

## 2 Flutes HARDMAX



Size R0.03~R6

# HSB

Super  
MG

HARD  
MAX

Shank Dia  
0/-0.005

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
			~50HRC	~55HRC	~60HRC	~65HRC	~70HRC										
○	○	●	●	●	●	○	○				○			○	○		

### Features

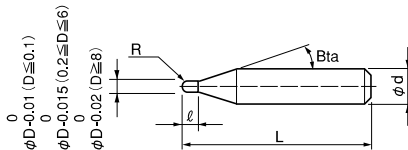
Offers high efficiency, long tool life and excellent surface finish on hard materials over 40HRC.

HARDMAX coat offers heat resistance, durability and lubricity at a high level.

Every coolant offers stable milling.

Ball tip point is designed with a negative rake angle that minimizes wear and improves the target dimensions.

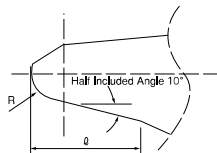
The low negative rake angle at the peripheral side of the ball offers an excellent surface finish and prevents deflection.



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

### ATTENTION

HSB 1001-0020-6 (R0.05) is a taper ball end mill with half included angle 10° (See the right drawing).



Radius of Ball Nose	Diameter Tolerance	Radius Accuracy	Helix Angle	Number of Flutes
R0.03 ~ R0.05	0/-0.01	±0.002	0°	2 Flutes *
R0.1 ~ R3	0/-0.015	±0.005	30°	
R4 ~ R6	0/-0.02	±0.007	30°	

\* Only HSB 1001-0020-6 has single flute.  
R accuracy: ±0.005, Diameter tolerance: 0/-0.015

Total 71 models

Unit (mm)

Model Number	Radius of Ball Nose R	Length of Cut ℓ	Shank Taper Angle Bta	Overall Length L	Shank Diameter φd	Suggested Retail Price ¥
HSB 20006-0006	R0.03	0.06	11°	50	4	17,460
HSB 20008-0008	R0.04	0.08	11°	50	4	14,550
HSB 1001-0020-6	R0.05	0.2	11°	50	6	13,320
HSB 2001-0010	R0.05	0.1	11°	50	4	12,120
HSB 2002-0020-6	R0.1	0.2	16°	50	6	9,840
HSB 2002-0030		0.3		50	4	8,520
HSB 2003-0030	R0.15	0.3	16°	50	4	6,960
HSB 2003-0030-6		0.3		50	6	8,400
HSB 2003-0045		0.45		50	4	6,960
HSB 2004-0040	R0.2	0.4	16°	50	4	4,680
HSB 2004-0040-6		0.4		50	6	6,120
HSB 2004-0060		0.6		50	4	4,680
HSB 2005-0050	R0.25	0.5	16°	50	4	4,320
HSB 2005-0050-6		0.5		50	6	5,760
HSB 2005-0075		0.75		50	4	4,320

Unit (mm)

Model Number	Radius of Ball Nose R	Length of Cut $\ell$	Shank Taper Angle $\beta$	Overall Length L	Shank Diameter $\phi d$	Suggested Retail Price ¥
HSB 2006-0060	R0.3	0.6	16°	50	4	4,200
HSB 2006-0060-6		0.6		50	6	5,520
HSB 2006-0090		0.9		50	4	4,200
HSB 2007-0100	R0.35	1	16°	50	4	8,000
HSB 2008-0080	R0.4	0.8	16°	50	4	4,200
HSB 2008-0080-6		0.8		50	6	5,520
HSB 2008-0120		1.2		50	4	4,200
HSB 2009-0130	R0.45	1.3	16°	50	4	8,000
HSB 2010-0100	R0.5	1	16°	50	4	3,840
HSB 2010-0100-6		1		50	6	5,160
HSB 2010-0150		1.5		50	4	3,840
HSB 2010-0250		2.5		50	4	3,840
HSB 2011-0160	R0.55	1.6	16°	50	4	9,280
HSB 2012-0180	R0.6	1.8	16°	50	4	5,400
HSB 2013-0190	R0.65	1.9	16°	50	4	9,280
HSB 2014-0210	R0.7	2.1	16°	50	4	5,400
HSB 2015-0150	R0.75	1.5	16°	50	4	4,680
HSB 2015-0150-6		1.5		50	6	6,000
HSB 2015-0200		2		50	4	4,680
HSB 2015-0225		2.25		50	4	4,680
HSB 2015-0400		4		50	4	4,680
HSB 2016-0240	R0.8	2.4	16°	50	4	5,400
HSB 2017-0250	R0.85	2.5	16°	50	4	9,280
HSB 2018-0270	R0.9	2.7	16°	50	4	8,000
HSB 2019-0280	R0.95	2.8	16°	50	4	9,280
HSB 2020-0200	R1	2	16°	50	4	3,480
HSB 2020-0200-6		2		60	6	4,680
HSB 2020-0300		3		50	4	3,480
HSB 2020-0600		6		60	4	3,480
HSB 2025-0250	R1.25	2.5	16°	50	4	5,950
HSB 2025-0250-6		2.5		60	6	6,360
HSB 2025-0375		3.75		50	4	5,950
HSB 2025-0600		6		60	4	5,950
HSB 2030-0300	R1.5	3	16°	50	6	4,200
HSB 2030-0450		4.5		70	6	4,200
HSB 2030-0800		8		70	6	4,200
HSB 2040-0400	R2	4	16°	50	6	4,800
HSB 2040-0600-4		6	—	70	4	4,300
HSB 2040-0600		6	16°	70	6	4,800
HSB 2040-0800		8	16°	70	6	4,800
HSB 2050-0500	R2.5	5	16°	50	6	5,710
HSB 2050-0750		7.5		80	6	5,760
HSB 2050-0800		8		80	6	5,760
HSB 2050-1200		12		80	6	5,760
HSB 2060-0600	R3	6	—	50	6	5,940
HSB 2060-0900		9		80	6	6,000
HSB 2060-1200		12		80	6	6,000
HSB 2080-0800	R4	8	—	60	8	9,270
HSB 2080-1200		12		90	8	9,360
HSB 2080-1400		14		90	8	9,360
HSB 2100-1000	R5	10	—	70	10	12,110
HSB 2100-1500		15		100	10	12,240
HSB 2100-1800		18		100	10	12,240
HSB 2120-1200	R6	12	—	75	12	20,580
HSB 2120-1800		18		110	12	20,790
HSB 2120-2200		22		110	12	20,790

φ3mm Shank  
V Series

UDC-PCD  
Series

CBN  
Series

Square

Square

Long Neck  
Square

Radius

Radius

Long Neck  
Radius

Taper Neck  
Radius

Ball

Ball / Long  
Shank Ball

Long Neck  
Ball

Taper Neck  
Ball

Taper

Taper

Barrel

Barrel

Spiral  
V Cutter

Spiral  
V Cutter

Drill

Drill

Technical Data

Technical Data

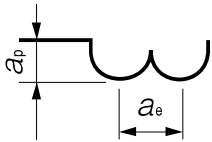
Milling Conditions for HSB / HSB-S

- φ3mm Shank V Series
- UDC-PCD Series
- CBN Series
- Square
- Long Neck Square
- Radius
- Long Neck Radius
- Taper Neck Radius
- Ball / Long Shank Ball
- Long Neck Ball
- Taper Neck Ball
- Taper
- Barrel
- Spiral V Cutter
- Drill
- Technical Data

WORK MATERIAL			PREHARDENED STEELS HARDENED STEELS NAK / STAVAX (~55HRC)				HARDENED STEELS SKD11 (55~62HRC)				HARDENED STEELS HAP10 (62~66HRC)				HARDENED STEELS HAP72 (66~70HRC)			
Model Number	Radius of Ball Nose (mm)	Length of Cut (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)
2006-0006	R0.03	0.06	30,000	100	0.002 or below	0.02	—	—	—	—	—	—	—	—	—	—	—	—
2008-0008	R0.04	0.08	30,000	130	0.003 or below	0.03	—	—	—	—	—	—	—	—	—	—	—	—
1001-0020-6	R0.05	0.2	30,000	30	0.002 or below	0.02	—	—	—	—	—	—	—	—	—	—	—	—
2001-0010		0.1	30,000	200	0.004 or below	0.04	—	—	—	—	—	—	—	—	—	—	—	—
2002-0020 (-6)	R0.1	0.2	60,000	200	0.003	0.005	60,000	200	0.002	0.003	60,000	130	0.002	0.003	45,000	65	0.002	0.003
2002-0030		0.3	60,000	200	0.003	0.005	60,000	200	0.002	0.003	60,000	130	0.002	0.003	45,000	65	0.002	0.003
2003-0030 (-6)	R0.15	0.3	60,000	350	0.006	0.008	45,000	310	0.004	0.007	43,500	180	0.003	0.005	32,500	90	0.003	0.005
2003-0045		0.45	60,000	350	0.006	0.008	45,000	310	0.004	0.007	43,500	180	0.003	0.005	32,500	90	0.003	0.005
2004-0040 (-6)	R0.2	0.4	50,000	500	0.01	0.02	37,500	420	0.007	0.012	35,000	240	0.005	0.008	26,250	120	0.005	0.008
2004-0060		0.6	50,000	500	0.01	0.02	37,500	420	0.007	0.012	35,000	240	0.005	0.008	26,250	120	0.005	0.008
2005-0050 (-6)	R0.25	0.5	44,000	650	0.015	0.04	33,000	530	0.01	0.02	30,000	300	0.007	0.01	22,500	150	0.007	0.01
2005-0075		0.75	44,000	650	0.015	0.04	33,000	530	0.01	0.02	30,000	300	0.007	0.01	22,500	150	0.007	0.01
2006-0060 (-6)	R0.3	0.6	40,000	1,100	0.03	0.13	30,000	1,200	0.02	0.1	26,500	800	0.01	0.075	20,000	400	0.01	0.075
2006-0090		0.9	40,000	1,100	0.03	0.13	30,000	1,200	0.02	0.1	26,500	800	0.01	0.075	20,000	400	0.01	0.075
2007-0100	R0.35	1	37,000	1,350	0.045	0.17	28,500	1,400	0.03	0.135	25,000	900	0.015	0.1	18,750	450	0.015	0.1
2008-0080 (-6)	R0.4	0.8	35,000	1,600	0.06	0.21	27,000	1,600	0.04	0.17	23,500	1,000	0.02	0.12	17,500	500	0.02	0.12
2008-0120		1.2	35,000	1,600	0.06	0.21	27,000	1,600	0.04	0.17	23,500	1,000	0.02	0.12	17,500	500	0.02	0.12
2009-0130	R0.45	1.3	32,500	1,650	0.1	0.28	25,500	1,800	0.055	0.21	22,000	1,300	0.025	0.14	16,500	650	0.025	0.14
2010-0100 (-6)	R0.5	1	30,000	1,750	0.2	0.4	24,000	2,000	0.1	0.3	21,000	1,750	0.05	0.2	16,000	875	0.05	0.2
2010-0150		1.5	30,000	1,750	0.2	0.4	24,000	2,000	0.1	0.3	21,000	1,750	0.05	0.2	16,000	875	0.05	0.2
2010-0250	R0.55	2.5	30,000	1,750	0.1	0.3	24,000	2,000	0.05	0.2	21,000	1,750	0.03	0.17	16,000	875	0.03	0.17
2011-0160		1.6	30,000	1,900	0.21	0.43	22,000	2,000	0.105	0.32	19,000	1,750	0.05	0.22	14,250	875	0.05	0.22
2012-0180	R0.6	1.8	30,000	2,000	0.22	0.46	20,500	2,000	0.11	0.34	17,800	1,750	0.05	0.23	13,350	875	0.05	0.23
2013-0190	R0.65	1.9	30,000	2,150	0.23	0.49	19,000	2,000	0.115	0.36	16,600	1,750	0.05	0.24	12,450	875	0.05	0.24
2014-0210	R0.7	2.1	30,000	2,300	0.24	0.52	18,000	2,000	0.12	0.39	15,700	1,750	0.055	0.27	11,800	875	0.055	0.27
2015-0150 (-6)	R0.75	1.5	30,000	2,450	0.25	0.55	17,000	2,000	0.12	0.4	15,000	1,750	0.06	0.29	11,250	875	0.06	0.29
2015-0200		2	30,000	2,450	0.25	0.55	17,000	2,000	0.12	0.4	15,000	1,750	0.06	0.29	11,250	875	0.06	0.29
2015-0225	R0.8	2.25	30,000	2,450	0.25	0.55	17,000	2,000	0.12	0.4	15,000	1,750	0.06	0.29	11,250	875	0.06	0.29
2015-0400		4	30,000	2,450	0.15	0.45	17,000	2,000	0.07	0.31	15,000	1,750	0.04	0.24	11,250	875	0.04	0.24
2016-0240	R0.85	2.4	30,000	2,550	0.25	0.58	16,200	2,000	0.13	0.43	14,200	1,750	0.06	0.3	10,650	875	0.06	0.3
2017-0250	R0.9	2.5	30,000	2,600	0.26	0.61	15,500	2,000	0.135	0.46	13,500	1,750	0.065	0.32	10,100	875	0.065	0.32
2018-0270	R0.95	2.7	30,000	2,700	0.28	0.65	15,000	2,000	0.14	0.48	13,000	1,750	0.07	0.34	9,750	875	0.07	0.34
2019-0280	R1	2.8	29,000	2,800	0.3	0.69	14,500	2,000	0.145	0.49	12,600	1,750	0.075	0.36	9,450	875	0.075	0.36
2020-0200 (-6)		2	28,000	2,900	0.3	0.7	14,000	2,100	0.15	0.5	12,250	1,800	0.08	0.35	9,200	900	0.08	0.35
2020-0300	R1.25	3	28,000	2,900	0.3	0.7	14,000	2,100	0.15	0.5	12,250	1,800	0.08	0.35	9,200	900	0.08	0.35
2020-0600		6	28,000	2,900	0.2	0.6	14,000	2,100	0.1	0.4	12,250	1,800	0.06	0.3	9,200	900	0.06	0.3
2025-0250 (-6)	R1.5	2.5	24,500	2,950	0.35	0.85	12,250	2,150	0.17	0.6	10,700	1,850	0.1	0.45	8,050	925	0.1	0.45
2025-0375		3.75	24,500	2,950	0.35	0.85	12,250	2,150	0.17	0.6	10,700	1,850	0.1	0.45	8,050	925	0.1	0.45
2025-0600	R2	6	24,500	2,950	0.26	0.75	12,250	2,150	0.125	0.5	10,700	1,850	0.08	0.4	8,050	925	0.08	0.4
2030-0300		3	21,000	3,000	0.4	1	10,500	2,200	0.2	0.7	9,200	1,900	0.12	0.55	6,900	950	0.12	0.55
2030-0450	R2.5	4.5	21,000	3,000	0.4	1	10,500	2,200	0.2	0.7	9,200	1,900	0.12	0.55	6,900	950	0.12	0.55
2030-0800		8	21,000	3,000	0.3	0.9	10,500	2,200	0.15	0.65	9,200	1,900	0.1	0.5	6,900	950	0.1	0.5
2040-0400	R2	4	18,000	3,200	0.5	1.3	9,000	2,300	0.25	0.95	7,900	2,000	0.15	0.75	5,900	1,000	0.15	0.75
2040-0600 (-4)		6	18,000	3,200	0.5	1.3	9,000	2,300	0.25	0.95	7,900	2,000	0.15	0.75	5,900	1,000	0.15	0.75
2040-0800	R2.5	8	18,000	3,200	0.5	1.3	9,000	2,300	0.25	0.95	7,900	2,000	0.15	0.75	5,900	1,000	0.15	0.75
2050-0500		5	15,600	3,500	0.5	1.5	7,800	2,500	0.25	1.05	6,800	2,100	0.15	0.85	5,100	1,050	0.15	0.85
2050-0750	R2.5	7.5	15,600	3,500	0.5	1.5	7,800	2,500	0.25	1.05	6,800	2,100	0.15	0.85	5,100	1,050	0.15	0.85
2050-0800		8	15,600	3,500	0.5	1.5	7,800	2,500	0.25	1.05	6,800	2,100	0.15	0.85	5,100	1,050	0.15	0.85
2050-1200		12	15,600	3,500	0.5	1.5	7,800	2,500	0.25	1.05	6,800	2,100	0.15	0.85	5,100	1,050	0.15	0.85

## Milling Conditions for HSB / HSB-S

WORK MATERIAL			PREHARDENED STEELS HARDENED STEELS NAK / STAVAX (~55HRC)				HARDENED STEELS SKD11 (55~62HRC)				HARDENED STEELS HAP10 (62~66HRC)				HARDENED STEELS HAP72 (66~70HRC)			
Model Number	Radius of Ball Nose (mm)	Length of Cut (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)
2060-0600	R3	6	13,000	3,500	0.6	1.8	6,500	2,500	0.3	1.3	5,700	2,200	0.2	1	4,300	1,100	0.2	1
2060-0900		9	13,000	3,500	0.6	1.8	6,500	2,500	0.3	1.3	5,700	2,200	0.2	1	4,300	1,100	0.2	1
2060-1200		12	13,000	3,500	0.6	1.8	6,500	2,500	0.3	1.3	5,700	2,200	0.2	1	4,300	1,100	0.2	1
2080-0800	R4	8	9,500	3,000	0.7	2.1	5,200	2,200	0.4	1.7	4,500	1,900	0.25	1.35	3,400	950	0.25	1.35
2080-1200		12	9,500	3,000	0.7	2.1	5,200	2,200	0.4	1.7	4,500	1,900	0.25	1.35	3,400	950	0.25	1.35
2080-1400		14	9,500	3,000	0.7	2.1	5,200	2,200	0.4	1.7	4,500	1,900	0.25	1.35	3,400	950	0.25	1.35
2100-1000	R5	10	7,500	2,500	0.8	2.5	4,300	2,000	0.5	2.1	3,750	1,750	0.3	1.7	2,800	875	0.3	1.7
2100-1500		15	7,500	2,500	0.8	2.5	4,300	2,000	0.5	2.1	3,750	1,750	0.3	1.7	2,800	875	0.3	1.7
2100-1800		18	7,500	2,500	0.8	2.5	4,300	2,000	0.5	2.1	3,750	1,750	0.3	1.7	2,800	875	0.3	1.7
2120-1200	R6	12	6,200	2,000	0.9	3	3,600	1,750	0.6	2.6	3,150	1,500	0.35	2	2,350	750	0.35	2
2120-1800		18	6,200	2,000	0.9	3	3,600	1,750	0.6	2.6	3,150	1,500	0.35	2	2,350	750	0.35	2
2120-2200		22	6,200	2,000	0.9	3	3,600	1,750	0.6	2.6	3,150	1,500	0.35	2	2,350	750	0.35	2



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 machines maximum speed, or when the tool is chattering and heats up to a red color.
- Reduce the milling parameters when a straight shank tool exceeds 35 mm of overhang length.
- Every coolant offers stable milling.

## Constant Velocity Joint

DRM2 (62HRC)



Work Size  $\phi 100 \times 50$  mm  
Coolant Oil Mist

6 Flute Square for Hard Materials **HMS**2 Flute Ball for Hard Materials **HSB**

Milling Process	Tool	Milling Spot	Spindle Speed (min <sup>-1</sup> )	Feed Rate (mm/min)	a <sub>p</sub> (mm)	a <sub>e</sub> (mm)	Allowance (mm)	Cycle Time (h:m:s)
Roughing	HSB R5	Pilot Hole	600	240	1	—	—	4:52
	HMS $\phi 10$ 6 Flute Square	Dimension	4,000	200	16	0.1	—	3:49
2,500				16	0.2	0.02	2:12	
Finishing	HSB R5	Contour	3,150	800	0.5	2	0.2	24:36
200				0.05	7	0	1:24	
Semi-finishing	HSB R2	Contour	15,000	1,400	0.25	0.7	0.07	15:18
	HSB R1	Contour	18,000	1,800	0.15	0.15	0.02	21:58
Finishing	HSB R1	Dimension	20,000	1,000	0.05	—	0	0:51
	CBN R1	Contour	20,000	1,800	0.07	0.04	0	71:19

2:26:12

$\phi 3$ mm Shank  
V Series

UDC-PCD  
Series

CBN  
Series

Square

Long Neck  
Square

Radius

Long Neck  
Radius

Taper Neck  
Radius

Ball / Long  
Shank Ball

Long Neck  
Ball

Taper Neck  
Ball

Taper

Barrel

Spiral  
V Cutter

Drill

Technical Data