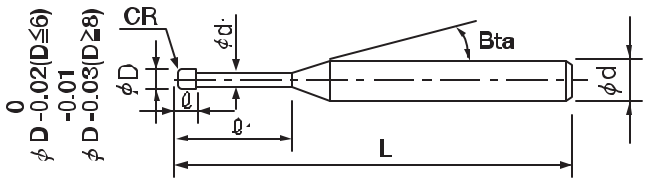
4 Flute

HRRS-S

Long Neck Radius
Size Ø2 - Ø12

Super MG | HARD MAX | 45° | R | R ±0.01 (Ø2 – Ø6) | R ±0.015 (Ø8 – Ø12) | Shank Dia 0/-0.005 | Back Taper Geometry | Variable Pitch

Number of Flutes	Process			Work Material		
	Roughing	Semi-Finishing	Finishing	Stainless Steel	Titanium	Chrome Cobalt
4	■	■	□	●	○	●



Applicable Work Material (● most suitable, ○ suitable)
Applicable Process (■ most suitable, □ suitable)

- Shorter overall length and overhang offers higher feed and precision.
- Special corner radius geometry / size offers larger step over.
- Seamless corner radius.
- Longer tool life with HARDMAX Coating.

Unit (mm)

Model Number	Outside Diameter ØD	Corner Radius CR	Effective Length ℓ1	Length of Cut ℓ	Neck Diameter Ød	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød
HRRS 4020-03-06S	2	R0.3	6	2	1.91	16°	45	4
HRRS 4020-05-06S	2	R0.5	6	2	1.91	16°	45	4
HRRS 4030-08-09-3S	3	R0.8	9	3	2.92	-	50	3
HRRS 4040-05-12S	4	R0.5	12	4	3.82	-	50	4
HRRS 4040-10-12S	4	R1	12	4	3.82	-	50	4
HRRS 4050-12-15S	5	R1.2	15	5	4.82	16°	50	6
HRRS 4060-10-18S	6	R1	18	6	5.82	-	50	6
HRRS 4060-20-18S	6	R2	18	6	5.82	-	50	6
HRRS 4080-10-24S	8	R1	24	8	7.82	-	60	8
HRRS 4080-20-24S	8	R2	24	8	7.82	-	60	8
HRRS 4100-10-30S	10	R1	30	10	9.82	-	65	10
HRRS 4100-20-30S	10	R2	30	10	9.82	-	65	10
HRRS 4120-10-36S	12	R1	36	12	11.82	-	75	12
HRRS 4120-20-36S	12	R2	36	12	11.82	-	75	12

for Chrome Cobalt Milling Conditions please refer to page 204 : Hardened Steel 45 - 55 HRC in our UNIMAX Series Vol. 16 Catalogue (QR CODE page 96).

Work Material			Stainless Steel (SUS304) Use water soluble coolant				Titanium (Grade 5) Side milling			
Model Number	Outside Diameter (mm)	Length of Cut (mm)	Spindle Speed (min⁻¹)	Feed (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min⁻¹)	Feed (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
HRRS 4020-03-06S	2	2	30,000	7,200	0.04	0.66	7,960	700	0.04	0.66
HRRS 4020-05-06S	2	2	30,000	7,200	0.04	0.66	7,960	700	0.04	0.66
HRRS 4030-08-09-3S	3	3	20,000	7,200	0.04	1.08	5,300	700	0.04	1.08
HRRS 4040-05-12S	4	4	15,000	7,200	0.05	1.32	4,780	700	0.05	1.32
HRRS 4040-10-12S	4	4	15,000	7,200	0.05	1.58	4,780	700	0.05	1.32
HRRS 4050-12-15S	5	5	12,000	7,200	0.06	1.80	3,820	760	0.06	1.8
HRRS 4060-10-18S	6	6	10,000	7,200	0.07	2.16	3,700	740	0.07	1.98
HRRS 4060-20-18S	6	6	10,000	7,200	0.07	2.34	3,700	740	0.07	1.98
HRRS 4080-10-24S	8	8	7,500	7,200	0.09	2.70	2,800	700	0.08	2.61
HRRS 4080-20-24S	8	8	7,500	7,200	0.10	2.79	2,800	700	0.08	2.61
HRRS 4100-10-30S	10	10	5,000	5,400	0.14	2.97	1,980	680	0.14	2.88
HRRS 4100-20-30S	10	10	5,000	5,400	0.14	3.06	1,980	680	0.14	2.88
HRRS 4120-10-36S	12	12	3,000	4,300	0.18	3.15	1,665	650	0.16	3.15
HRRS 4120-20-36S	12	12	3,000	4,300	0.18	3.15	1,665	650	0.16	3.15

4 Flute

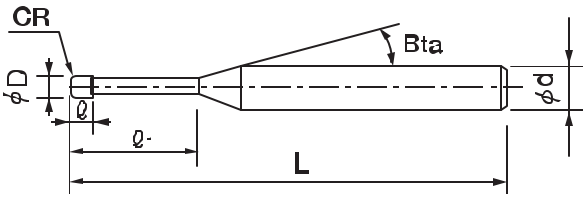
HLRS 4000

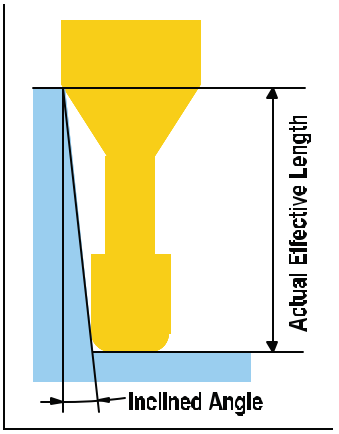
Long Neck Radius
Size Ø0.8 - Ø6

Number of Flutes	Process			Work Material		
	Roughing	Semi-Finishing	Finishing	Stainless Steel	Titanium	Chrome Cobalt
4	□	■	■	●	◦	●

Applicable Work Material (● most suitable, ◦ suitable)

Applicable Process (■ most suitable, □ suitable)





- The 4 flutes design offers high milling efficency and accuracy.
- The rigid tool geometry offers longer tool life.
- Suitable for both dry and wet coolant types.
- The new HARDMAX Coating ensures improved heat resistance.

Unit (mm)

Model Number	Outside Diameter Ø D	Corner Radius CR	Effective Length ℓ	Length of cut ℓ1	Neck Diameter Ø c	Shank Taper Angle B≧	Overall Length L	Shank Diameter Ø d
LRS 4000-02-02C	0.8	R0.2	2	0.40	0.70	15°	50	4
LRS 4000-02-04C			4					
LRS 4000-02-06C			6					
LRS 4010-02-02C	1.0	R0.2	2	0.8	0.95	15°	50	4
-LRS 1010-02-04C			4					
-LRS 1010-02-06C			6					
-LRS 1012-02-04C	1.2	R0.2	4	0.96	1.11	15°	50	4
-LRS 1012-02-06C			6					
-LRS 4012-03-04C		R0.3	4					
LRS 4012-03-06C			6					
LRS 4015-01-04C	1.5	R0.1	4	1.2	1.45	15°	50	4
LRS 4015-01-06C			6					
LRS 4015-01-08C			8					
-LRS 1015-01-10C			10					
-LRS 1015-02-04C		R0.2	4					
-LRS 1015-02-06C			6					
-LRS 1015-02-08C			8					
-LRS 4015-02-10C			10					
-LRS 4015-03-04C		R0.3	4					
LRS 4015-03-06C			6					
LRS 4015-03-08C			8					
LRS 4015-03-10C			10					
LRS 4020-01-06C	2.0	R0.1	6	1.6	1.92	15°	50	4
-LRS 1020-01-08C			8					
-LRS 1020-01-10C			10					
-LRS 1020-02-06C		R0.2	6					
-LRS 1020-02-08C			8					
-LRS 4020-02-10C			10					
LRS 4020-03-06C		R0.3	6					
LRS 4020-03-08C			8					
LRS 4020-03-10C			10					
LRS 4020-03-12C			12				55	
-LRS 1025-01-06C	2.5	R0.1	6	2	2.42	15°	50	4
-LRS 1025-01-08C			8				50	
-LRS 1025-01-10C			10				50	
-LRS 1025-01-16C			16				60	
-LRS 4025-02-06C		R0.2	6				50	
-LRS 4025-02-08C			8				50	
LRS 4025-02-10C			10				50	
LRS 4025-02-16C			16				60	
LRS 4025-03-06C		R0.3	6				50	
-LRS 1025-03-08C			8				50	
-LRS 1025-03-10C			10				50	
-LRS 1025-03-16C			16				60	
-LRS 1025-05-06C		R0.5	6				50	
-LRS 4025-05-08C			8				50	
-LRS 4025-05-10C			10				50	
LRS 4025-05-16C			16				60	

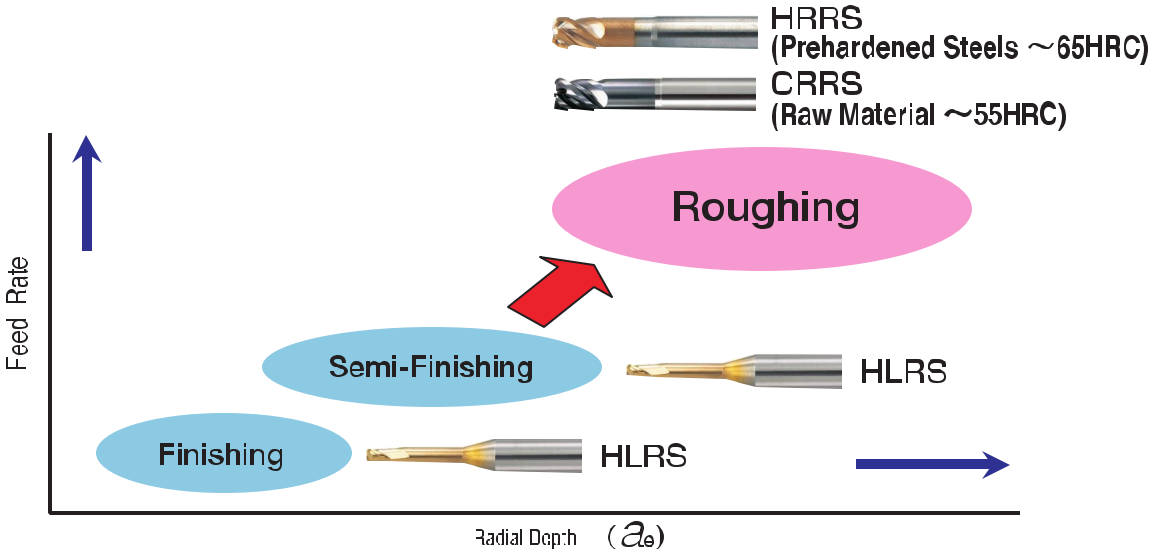
* 219 models available in total from Diameter 0.8mm to 6mm with various corner radius from 0.05mm to 1mm.
For more details please ask your distributor

4 Flute

for Chrome Coated Milling Conditions please refer to page 200 : Hardened Steel 45 - 55 HRC in our JNMAX Series Vol. 16 Catalogue (QR CODE page 26).

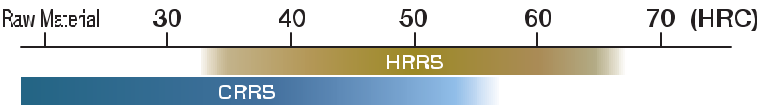
WORK MATERIAL				STAINLESS STEELS Use a oil soluble coolant			TITANIUM (GRADE 5)			Radial Depth
Model Number	Outside Diameter	Effective Length	L/D	Speed (min^{-1})	Feed (mm/min)	Axial Depth a_p (mm)	Speed (min^{-1})	Feed (mm/min)	Axial Depth a_p (mm)	Radial Depth a_e (mm)
HLRS 4009	0.8	7	2.5	20,000	1,100	0.025	15,900	500	0.015	0.267
		3	3.75	18,800	950	0.021	14,300	500	0.015	0.267
		4	5	17,500	840	0.018	13,300	500	0.010	0.264
HLRS 4012	1.2	4	3.3	13,200	1,360	0.032	11,900	550	0.020	0.330
		6	5	11,200	1,160	0.028	11,000	550	0.020	0.330
HLRS 4015	1.5	4	2.7	13,200	1,360	0.054	9,500	550	0.030	0.0495
		6	4	11,600	1,250	0.041	9,300	600	0.030	0.495
		8	5.3	10,200	1,050	0.037	8,500	600	0.025	0.495
		10	6.7	9,300	930	0.032	8,300	550	0.025	0.495
HLRS 4020	2	8	4	11,200	1,160	0.058	8,300	700	0.040	0.360
		10	5	10,000	1,090	0.049	7,500	650	0.040	0.360
		12	6	9,100	1,030	0.046	7,300	600	0.035	0.360
HLRS 4025	2.5	8	3.2	11,300	1,430	0.075	6,400	700	0.040	0.825
		10	4	10,500	1,400	0.067	6,300	650	0.040	0.825
		16	6.4	8,900	1,400	0.059	5,600	600	0.040	0.825

Usage of Radius Series



4 Flutes Active Corner Radius End Mill's Target Hardness

- HARDMAX HRRS (Prehardened Steels ~65HRC)
- UTCOAT CRRS (Raw Material ~55HRC)



- UTCOAT CNRS
  Ø6mm - Ø12mm

For Hard Materials
(Titanium and Heat Resistant Steels)

2 Flute

CSEB

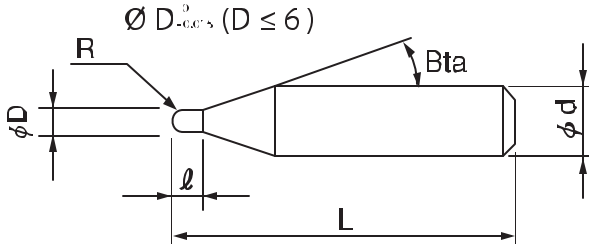
Ball

Size R0.05 - R6

Number of Flutes	Process			Work Material		
	Roughing	Semi-Finishing	Finishing	Stainless Steel	Titanium	Chrome Cobalt
2	■	■	■	●	●	●

Applicable Work Material (● most suitable, ● suitable)

Applicable Process (■ most suitable, ■ suitable)



New robust geometry offers durability when roughing, yet gives excellent surface quality for finishing.
The new multi-layered UTCOAT resists wear though improved hardness, durability and coating adhesion to the tool.
Broad application range from raw material to titanium.

Unit (mm)

Model Number	Radius of Ball Nose R	Length of Cut ℓ	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ø d
CSEB 2002-0020-6	R0.1	0.2	1°	50	6
CSEB 2002-0030	R0.1	0.3	1°	50	4
CSEB 2003-0030	R0.15	0.3	1°	50	4
CSEB 2003-0030-6	R0.15	0.3	1°	50	6
CSEB 2003-0045	R0.15	0.45	1°	50	4
CSEB 2004-0040	R0.2	0.4	1°	50	4
CSEB 2004-0040-6	R0.2	0.4	1°	50	6
CSEB 2004-0060	R0.2	0.6	1°	50	4
CSEB 2005-0050	R0.25	0.5	1°	50	4
CSEB 2005-0050-6	R0.25	0.5	1°	50	6
CSEB 2005-0075	R0.25	0.75	1°	50	4

for Chrome Cobalt Milling Conditions please refer to page 234 : Hardened Steel 45 - 55 HRC in our UNIMAX Series Vol. 16 Catalogue (QR CODE page 27)

Work Material			Stainless Steel (SUS304) Use of soluble coolant				TITANIUM (Grade 5)			
Model Number	Radius of Ball Nose (mm)	Length of Cut	Spindle Speed (min⁻¹)	Feed (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min⁻¹)	Feed (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
CSEB 2002-0020-6	R0.1	0.2	60,000	250	0.006	0.024	60,000	250	0.008	0.024
CSEB 2002-0030	R0.1	0.3	60,000	250	0.006	0.024	60,000	250	0.008	0.024
CSEB 2003-0030	R0.15	0.3	54,000	350	0.012	0.024	54,000	350	0.012	0.024
CSEB 2003-0030-6	R0.15	0.3	54,000	350	0.012	0.024	54,000	350	0.012	0.024
CSEB 2003-0045	R0.15	0.45	54,000	350	0.012	0.024	54,000	350	0.012	0.024
CSEB 2004-0040	R0.2	0.4	50,000	550	0.020	0.040	50,000	550	0.020	0.040
CSEB 2004-0040-6	R0.2	0.4	50,000	550	0.020	0.040	50,000	550	0.020	0.040
CSEB 2004-0060	R0.2	0.6	50,000	550	0.020	0.040	50,000	550	0.020	0.040
CSEB 2005-0050	R0.25	0.5	45,000	750	0.030	0.060	45,000	750	0.030	0.060
CSEB 2005-0050-6	R0.25	0.5	40,000	750	0.030	0.060	40,000	750	0.030	0.060
CSEB 2005-0075	R0.25	0.75	40,000	750	0.030	0.060	40,000	750	0.030	0.060

* 77 models available in total from Radius R0.05 mm to R6 mm.
For more details please ask your distributor.

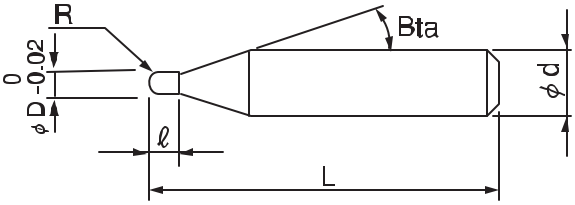
3 Flute

CFB

Ball
Size R0.3 - R6

Super MG | UT COAT | 30° | R +0.005 (R1 - R1.5) | R +0.007 (R2 - R3) | R ±0.01 (R4 - R6) | Shank Dia 0/-0.005 | Variable Pitch

Number of Flutes	Process			Work Material		
	Roughing	Semi-Finishing	Finishing	Stainless Steel	Titanium	Chrome Cobalt
3	■	■	■	●	●	●



Applicable Work Material (● most suitable, ● suitable)
Applicable Process (■ most suitable, ■ suitable)

3 flutes design offers high feed milling, reducing cycle times when roughing.
Capable of deep milling that raises machine efficiency, even with complicated shapes that require slow feeds.
Variable pitch design minimizes tool chattering.
The original design features help to promote excellent chip evacuation and surface finishing on tools that are 0.75mm and larger. Diameter tolerance : 0 / -0.02mm.

Unit (mm)

Model Number	Radius of Ball Nose R	Length of Cut ℓ	Shank Taper Angle Bta	Overall Length L	Shank Diameter ϕ d
CFB 3006-0090	R0.3	0.9	16°	50	4
CFB 3008-0120	R0.4	1.2	16°	50	4
CFB 3010-0150	R0.5	1.5	16°	50	4
CFB 3015-0225	R0.75	2.25	16°	50	4
CFB 3020-0300	R1	3	16°	50	4
CFB 3030-0450	R1.5	4.5	16°	60	6
CFB 3040-0600	R2	6	16°	70	6
CFB 3050-0750	R2.5	7.5	16°	80	6
CFB 3060-0900	R3	9	-	80	6
CFB 3080-1200	R4	12	-	90	8
CFB 3100-1500	R5	15	-	100	10
CFB 3120-1800	R6	18	-	110	12

for Chrome Cobalt Milling Conditions please refer to page 241 : Hardened Steel 45 - 55 HRC in our UNIMAX Series Vol. 16 Catalogue (QR CODE page 27).

Work Material			Stainless Steel (SUS304) Use water soluble coolant				Titanium (Grade 5)			
Model Number	Radius of Ball Nose (mm)	Length of Cut (mm)	Spindle Speed (min⁻¹)	Feed (mm/min)	ap Axial Depth (mm)	ae Radial Depth (mm)	Spindle Speed (min⁻¹)	Feed (mm/min)	ap Axial Depth (mm)	ae Radial Depth (mm)
CFB 3006-0090	R0.3	0.9	20,000	1,000	0.015	0.09	20,000	1,000	0.015	0.09
CFB 3008-0120	R0.4	1.2	20,000	1,250	0.02	0.12	20,000	1,250	0.02	0.12
CFB 3010-0150	R0.5	1.5	20,000	1,500	0.025	0.15	20,000	1,500	0.025	0.15
CFB 3015-0225	R0.75	2.25	20,000	2,500	0.035	0.22	20,000	2,500	0.035	0.22
CFB 3020-0300	R1	3	24,000	4,000	0.1	0.4	24,000	4,000	0.1	0.4
CFB 3030-0450	R1.5	4.5	16,000	4,000	0.15	0.65	16,000	4,000	0.15	0.65
CFB 3040-0600	R2	6	12,000	1,000	0.2	0.85	12,000	4,000	0.2	0.85
CFB 3050-0750	R2.5	7.5	10,000	4,000	0.25	1	10,000	4,000	0.25	1
CFB 3060-0900	R3	9	8,000	4,000	0.3	1.3	8,000	4,000	0.3	1.3
CFB 3080-1200	R4	12	6,000	4,000	0.4	1.7	6,000	4,000	0.4	1.7
CFB 3100-1500	R5	15	4,800	1,000	0.5	2.1	4,800	4,000	0.5	2.1
CFB 3120-1800	R6	18	4,000	4,000	0.6	2.6	4,000	4,000	0.6	2.6

* 14 models available in total from Radius 0.3 mm to 6mm.
For more details please ask your distributor.

4 Flute

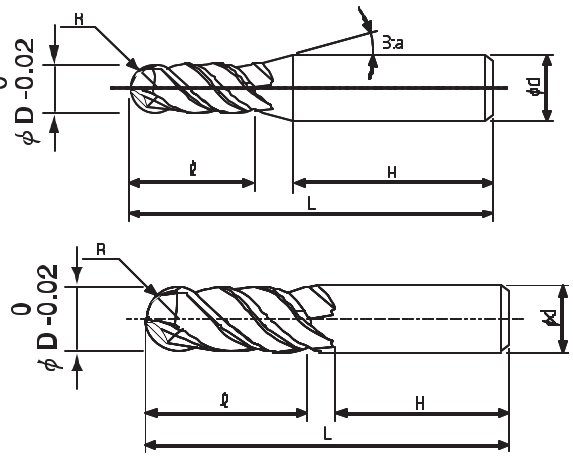
HFB-S

Short Ball
Size R1 - R6

Super MG | HARD MAX | 40° | R ±0.005 (R1 - R1.5) | R ±0.007 (R2 - R3) | R ±0.01 (R4 - R6) | Shank Dia 0/-0.005 | Variable P...

Number of Flutes	Process			Work Material		
	Roughing	Semi-Finishing	Finishing	Stainless Steel	Titanium	Chrome Cobalt
4	■	■	□	●	●	●

Applicable Work Material (● most suitable, • suitable)
Applicable Process (■ most suitable, □ suitable)



The tool geometry offers oustanding chip evacuation performance.
The new tip design offers excellent cutting performance.
Offers excellent tool performance to cost ratio.
Diameter Tolerance : 0/ -0.02mm

Unit (mm)

Model Number	Radius of Ball Nose R	Length of Cut ℓ	Shank Taper Angle θa	Overall Length L	Shank Diameter Ød
HFB 4020-0300S	R1	3	16°	40	4
HFB 4030-0450S	R1.5	4.5	16°	40	4
HFB 4040-0600S	R2	6	16°	45	6
HFB 4060-0900S	R3	9	-	50	6
HFB 4080-1200S	R4	12	-	60	8
HFB 4100-1500S	R5	15	-	60	10
HFB 4120-1800S	R6	18	-	60	12

for Chrome Cobalt Milling Conditions please refer to page 248 : Hardened Steel 45 - 55 HRC in our UNIMAX Series Vol. 16 Catalogue (QR CODE page 27).

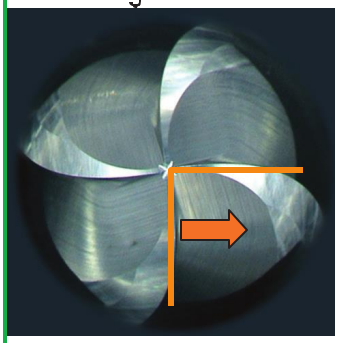
Work Material			Stainless Steel (SUS304) Use water soluble coolant.				Titanium (Grade 5) Use air blow.			
Model Number	Radius of Ball Nose (mm)	Length of Cut (mm)	Spindle Speed (min⁻¹)	Feed (mm/min)	ap Axial Depth (mm)	ae Radial Depth (mm)	Spindle Speed (min⁻¹)	Feed mm/min	ap Axial Depth (mm)	ae Radial Depth (mm)
HFB 4020-0300S	R1	3	24,000	4,000	0.20	0.60	24,000	4,000	0.20	0.60
HFB 4030-0450S	R1.5	4.5	16,000	4,000	0.30	0.90	16,000	4,000	0.30	0.90
HFB 4040-0600S	R2	6	12,000	4,000	0.40	1.20	12,000	4,000	0.40	1.20
HFB 4060-0900S	R3	9	8,000	4,000	0.60	1.80	8,000	4,000	0.60	1.80
HFB 4080-1200S	R4	12	6,000	4,000	0.80	2.40	6,000	4,000	0.80	2.40
HFB 4100-1500S	R5	15	4,800	4,000	1.00	3.00	4,800	4,000	1.00	3.00
HFB 4120-1800S	R6	18	4,000	4,000	1.20	3.60	4,000	4,000	1.20	3.60

* 7 models available in data from Radius 1mm to 6mm
For more details please ask your distributor.

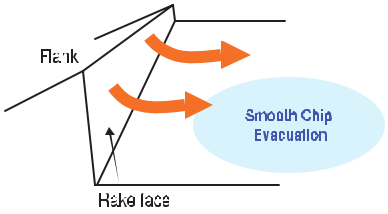
4 Flute

Feature 1 Special Design Achieves Outstanding Chip Evacuation

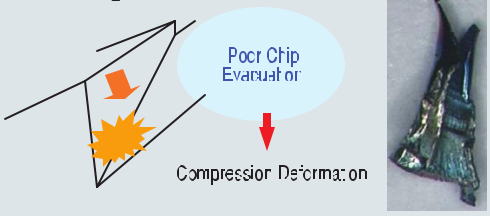
HFB Design

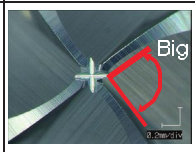
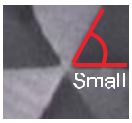
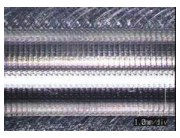
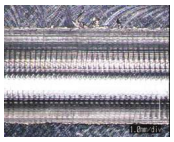
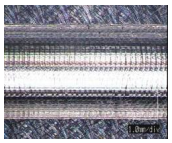
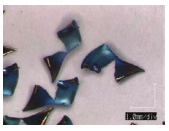
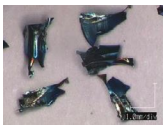


Flat (Non-rolled up) chip shape helps smooth chip evacuation.



Convertional Design



	HFB	Competitor A	Competitor B
Tip Point			
Milling Surface			
Chip Condition			

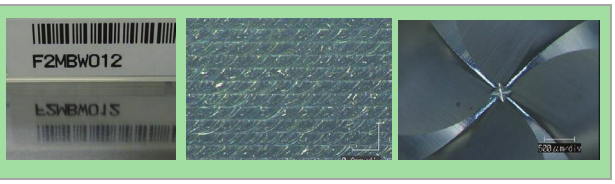
Tool	R2
Work Material	YXR33 (52HRC)
Spindle Speed	6,000min⁻¹
Feed Rate	2,400mm/min (Slotting:1,200mm/min)
Axial Depth a_p	1mm (0.25D) D: Outside Diameter
Radial Depth a_e	1mm (0.25D) D: Outside Diameter
Overhang	15mm
Coolant	Air Blow (Through Spindle)
Pocket Size	100mmx20mmx8mm(X×Y×Z)
Cycle Time	28.2min

The large pocket design of the HFB promotes better chip evacuation and longer tool life when compared to a conventional design which shows premature damage.

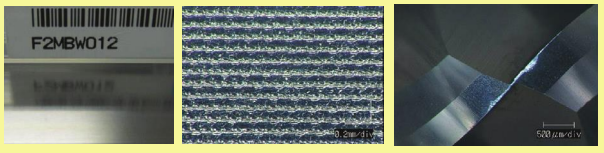
Feature 2 Surface Finish Performance

STAVAX (53HRC) Milling Example: Surface Finishing HFB (R3)

HFB R3
Max Roughness
Rz: 0.9μm



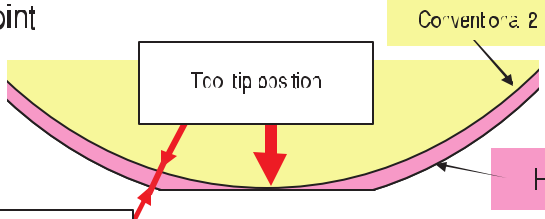
Conventional
2 Flutes
Max Roughness
Rz: 6.43μm



Spindle Speed	12,800min⁻¹
Feed Rate	2,500mm/min
Axial Depth a_p	0.06mm(0.01D)
Radial Depth a_e	0.12mm(0.02D)
Coolant	Oil Mist

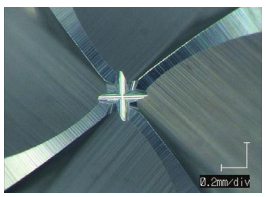
4 grooves on the tip point help surface finishing process. Max roughness value was 0.9μm on 1hour testing.
The tool condition is better than conventional 2 Flutes.

Tip point



Radius	Max R tolerance error point	HFB R Tolerance
R2 - R3	under +5μm	7μm
R4 - R5	under +7μm	±10μm
R6	under +10μm	

4 Tip Point Grooves



4 tip point groove can achieve longer tool life.

2 Flute

CSELB

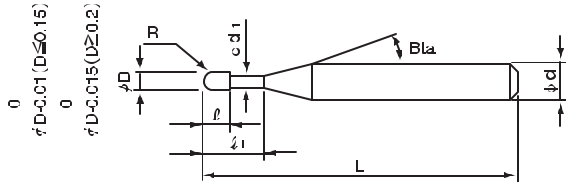
Long Neck Ball
Size R0.05 - R3

Super MG | UT COAT | Shank Dia 0/-0.005 | Back Taper Geometry

Number of Flutes	Process			Work Material		
	Roughing	Semi-Finishing	Finishing	Stainless Steel	Titanium	Chrome Cobalt
2	■	■	■	●	●	●

Applicable Work Material (● most suitable, ● suitable)

Applicable Process (■ most suitable, ■ suitable)



New robust gometry offers durability when roughing, yet gives excellent surface quality for finishing.
The new multi layered UTCOAT resists wear though improved hardness, durability and coating adhesion to the tool.
Broad application range from raw materials to Tilanium.

Unit (mm)

Model Number	Radius of Ball Nose R	Effective Length ℓ1	Length of Cut ℓ	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød
CSELB 2002-005	R0.1	0.5	0.16	11°	45	4
CSELB 2002-0075	R0.1	0.75	0.16	11°	45	4
CSELB 2002-010	R0.1	1.0	0.16	11°	45	4
CSELB 2003-0075	R0.15	0.75	0.24	11°	45	4
CSELB 2003-010	R0.15	1	0.24	11°	45	4
CSELB 2003-015	R0.15	1.5	0.24	11°	45	4
CSELB 2004-010	R0.2	1	0.32	11°	45	4
CSELB 2004-015	R0.2	1.5	0.32	11°	45	4
CSELB 2004-020	R0.2	2	0.32	11°	45	4
CSELB 2005-015	R0.25	1.5	0.4	11°	45	4
CSELB 2005-020	R0.25	2	0.4	11°	45	4
CSELB 2005-025	R0.25	2.5	0.4	11°	45	4

for Chrome Cobalt Milling Conditions please refer to page 302 : Hardened Steel 45 - 55 HRC in our UNIMAX Series Vol. 16 Catalogue (QR CODE page 27)

Work Material			Stainless Steel (SUS304) Use oil coolant.				Titanium (Grade 5)			
Model Number	Radius of Ball Nose (mm)	Effective Length (mm)	Spindle Speed (min⁻¹)	Feed (mm/min)	ae Axial Depth (mm)	ap Radial Depth (mm)	Spindle Speed (min⁻¹)	Feed (mm/min)	ae Axial Depth (mm)	ap Radial Depth (mm)
CSELB 2002-005	R0.1	0.5	60,000	250	0.008	0.016	60,000	250	0.008	0.016
CSELB 2002-0075	R0.1	0.75	60,000	220	0.007	0.015	60,000	220	0.007	0.015
CSELB 2002-010	R0.1	1	60,000	200	0.005	0.015	60,000	200	0.005	0.015
CSELB 2003-0075	R0.15	0.75	43,000	400	0.012	0.024	43,000	400	0.012	0.024
CSELB 2003-010	R0.15	1	43,000	350	0.008	0.024	43,000	350	0.008	0.024
CSELB 2003-015	R0.15	1.5	43,000	330	0.007	0.021	43,000	330	0.007	0.021
CSELB 2004-010	R0.2	1	35,000	1,000	0.02	0.04	35,000	1,000	0.02	0.04
CSELB 2004-015	R0.2	1.5	35,000	700	0.016	0.033	35,000	700	0.016	0.033
CSELB 2004-020	R0.2	2	35,000	500	0.011	0.033	35,000	500	0.011	0.033
CSELB 2005-015	R0.25	1.5	34,000	900	0.025	0.05	34,000	900	0.025	0.05
CSELB 2005-020	R0.25	2	34,000	700	0.23	0.046	34,000	700	0.23	0.046
CSELB 2005-025	R0.25	2.5	34,000	600	0.015	0.045	34,000	600	0.015	0.045

* 165 models available in total. from Radius R0.05mm to R3mm with effective length from 4 to 30 X diameter.
For more details please ask your distributor

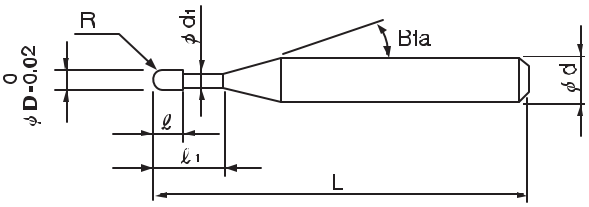
3 Flute

CFLB

Long Neck Ball
Size R0.3 - R3

Super MG | UT COAT | 30° | R ±0.005 (R0.3 - R1.5) | R ±0.007 (R2 - R3) | Shank Dia 0/-0.005 | Variable Pitch

Number of Flutes	Process			Work Material		
	Roughing	Semi - Finish	Finish	Stainless Steel	Titanium	Chrome Cobalt
3	■	■	■	●	●	●



Applicable Work Material (● most suitable, ● suitable)

Applicable Process (■ most suitable, ■ suitable)

3 flute design offers higher feed rate milling, reducing cycle times when roughing.
Capable of deep milling that raises machine efficiency, even with complicated shape that require slow feeds.
Variable pitch design minimizes tool chattering.
The original design features help to promote excellent chip evacuation and surface finishing on tools that are R0.75mm and larger. Diameter tolerance : 0 / -0.02mm.

Model Number	Radius of Ball Nose R	Effective Length of cut ℓ1	Length of cut ℓ	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ø d
CFLB 3006-020	R0.3	2	0.48	16°	50	4
CFLB 3006-030	R0.3	3	0.48	16°	50	4
CFLB 3010-025	R0.5	2.5	0.8	16°	50	4
CFLB 3010-030	R0.5	3	0.8	16°	50	4
CFLB 3010-040	R0.5	4	0.8	16°	50	4
CFLB 3015-060	R0.75	6	1.2	16°	50	4
CFLB 3015-080	R0.75	8	1.2	16°	50	4
CFLB 3015-100	R0.75	10	1.2	16°	50	4
CFLB 3020-060	R1	6	1.6	16°	50	4
CFLB 3020-080	R1	8	1.6	16°	50	4
CFLB 3020-100	R1	10	1.6	16°	50	4
CFLB 3030-080	R1.5	8	2.4	16°	60	6
CFLB 3030-100	R1.5	10	2.4	16°	60	6
CFLB 3030-120	R1.5	12	2.4	16°	60	6
CFLB 3040-120	R2	12	3.2	16°	70	6
CFLB 3040-160	R2	16	3.2	16°	70	6
CFLB 3040-200	R2	20	3.2	16°	70	6

for Chrome Cobalt Milling Conditions please refer to page 322 : Titanium in our UNIMAX Series Vol. 16 Catalogue (QR CODE page 27).

Work Material			Stainless Steel (SUS304) Use water soluble coolant.				Titanium (Grade 5)			
Model Number	Radius of Ball Nose (mm)	Effective Length (mm)	Spindle Speed (min⁻¹)	Feed Rate (mm/min)	ae Axial Depth (mm)	ap Radial Depth (mm)	Spindle Speed (min⁻¹)	Feed Rate (mm/min)	ae Axial Depth (mm)	ap Radial Depth (mm)
CFLB 3006-020	R0.3	2	20,000	1,000	0.015	0.09	20,000	1,000	0.015	0.09
CFLB 3006-030	R0.3	3	20,000	1,000	0.015	0.09	20,000	1,000	0.015	0.09
CFLB 3010-025	R0.5	2.5	20,000	500	0.025	0.15	20,000	500	0.025	0.15
CFLB 3010-030	R0.5	3	20,000	1,500	0.025	0.15	20,000	1,500	0.025	0.15
CFLB 3010-040	R0.5	4	20,000	1,500	0.025	0.15	20,000	1,500	0.025	0.15
CFLB 3015-080	R0.75	8	20,000	2,500	0.035	0.22	20,000	2,500	0.035	0.22
CFLB 3015-080	R0.75	8	20,000	2,500	0.035	0.22	20,000	2,500	0.035	0.22
CFLB 3015-100	R0.75	10	16,000	2,000	0.025	0.19	16,000	2,000	0.025	0.19
CFLB 3020-060	R1	6	20,000	3,200	0.100	0.43	20,000	3,200	0.100	0.43
CFLB 3020-080	R1	8	20,000	3,000	0.100	0.43	20,000	3,000	0.100	0.43
CFLB 3020-100	R1	10	20,000	4,000	0.100	0.43	20,000	4,000	0.100	0.43
CFLB 3030-080	R1.5	8	16,000	4,000	0.150	0.65	16,000	4,000	0.150	0.65
CFLB 3030-100	R1.5	10	16,000	3,600	0.150	0.65	16,000	3,600	0.150	0.65
CFLB 3030-120	R1.5	12	16,000	4,000	0.135	0.65	16,000	4,000	0.135	0.65
CFLB 3040-120	R2	12	12,000	3,600	0.200	0.87	12,000	3,600	0.200	0.87
CFLB 3040-160	R2	16	10,000	3,000	0.200	0.87	10,000	3,000	0.200	0.87
CFLB 3040-200	R2	20	9,000		0.200	0.87	9,000		0.200	0.87

*More models available, 32 models in total from Radius R0.3 mm to R3 mm with effective length from 5 to 15 X diameter.
For more details please ask your distributor

2 Flute

C-UMD

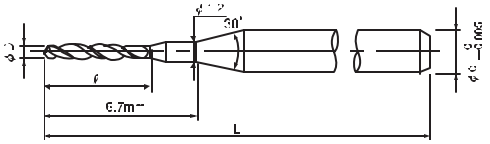
Drill
Size Ø0.1 - Ø3

Super MG | MICRO COAT | 24° | Shank Dia 0/-0.005

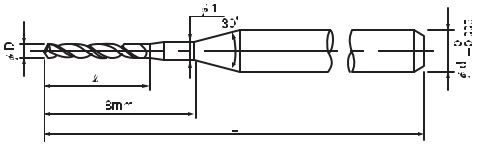
Number of Flutes	Process			Work Material		
	Roughing	Semi-Finishing	Finishing	Stainless Steel	Titanium	Chrome Cobalt
2				●	●	

Applicable Work Material (● most suitable, ● suitable)
Applicable Process (most suitable, suitable)

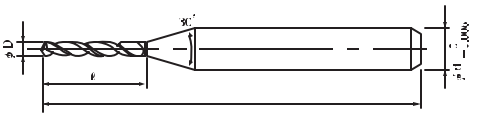
■ φ 0.1 ~ φ 0.25



■ φ 0.26 ~ φ 0.65



■ φ 0.66 ~ φ 3



Diameter tolérance : ØD ≤ 3 :ØD
Point Angle : 150°
225 models available: from Ø 0.1 mm to Ø 3 mm by increments of 0.01mm

Unit (mm)

Model Number	Diameter ØD	Flute Length ℓ	Overall Length l	Shank Diameter Ød
C-UMD 2010-012	0.1	1.2	38	3
C-UMD 2011-012	0.11	1.2	38	3
C-UMD 2012-014	0.12	1.4	38	3
C-UMD 2014-014	0.14	1.4	38	3
C-UMD 2015-020	0.15	2	38	3
C-UMD 2019-020	0.19	2	38	3
C-UMD 2020-025	0.20	2.5	38	3
C-UMD 2024-025	0.24	2.5	38	3
C-UMD 2025-030	0.25	3	38	3
C-UMD 2029-030	0.29	3	38	3
C-UMD 2030-050	0.30	5	38	3
C-UMD 2034-050	0.34	5	38	3
C-UMD 2035-060	0.35	6	38	3
C-UMD 2038-060	0.39	6	38	3
C-UMD 2040-070	0.40	7	38	3
C-UMD 2069-070	0.69	7	38	3
C-UMD 2070-080	0.70	8	38	3
C-UMD 2079-080	0.79	8	38	3
C-UMD 2080-100	0.80	10	38	3
C-UMD 2159-100	1.59	10	38	3
C-UMD 2160-120	1.60	12	38	3
C-UMD 2300-120	3.00	12	38	3

Work Material		Stainless Steel (SUS304) Use water soluble coolant			Titanium (Grade 5) Use oil coolant.		
Diameter (mm)	Recommended Step Amount (mm)	Spindle Speed (min⁻¹)	Feed (mm/min)	Velocity (m/min)	Spindle Speed (min⁻¹)	Feed (mm/min)	Velocity (m/min)
Ø 0.3	0.1 - 0.2 ØD	7,000	30	12-16	6,000	10	5-10
Ø 0.4	0.1 - 0.2 ØD	8,000	30	12-16	6,500	15	5-10
Ø 0.5	0.1 - 0.2 ØD	9,500	50	12-16	7,000	25	10-15
Ø 0.6	0.1 - 0.2 ØD	8,000	60	12-16	7,500	30	10-15
Ø 0.7	0.1 - 0.2 ØD	6,700	70	12-16	8,000	50	15-20
Ø 0.8	0.1 - 0.2 ØD	6,300	80	12-16	8,500	70	20-25
Ø 0.9	0.1 - 0.2 ØD	6,000	90	17-20	9,000	80	25-30
Ø 1	0.1 - 0.2 ØD	6,000	100	17-20	9,500	90	30-35
Ø 2	0.1 - 0.2 ØD	3,000	110	17-20	5,500	100	30-35
Ø 3	0.1 - 0.2 ØD	2,500	110	17-20	3,500	100	30-35

2 Flute

Drilling Example 1

Comments

● Tip Damage:

Damage by chipping can be seen on the Carbide Drill. The High-Speed Steel Drill exhibits wear on the top chisel line and corners. The High Speed drill also has the work material adhering to it.

● Hole Position:

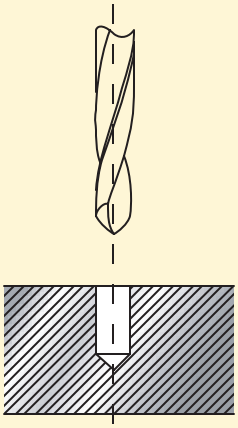
The solid carbide drill has minimal deflection when compared to a High Speed steel model, through the entire drilling cycle.

Drilling Condition

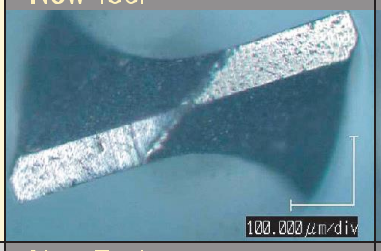
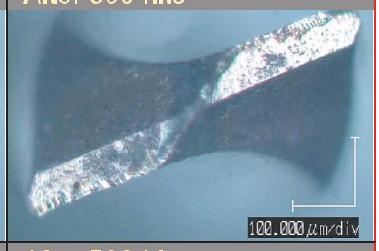
Tool:	Ø0.6×Flute Length 7mm
Work Material:	SUS304 (1.4301)
Spindle Speed:	8,000min⁻¹
Velocity:	15m/min
Z Feed Rate:	50mm/min
Chip Load:	0.00625mm/rev
Step Amount:	0.12 mm/time
Hole Depth:	2.4mm
Number of Holes:	500 Holes
Drilling Time:	25 min/100 holes
Overhang Length:	10mm
Coolant:	Water Soluble Cutting Oil (Nozzle)

Process Form

*Blind Hole Step Process



Comparison of Tip Damage

	New Tool	After 250 hits	After 500 hits
Ø0.6 Flute Length 7mm Ti-Composite Membrane			
Company A High Speed Steel Drill			

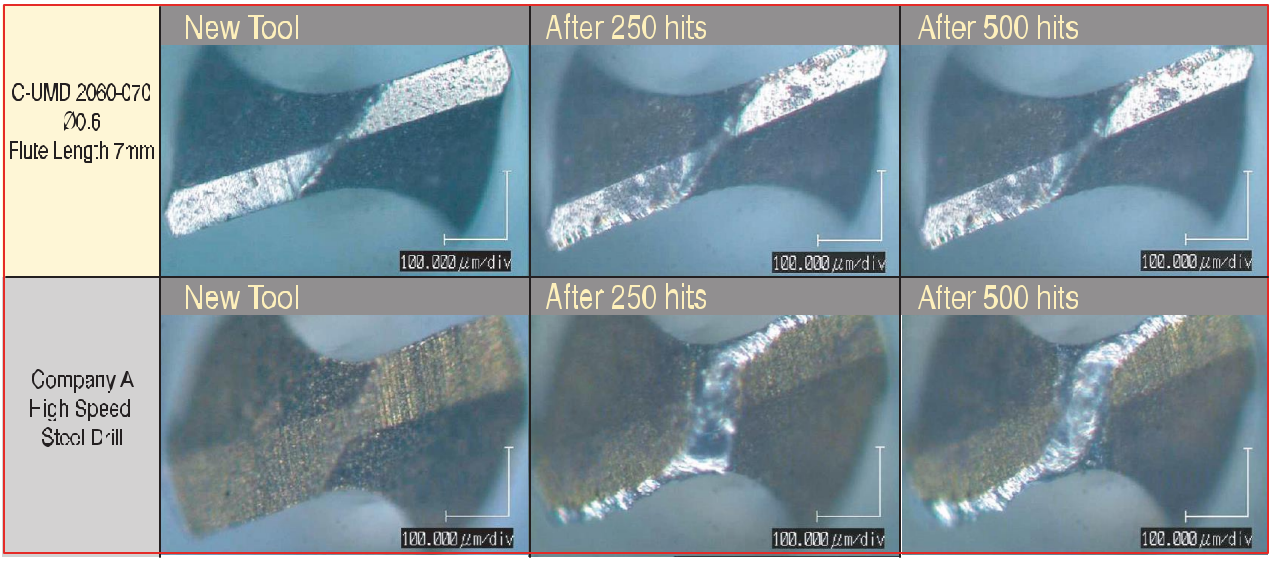
2 Flute

Drilling Example 1 on Stainless Steel (SUS304)

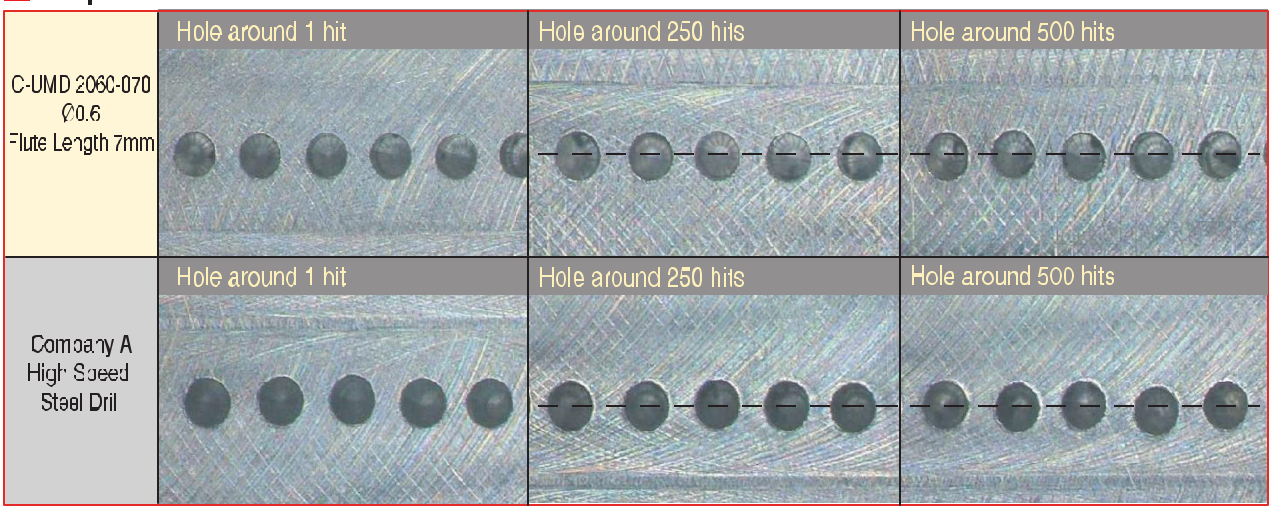
Drilling Condition

Tool	Ø 0.6 × Flute Length 7mm	Work Material:	SUS304 (1.4301)
Spindle Speed:	8,000min⁻¹	Overhang Length:	10mm
Velocity:	15m/min	Coolant:	Water Soluble Cutting Oil (Nozzle)
Z Feed Rate:	50mm/min	Number of Holes:	500 Holes
Chip Load:	0.00625mm/rev	Drilling Time:	25 min/100 holes
Step Amount:	0.12mm/time		
Hole Depth:	2.4mm		

Comparison of Tip Damage



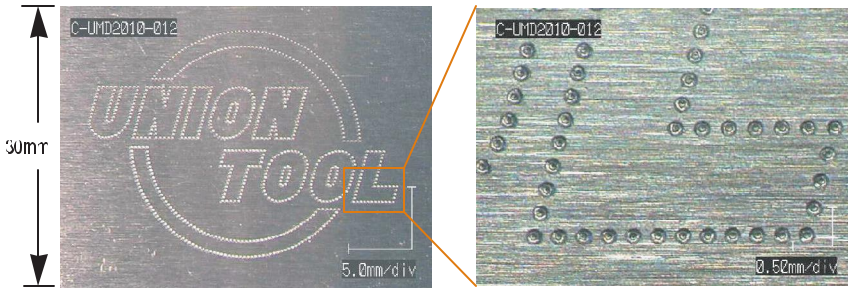
Comparison of Hole Position



Drilling Example 2 on Stainless Steel (SUS304)

Drilling Condition

Tool:	C-UMD 2010-012 Ø 0.1
Work Material:	SUS304 (1.4301)
Number of Holes:	800 holes



2 Flute

UTDSX

Drill

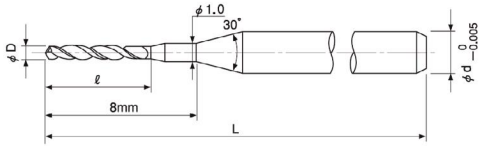
Size Ø0.3 - Ø2

Number of Flutes	Process			Work Material		
	Roughing	Semi-Finishing	Finishing	Stainless Steel	Titanium	Chrome Cobalt
2				●	●	

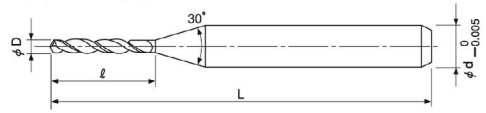
Applicable Work Material (● most suitable, ● suitable)

Applicable Process (■ most suitable, ■ suitable)

■ϕ0.3~ϕ0.65



■ϕ0.7~ϕ2.0



Diameter Tolerance: Ø D 0/-0.01mm

Point Angle : 130°

Unit (mm)

Model Number	Diameter ØD	Flute Length ℓ	Overall Length L	Shank Diameter Ød
UTDSX 2030-015	0.30	1.5	38	3
UTDSX 2035-018	0.35	1.8	38	3
UTDSX 2040-020	0.40	2	38	3
UTDSX 2045-023	0.45	2.3	38	3
UTDSX 2050-025	0.50	2.5	38	3
UTDSX 2055-028	0.55	2.8	38	3
UTDSX 2060-030	0.60	3	38	3
UTDSX 2065-033	0.65	3.3	38	3
UTDSX 2070-035	0.70	3.5	38	3
UTDSX 2075-038	0.75	3.8	38	3
UTDSX 2080-040	0.80	4	38	3
UTDSX 2085-043	0.85	4.3	38	3
UTDSX 2090-045	0.90	4.5	38	3
UTDSX 2095-048	0.95	4.8	38	3
UTDSX 2100-050	1.00	5	38	3
UTDSX 2105-053	1.05	5.3	38	3
UTDSX 2110-055	1.10	5.5	38	3
UTDSX 2115-058	1.15	5.8	38	3
UTDSX 2120-060	1.20	6	38	3
UTDSX 2125-063	1.25	6.3	38	3
UTDSX 2130-065	1.30	6.5	38	3
UTDSX 2135-068	1.35	6.8	38	3
UTDSX 2140-070	1.40	7	38	3
UTDSX 2145-073	1.45	7.3	38	3
UTDSX 2150-075	1.50	7.5	38	3
UTDSX 2155-078	1.55	7.8	38	3
UTDSX 2160-080	1.60	8	38	3
UTDSX 2165-083	1.65	8.3	38	3
UTDSX 2170-085	1.70	8.5	38	3
UTDSX 2175-088	1.75	8.8	38	3
UTDSX 2180-090	1.80	9	38	3
UTDSX 2185-093	1.85	9.3	38	3
UTDSX 2190-095	1.90	9.5	38	3
UTDSX 2195-098	1.95	9.8	38	3
UTDSX 2200-100	2.00	10	38	3

Work Material		Stainless Steel (SUS304) Use water soluble coolant.			Titanium (Grade 5) Use oil coolant.		
Diameter (mm)	Recommended Step Amount (mm)	Spindle Speed (min⁻¹)	Feed (mm/min)	Velocity (m/min)	Spindle Speed (min⁻¹)	Feed (mm/min)	Velocity (m/min)
Ø 0.3	0.1 - 0.2 ØD	7,000	30	12-16	6,000	10	5-10
Ø 0.4	0.1 - 0.2 ØD	8,000	30	12-16	6,500	15	5-10
Ø 0.5	0.1 - 0.2 ØD	9,500	50	12-16	7,000	25	10-15
Ø 0.6	0.1 - 0.2 ØD	8,000	60	12-16	7,500	30	10-15
Ø 0.7	0.1 - 0.2 ØD	6,700	70	12-16	8,000	50	15-20
Ø 0.8	0.1 - 0.2 ØD	6,300	80	12-16	8,500	70	20-25
Ø 0.9	0.1 - 0.2 ØD	6,000	90	17-20	9,000	80	25-30
Ø 1	0.1 - 0.2 ØD	6,000	100	17-20	9,500	90	30-35
Ø 2	0.1 - 0.2 ØD	3,000	130	17-20	5,500	100	30-35

QR Code For Milling Conditions

For Chrome Cobalt Material

CZS

Square
Size Ø1 - Ø20
Unimax Series Vol. 16 Catalogue: Page 90
Parameters 45 - 55 HRC

HLS 2000

Long Neck Square
Size Ø0.1 - Ø6
Unimax Series Vol. 16 Catalogue: Page 115
Parameters 45 - 55 HRC

HLS 4000

Long Neck Square
Size Ø1 - Ø6
Unimax Series Vol. 16 Catalogue: Page 149
Parameters 45 - 55 HRC

CNRS

Corner Radius
Size Ø6 - Ø12
Unimax Series Vol. 16 Catalogue: Page 161
Parameters Inconnel 718

CRRS

Long Neck Radius
Size Ø6 - Ø12
Unimax Series Vol. 16 Catalogue: Page 209
Parameters 30 - 55 HRC

HRRS-S

Long Neck Radius
Size Ø2 - Ø12
Unimax Series Vol. 16 Catalogue: Page 204
Parameters 45 - 55 HRC

HLRS 4000

Long Neck Radius
Size Ø0.8 - Ø6
Unimax Series Vol. 16 Catalogue: Page 200
Parameters 45 - 55 HRC

QR Code For Milling Conditions

For Chrome Cobalt Material

CSEB
Ball
Size R0.05 - R6
Unimax Series Vol. 16 Catalogue: Page 234
Parameters 45 - 55 HRC

CFB
Ball
Size R0.3 - R6
Unimax Series Vol. 16 Catalogue: Page 241
Parameters 45 - 55 HRC

HFB
Ball
Size R1 - R6
Unimax Series Vol. 16 Catalogue: Page 246
Parameters 45 - 55 HRC

CSELB
Long Neck Ball
Size R0.05 - R3
Unimax Series Vol. 16 Catalogue: Page 302
Parameters 45 - 55 HRC

CFLB
Long Neck Ball
Size R0.3 - R3
Unimax Series Vol. 16 Catalogue: Page 322
Parameters TitaniuM

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