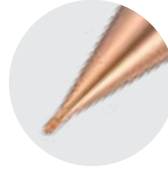


Solid ball nose end mill for machining hardened material (Micro solid tools)

# 2KMB

Standard type  
Total 15 Items  
R0.05 - R2.0



Long neck type  
Total 109 Items  
R0.05 - R2.0



## Solving new challenges in solid tool machining

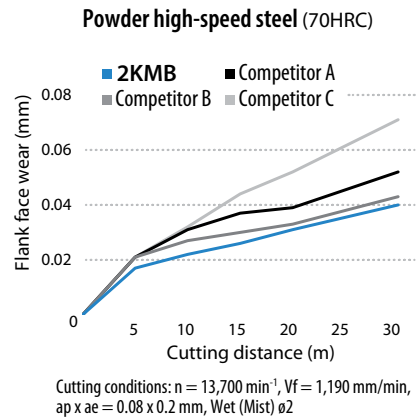
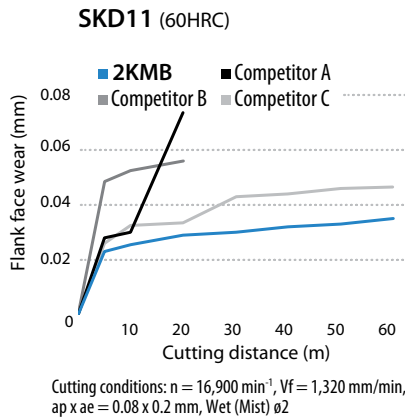
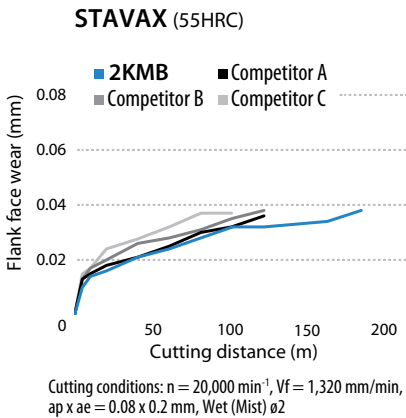
The new solid tool lineup is an optimized tool for precision parts and mold machining.

### Long tool life in various hardened materials

Prehardened steel 35 - 45 HRC	Prehardened steel Hardened steel 45 - 55 HRC	Hardened steel 55 - 62 HRC	Hardened steel 62 - 66 HRC	Hardened steel 66 - 70 HRC
----------------------------------	--	-------------------------------	-------------------------------	-------------------------------

Compatible with a variety of hardened materials such as stainless steel, high-speed steel, etc., as well as alloy tool steel (~ 70 HRC)

#### Wear resistance comparison (Internal evaluation)



### Experience the excellent finish

The new MEGACOAT HARD EX coating technology and a unique shape creates a glossy and beautiful finished surface

Reduced process cycle times

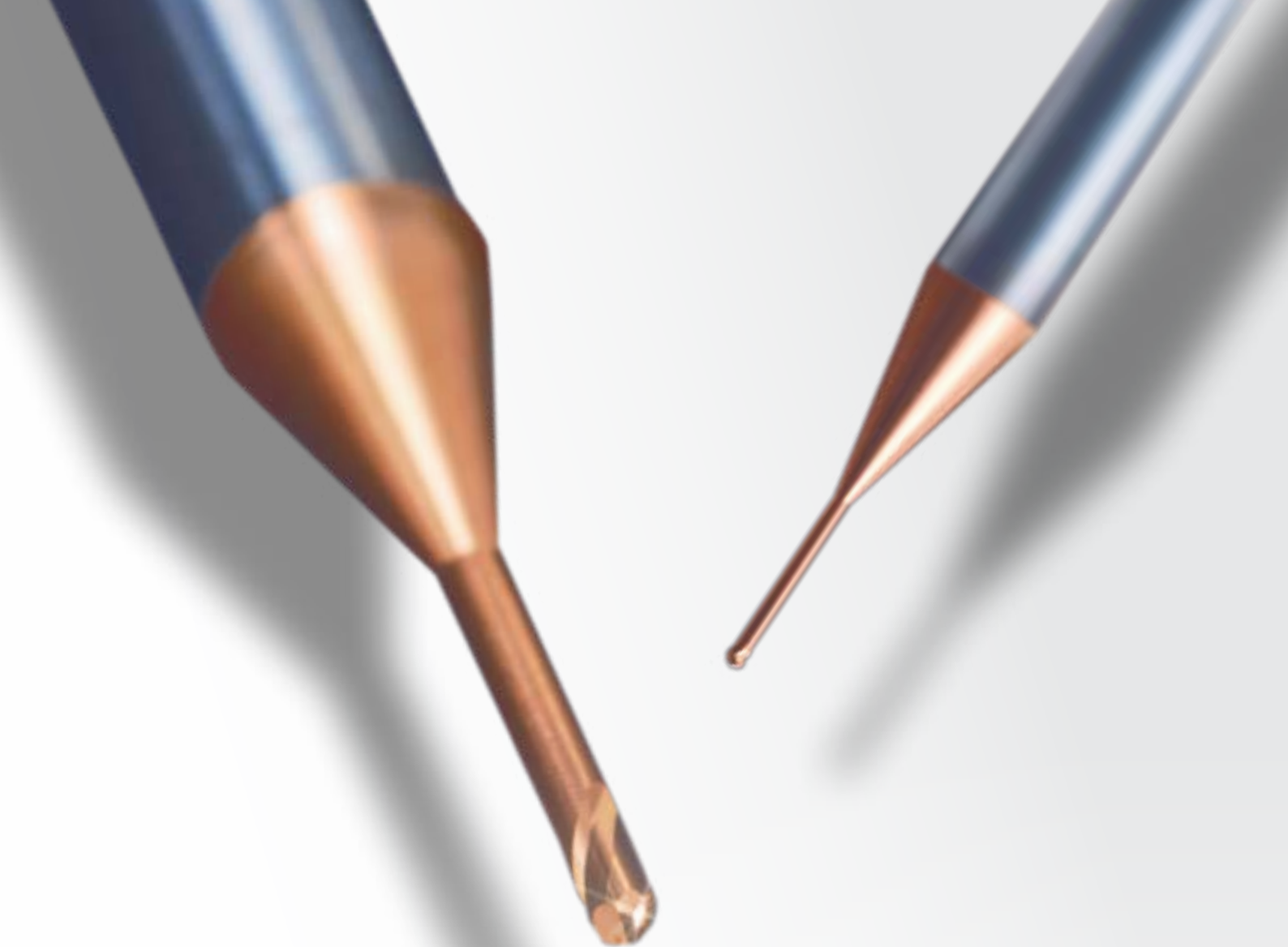
#### Surface finish condition

(Internal evaluation)

Cutting conditions:  $n = 18,000 \text{ min}^{-1}$ ,  
 $V_f = 1,600 \text{ mm/min}$ ,  
 $a_p \times a_e = 0.1 \times 0.15 \text{ mm}$ ,  
Wet (Mist)  
 $\phi 2.5$  (Long neck type)  
Powder high-speed steel (70 HRC)



# INNOVATIVE



**DESIGN**

# Long tool life with unique coating



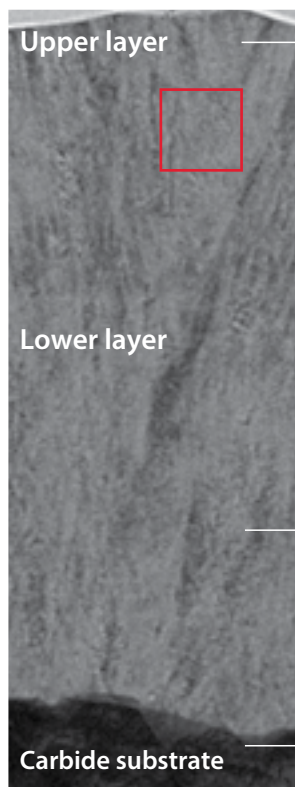
New PVD coating **NEW**

## MEGACOAT HARD EX

Kyocera's original new coating MEGACOAT HARD enables long tool life for various hardened materials.

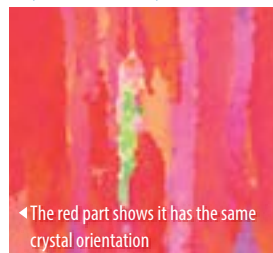
Advanced technology from Kyocera uses a special two-layer structure with both chipping resistance and abrasion resistance

### Section view



#### Chipping suppression

High-toughness crystalline layer



◀ The red part shows it has the same crystal orientation

- Unique structure for high shock resistance
- Toughness improvement by controlling internal stress and crystal growth direction

#### Suppresses the progression of high-temperature wear

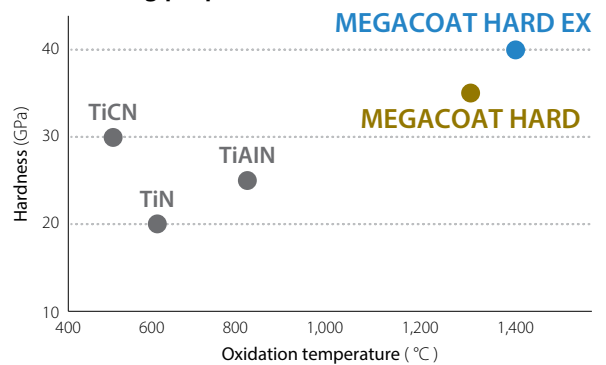
Special laminated structural layer

- High hardness
- Excellent oxidation resistance and unique composition design with high lubricity

#### Suppresses hard film peeling

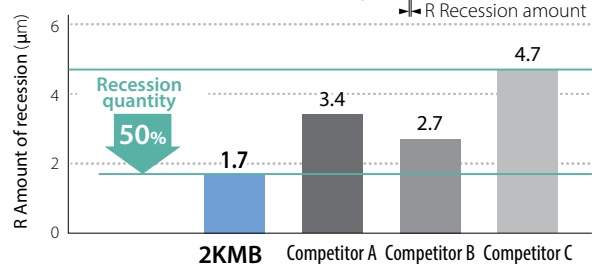
Special interface treatment

### Coating properties



### Wear resistance comparison (Internal evaluation)

R Recession after 500 mm machining



Cutting conditions:  $n = 40,000 \text{ min}^{-1}$ ,  $V_f = 70 \text{ mm/min}$ ,  $a_p \times a_e = 0.003 \times 0.005 \text{ mm}$ , Wet (Oil-based) Shouldering SKD 11 (60HRC)  $\phi 0.1$  (Long neck type)

# Unique shape controls hardened material



Point

## 01 High quality with an S-shaped flute design

Excellent sharpness

High quality finish and high abrasion resistance

Point

## 02

### High rigidity with a large core thickness

Ensures high rigidity and stable  
machining

Ball section comparison  
(Internal evaluation)  
Outer diameter  $\phi 1$

Product cross-section

18%



2KMB

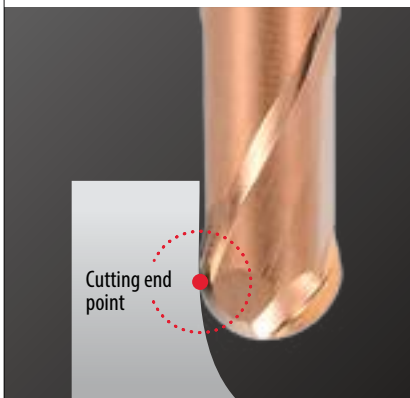
Competitor A

Point

## 03

### Low resistance with a strong back taper

Chatter resistant point design  
improves finished surface quality  
and reduction of inclination



Cutting end  
point

Point

## 04

### Stable machining with a unique cutting edge shape

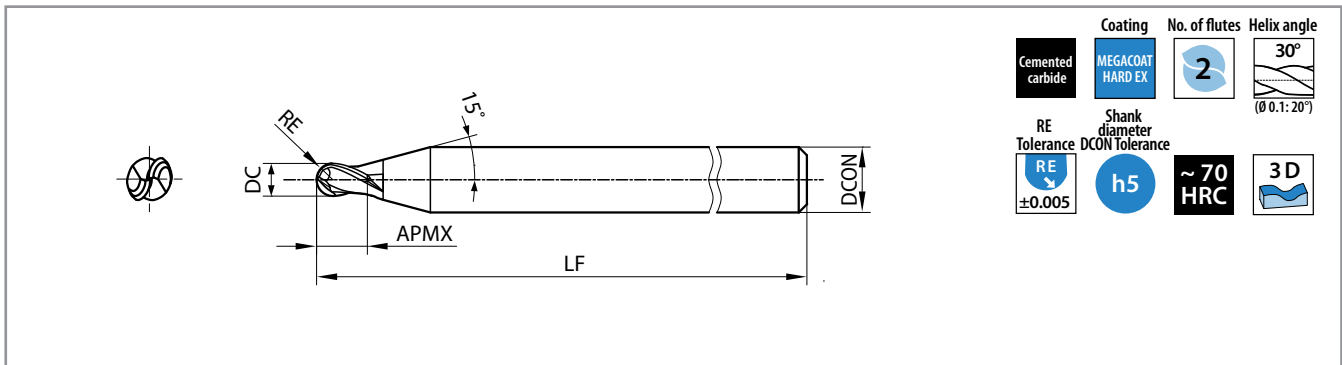
Cutting edge strength and low  
resistance achieves stable  
machining and high-quality  
finished surfaces



Variable flank face

Variable rake face

## 2KMB Standard type



Description	Availability	Dimensions (mm)				
		RE	DC	APMX	DCON	LF
2KMB0010-0010-S4	●	R0.05	0.1	0.1	4	50
2KMB0015-0015-S4	●	R0.075	0.15	0.15	4	50
2KMB0020-0020-S4	●	R0.1	0.2	0.2	4	50
2KMB0030-0030-S4	●	R0.15	0.3	0.3	4	50
2KMB0040-0060-S4	●	R0.2	0.4	0.6	4	50
2KMB0050-0080-S4	●	R0.25	0.5	0.8	4	50
2KMB0060-0090-S4	●	R0.3	0.6	0.9	4	50
2KMB0080-0120-S4	●	R0.4	0.8	1.2	4	50
2KMB0100-0150-S4	●	R0.5	1	1.5	4	50
2KMB0150-0230-S4	●	R0.75	1.5	2.3	4	50
2KMB0200-0300-S4	●	R1	2	3	4	60
2KMB0250-0380-S6	●	R1.25	2.5	3.8	6	60
2KMB0300-0500-S6	●	R1.5	3	5	6	60
2KMB0400-0600-S4	●	R2	4	6	4	70
2KMB0400-0600-S6	●	R2	4	6	6	70

The ball radius is based on 1/2 of the actual outer diameter.

Neck angle is a reference value.

Standard type is not a strong back taper shape.

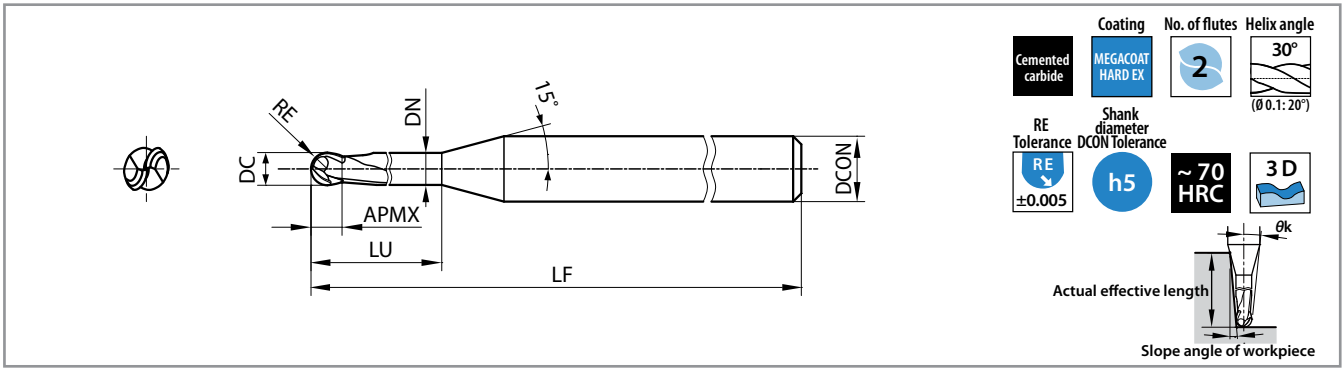
● : Available

## Description's view

Example: 2KMBL0100-0500-S4

<b>2KMB</b>	<b>L</b>	<b>0100</b>	-	<b>0500</b>	-	<b>S4</b>
Product name For precision die (Fine machining) solid ball nose end mill 2-flute	Type None: Standard type L: Long neck type	Outer diameter DC  ø1.0		Standard type: Flute length (APMX) Long neck type: Length under neck (LU)  0500 : LU 5mm		Shank diameter DCON  ø 4.0

# 2KMB Long neck type

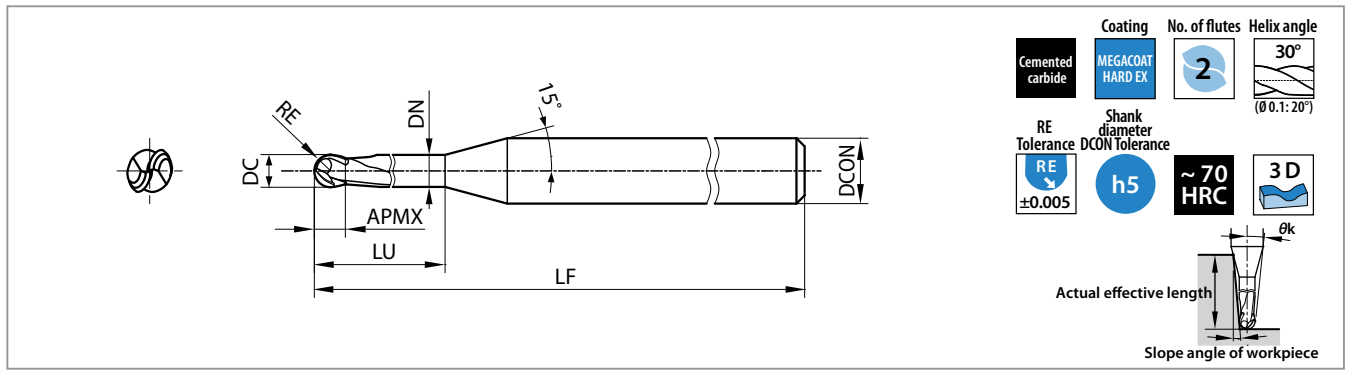


Description	Availability	Dimensions (mm)							Interference angle	Actual effective length for slope angle of workpiece				
		RE	DC	APMX	LU	DN	DCON	LF		$\theta_k$	0.5°	1°	1.5°	2°
2KMBL0010-0020-S4	●	R0.05	0.1	0.07	0.2	0.09	4	45	14.68°	0.22	0.23	0.23	0.24	0.25
2KMBL0010-0030-S4	●				0.3				14.49°	0.32	0.33	0.34	0.35	0.38
2KMBL0010-0050-S4	●				0.5				14.13°	0.53	0.55	0.56	0.58	0.63
2KMBL0015-0030-S4	●	R0.075	0.15	0.1	0.3	0.14	4	45	14.53°	0.32	0.33	0.34	0.35	0.37
2KMBL0015-0050-S4	●				0.5				14.17°	0.53	0.54	0.56	0.58	0.62
2KMBL0015-0100-S4	●				1				13.33°	1.05	1.08	1.12	1.16	1.24
2KMBL0020-0030-S4	●	R0.1	0.2	0.15	0.3	0.19	4	45	14.58°	0.32	0.33	0.34	0.35	0.37
2KMBL0020-0050-S4	●				0.5				14.2°	0.53	0.54	0.56	0.58	0.62
2KMBL0020-0075-S4	●				0.75				13.76°	0.79	0.81	0.84	0.86	0.93
2KMBL0020-0100-S4	●				1				13.35°	1.04	1.08	1.11	1.15	1.24
2KMBL0020-0125-S4	●				1.25				12.96°	1.3	1.35	1.39	1.44	1.55
2KMBL0020-0150-S4	●	1.5	12.59°	1.56	1.61	1.67	1.73	1.86						
2KMBL0030-0050-S4	●	R0.15	0.3	0.2	0.5	0.29	4	45	14.28°	0.53	0.54	0.55	0.57	0.6
2KMBL0030-0060-S4	●				0.6				14.09°	0.63	0.65	0.66	0.68	0.73
2KMBL0030-0075-S4	●				0.75				13.82°	0.78	0.81	0.83	0.86	0.91
2KMBL0030-0100-S4	●				1				13.39°	1.04	1.07	1.11	1.14	1.22
2KMBL0030-0125-S4	●				1.25				12.99°	1.3	1.34	1.38	1.43	1.54
2KMBL0030-0150-S4	●				1.5				12.61°	1.56	1.61	1.66	1.72	1.85
2KMBL0030-0175-S4	●				1.75				12.25°	1.82	1.88	1.94	2.01	2.16
2KMBL0030-0200-S4	●				2				11.91°	2.08	2.14	2.22	2.29	2.47
2KMBL0040-0050-S4	●	R0.2	0.4	0.3	0.5	0.39	4	45	14.35°	0.52	0.54	0.55	0.56	0.59
2KMBL0040-0080-S4	●				0.8				13.79°	0.83	0.86	0.88	0.91	0.96
2KMBL0040-0100-S4	●				1				13.44°	1.04	1.07	1.1	1.14	1.21
2KMBL0040-0150-S4	●				1.5				12.63°	1.56	1.61	1.66	1.71	1.83
2KMBL0040-0200-S4	●				2				11.91°	2.07	2.14	2.21	2.29	2.46
2KMBL0040-0250-S4	●				2.5				11.27°	2.59	2.68	2.76	2.86	3.08
2KMBL0040-0300-S4	●				3				10.69°	3.11	3.21	3.32	3.44	3.7
2KMBL0050-0100-S4	●	R0.25	0.5	0.35	1	0.49	4	45	13.49°	1.04	1.07	1.1	1.13	1.2
2KMBL0050-0150-S4	●				1.5				12.65°	1.56	1.6	1.65	1.7	1.82
2KMBL0050-0200-S4	●				2				11.91°	2.07	2.14	2.21	2.28	2.44
2KMBL0050-0250-S4	●				2.5				11.25°	2.59	2.67	2.76	2.85	3.07
2KMBL0050-0300-S4	●				3				10.66°	3.11	3.21	3.31	3.43	3.69
2KMBL0050-0350-S4	●				3.5				10.13°	3.62	3.74	3.87	4	4.31
2KMBL0050-0400-S4	●				4				9.65°	4.14	4.28	4.42	4.58	4.93

The ball radius is based on 1/2 of the actual outer diameter.  
 Neck angle is a reference value.  
 Be careful not to interfere with the workpiece.

● : Available

# 2KMB Long neck type



Description	Availability	Dimensions (mm)							Interference angle $\theta_k$	Actual effective length for slope angle of workpiece				
		RE	DC	APMX	LU	DN	DCON	LF		0.5°	1°	1.5°	2°	3°
2KMBL0060-0100-S4	●	R0.3	0.6	0.45	1	0.59	4	45	13.54°	1.04	1.06	1.09	1.12	1.19
2KMBL0060-0150-S4	●				1.5				12.67°	1.55	1.6	1.65	1.7	1.81
2KMBL0060-0200-S4	●				2				11.91°	2.07	2.13	2.2	2.27	2.43
2KMBL0060-0250-S4	●				2.5				11.23°	2.59	2.67	2.75	2.85	3.05
2KMBL0060-0300-S4	●				3				10.63°	3.11	3.2	3.31	3.42	3.67
2KMBL0060-0350-S4	●				3.5				10.08°	3.62	3.74	3.86	4	4.3
2KMBL0060-0400-S4	●				4				9.59°	4.14	4.27	4.42	4.57	4.92
2KMBL0060-0450-S4	●				4.5				9.15°	4.66	4.81	4.97	5.15	5.54
2KMBL0060-0500-S4	●				5				8.74°	5.17	5.34	5.52	5.72	6.16
2KMBL0070-0200-S4	●	R0.35	0.7	0.5	2	0.69	4	45	11.91°	2.07	2.13	2.19	2.26	2.42
2KMBL0070-0400-S4	●				4				9.54°	4.14	4.27	4.41	4.56	4.91
2KMBL0080-0200-S4	●	R0.4	0.8	0.6	2	0.78	4	45	11.88°	2.09	2.15	2.21	2.28	2.43
2KMBL0080-0300-S4	●				3				10.53°	3.12	3.22	3.32	3.43	3.67
2KMBL0080-0400-S4	●				4				9.46°	4.15	4.29	4.43	4.58	4.92
2KMBL0080-0500-S4	●				5				8.58°	5.19	5.36	5.53	5.73	6.16
2KMBL0080-0600-S4	●	6	7.85°	6.22	6.43	6.64	6.88	7.4						
2KMBL0090-0200-S4	●	R0.45	0.9	0.65	2	0.88	4	45	11.88°	2.09	2.14	2.2	2.27	2.42
2KMBL0090-0400-S4	●				4				9.4°	4.15	4.28	4.42	4.57	4.9
2KMBL0090-0600-S4	●				6				7.77°	6.22	6.42	6.64	6.87	7.39
2KMBL0100-0200-S4	●	R0.5	1	0.75	2	0.98	4	45	11.88°	2.08	2.14	2.2	2.26	2.41
2KMBL0100-0250-S4	●				2.5				11.12°	2.6	2.67	2.75	2.84	3.03
2KMBL0100-0300-S4	●				3				10.45°	3.12	3.21	3.31	3.41	3.65
2KMBL0100-0400-S4	●				4				9.33°	4.15	4.28	4.42	4.56	4.89
2KMBL0100-0500-S4	●				5				8.42°	5.19	5.35	5.52	5.71	6.14
2KMBL0100-0600-S4	●				6				7.68°	6.22	6.42	6.63	6.86	7.38
2KMBL0100-0700-S4	●	7	7.05°	7.25	7.49	7.74	8.01	8.62						
2KMBL0120-0240-S4	●	R0.6	1.2	0.9	2.4	1.18	4	45	11.22°	2.49	2.56	2.63	2.71	2.88
2KMBL0120-0400-S4	●				4				9.19°	4.15	4.27	4.4	4.55	4.87
2KMBL0120-0600-S4	●				6				7.49°	6.22	6.41	6.62	6.85	7.35
2KMBL0120-0800-S4	●				8				6.31°	8.28	8.55	8.84	9.15	9.84
2KMBL0140-0800-S4	●	R0.7	1.4	1	8	1.37	4	45	6.08°	8.3	8.56	8.85	9.15	9.84
2KMBL0140-1200-S4	●				12				4.59°	12.43	12.84	13.28	13.75	14.81

The ball radius is based on 1/2 of the actual outer diameter.  
 Neck angle is a reference value.  
 Be careful not to interfere with the workpiece.

● : Available

## 2KMB Long neck type

Description	Availability	Dimensions (mm)							Interference angle	Actual effective length for slope angle of workpiece				
		RE	DC	APMX	LU	DN	DCON	LF		0k	0.5°	1°	1.5°	2°
2KMBL0150-0300-S4	●	R0.75	1.5	1.1	3	1.47	4	45	10.17°	3.13	3.21	3.3	3.4	3.61
2KMBL0150-0400-S4	●				4				8.92°	4.16	4.28	4.41	4.55	4.85
2KMBL0150-0600-S4	●				6				7.15°	6.23	6.42	6.63	6.85	7.34
2KMBL0150-0800-S4	●				8				5.97°	8.3	8.56	8.84	9.15	9.83
2KMBL0150-1000-S4	●				10				5.12°	10.36	10.7	11.06	11.45	12.31
2KMBL0150-1200-S4	●				12				4.48°	12.43	12.84	13.28	13.75	14.8
2KMBL0160-0800-S4	●	R0.8	1.6	1.2	8	1.57	4	45	5.84°	8.3	8.56	8.84	9.14	9.82
2KMBL0160-1200-S4	●				12				4.37°	12.43	12.84	13.27	13.74	14.79
2KMBL0200-0300-S4	●	R1	2	1.5	3	1.97	4	45	9.81°	3.12	3.19	3.27	3.36	3.55
2KMBL0200-0400-S4	●				4				8.39°	4.15	4.26	4.38	4.51	4.79
2KMBL0200-0600-S4	●				6				6.5°	6.22	6.4	6.6	6.81	7.28
2KMBL0200-0800-S4	●				8				5.3°	8.29	8.54	8.82	9.11	9.77
2KMBL0200-1000-S4	●				10				4.48°	10.36	10.68	11.03	11.41	12.25
2KMBL0200-1200-S4	●				12				3.87°	12.42	12.82	13.25	13.71	14.74
2KMBL0200-1300-S4	●				13				3.63°	13.46	13.89	14.36	14.86	15.98
2KMBL0200-1400-S4	●				14				3.41°	14.49	14.96	15.47	16.01	17.23
2KMBL0200-1600-S4	●				16			3.05°	16.56	17.1	17.68	18.31	19.71	
2KMBL0250-0600-S4	●				R1.25			2.5	2.3	6	2.45	4	45	5.61°
2KMBL0250-0800-S4	●	8	4.45°	8.32		8.57	8.83			9.11				9.75
2KMBL0250-1000-S4	●	10	3.69°	10.39		10.7	11.05			11.41				12.24
2KMBL0250-1500-S4	●	15	2.59°	15.55		16.05	16.59			17.16			-	
2KMBL0250-2000-S4	●	20	1.99°	20.72		21.4	22.13			-			-	
2KMBL0300-0600-S6	●	R1.5	3	2.5	6	2.9	6	60	8.3°	6.34	6.51	6.69	6.88	7.32
2KMBL0300-0800-S6	●				8				6.97°	8.41	8.65	8.91	9.18	9.81
2KMBL0300-1000-S6	●				10				6°	10.47	10.79	11.12	11.48	12.29
2KMBL0300-1200-S6	●				12				5.27°	12.54	12.93	13.34	13.78	14.78
2KMBL0300-1400-S6	●				14				4.69°	14.61	15.07	15.56	16.08	17.27
2KMBL0300-1600-S6	●				16				4.23°	16.68	17.21	17.77	18.38	19.75
2KMBL0300-2000-S6	●				20			3.54°	20.81	21.48	22.21	22.98	24.73	
2KMBL0300-2500-S6	●				25			2.94°	25.98	26.83	27.75	28.73	-	
2KMBL0350-1500-S6	●				R1.75			3.5	2.8	15	3.4	6	60	3.96°
2KMBL0350-2000-S6	●	20	65	3.1°		20.8	21.47			22.18			22.94	24.66
2KMBL0350-2500-S6	●	25	70	2.55°		25.97	26.81			27.72			28.69	-
2KMBL0350-3000-S6	●	30	75	2.17°		31.14	32.16			33.26			34.44	-
2KMBL0400-0800-S6	●	R2	4	3	8	3.9	6	65	5.76°	8.39	8.61	8.85	9.11	9.69
2KMBL0400-1000-S6	●				10				4.8°	10.46	10.75	11.07	11.41	12.17
2KMBL0400-1200-S6	●				12				4.11°	12.52	12.89	13.28	13.71	14.66
2KMBL0400-1400-S6	●				14				3.6°	14.59	15.03	15.5	16.01	17.14
2KMBL0400-1500-S6	●				15				3.39°	15.63	16.1	16.61	17.16	18.39
2KMBL0400-2000-S6	●				20				2.62°	20.79	21.45	22.15	22.91	-
2KMBL0400-2500-S6	●				25			2.13°	25.96	26.8	27.69	28.66	-	
2KMBL0400-3000-S6	●				30			1.8°	31.13	32.15	33.23	-	-	
2KMBL0400-3500-S6	●				35			1.56°	36.3	37.49	38.78	-	-	

The ball radius is based on 1/2 of the actual outer diameter.

Neck angle is a reference value.

Be careful not to interfere with the workpiece.

● : Available



## 2KMB Reference cutting conditions table Standard type

Ball radius RE (mm)	Flute length APMX (mm)	Prehardened steel NAK(35-45HRC)				Prehardened steel / Hardened steel STAVAX-SKD61(45-55HRC)				Hardened steel SKD11(55-62HRC)				Hardened steel Powder high-speed steel - SKH (62-66HRC)				Hardened steel Powder high-speed steel (66-70HRC)			
		No. of revolutions n (min <sup>-1</sup> )	Feed Vf (mm/min)	Depth of cut ap (mm)	Cutting width ae (mm)	No. of revolutions n (min <sup>-1</sup> )	Feed Vf (mm/min)	Depth of cut ap (mm)	Cutting width ae (mm)	No. of revolutions n (min <sup>-1</sup> )	Feed Vf (mm/min)	Depth of cut ap (mm)	Cutting width ae (mm)	No. of revolutions n (min <sup>-1</sup> )	Feed Vf (mm/min)	Depth of cut ap (mm)	Cutting width ae (mm)	No. of revolutions n (min <sup>-1</sup> )	Feed Vf (mm/min)	Depth of cut ap (mm)	Cutting width ae (mm)
R0.05	0.1	50,000	200	0.008	0.008	40,000	170	0.006	0.006	40,000	110	0.003	0.006	40,000	70	0.002	0.006	40,000	60	0.002	0.003
R0.075	0.15	50,000	280	0.008	0.008	40,000	200	0.006	0.006	40,000	170	0.003	0.006	40,000	110	0.002	0.006	40,000	90	0.002	0.003
R0.1	0.2	50,000	330	0.015	0.031	40,000	400	0.011	0.022	40,000	350	0.011	0.011	40,000	260	0.003	0.006	40,000	170	0.003	0.003
R0.15	0.3	50,000	770	0.015	0.046	40,000	460	0.011	0.033	40,000	400	0.011	0.022	40,000	330	0.006	0.011	40,000	200	0.003	0.006
R0.2	0.6	50,000	800	0.031	0.092	40,000	1,100	0.022	0.066	40,000	900	0.022	0.055	40,000	530	0.011	0.022	35,000	460	0.01	0.022
R0.25	0.8	50,000	1,150	0.046	0.108	40,000	1,300	0.033	0.077	40,000	1,100	0.028	0.055	40,000	660	0.017	0.033	30,000	500	0.011	0.022
R0.3	0.9	50,000	1,950	0.077	0.154	40,000	1,760	0.055	0.11	40,000	1,320	0.033	0.066	30,000	790	0.022	0.055	25,000	590	0.022	0.055
R0.4	1.2	50,000	2,400	0.154	0.231	40,000	2,400	0.11	0.165	40,000	2,000	0.077	0.11	30,000	1,320	0.055	0.11	25,000	990	0.033	0.11
R0.5	1.5	45,000	3,000	0.154	0.462	40,000	2,750	0.11	0.33	30,000	2,200	0.11	0.22	25,000	1,540	0.088	0.11	20,000	1,100	0.055	0.11
R0.75	2.3	35,000	3,300	0.231	0.462	30,000	3,300	0.165	0.33	30,000	2,750	0.11	0.33	25,000	2,200	0.11	0.22	20,000	1,650	0.066	0.22
R1	3	25,000	3,600	0.308	0.77	25,000	3,300	0.22	0.55	25,000	2,750	0.22	0.55	20,000	2,200	0.165	0.33	16,000	1,650	0.11	0.33
R1.25	3.8	25,000	3,800	0.462	0.77	25,000	3,300	0.33	0.55	25,000	2,750	0.22	0.55	20,000	2,200	0.165	0.44	16,000	1,650	0.11	0.44
R1.5	5	23,590	4,100	0.308	1.232	20,000	3,300	0.22	0.88	18,000	2,750	0.22	0.66	14,000	2,200	0.22	0.55	12,000	1,650	0.132	0.55
R2	6	20,400	4,100	0.462	2.31	20,000	3,300	0.33	1.65	16,000	2,750	0.22	0.88	12,000	2,200	0.22	0.66	9,500	1,650	0.165	0.66

If chatter occurs, adjust cutting conditions as necessary.

Pay particular attention to cutting condition settings and tool passes in areas where cutting load is high, such as corners.

Adjust the number of revolutions and feed rate at the same rate.

Oil mist coolant is recommended.

If  $\phi 1\text{mm}$  or L/D (aspect ratio) exceeds 8, adjust cutting conditions as needed.

## 2KMB Reference cutting conditions table Long neck type

		Prehardened steel NAK(35-45HRC)				Prehardened steel / Hardened steel STAVAX · SKD61(45-55HRC)				Hardened steel SKD11(55-62HRC)				Hardened steel Powder high-speed steel · SKH (62-66HRC)				Hardened steel Powder high-speed steel (66-70HRC)			
Ball radius RE (mm)	Effective length LU (mm)	No. of revolutions n (min <sup>-1</sup> )	Feed Vf (mm/min)	Depth of cut ap (mm)	Cutting width ae (mm)	No. of revolutions n (min <sup>-1</sup> )	Feed Vf (mm/min)	Depth of cut ap (mm)	Cutting width ae (mm)	No. of revolutions n (min <sup>-1</sup> )	Feed Vf (mm/min)	Depth of cut ap (mm)	Cutting width ae (mm)	No. of revolutions n (min <sup>-1</sup> )	Feed Vf (mm/min)	Depth of cut ap (mm)	Cutting width ae (mm)	No. of revolutions n (min <sup>-1</sup> )	Feed Vf (mm/min)	Depth of cut ap (mm)	Cutting width ae (mm)
R0.05	0.2	50,000	230	0.005	0.008	40,000	140	0.003	0.006	40,000	110	0.002	0.006	40,000	80	0.002	0.003	40,000	60	0.002	0.003
	0.3	50,000	230	0.005	0.008	40,000	110	0.003	0.006	40,000	80	0.002	0.006	40,000	60	0.002	0.003	40,000	40	0.002	0.003
	0.5	50,000	230	0.003	0.005	40,000	80	0.002	0.003	40,000	60	0.001	0.003	40,000	30	0.001	0.002	40,000	20	0.001	0.002
R0.075	0.3	50,000	280	0.005	0.008	40,000	200	0.003	0.006	40,000	170	0.002	0.006	40,000	110	0.002	0.003	40,000	90	0.002	0.003
	0.5	50,000	280	0.005	0.008	40,000	170	0.003	0.006	40,000	130	0.002	0.006	40,000	80	0.002	0.003	40,000	60	0.002	0.003
	1	46,000	230	0.003	0.005	40,000	80	0.002	0.003	40,000	60	0.001	0.003	40,000	30	0.001	0.002	40,000	20	0.001	0.002
R0.1	0.3	50,000	330	0.015	0.015	40,000	390	0.011	0.011	40,000	330	0.007	0.006	40,000	220	0.003	0.003	40,000	170	0.003	0.003
	0.5	50,000	330	0.012	0.015	40,000	350	0.009	0.011	40,000	310	0.006	0.006	40,000	200	0.003	0.003	40,000	140	0.003	0.003
	0.75	50,000	330	0.008	0.015	40,000	310	0.006	0.011	40,000	220	0.003	0.006	40,000	170	0.002	0.003	40,000	120	0.002	0.003
	1	50,000	330	0.005	0.008	40,000	280	0.003	0.006	40,000	180	0.002	0.003	40,000	130	0.001	0.002	40,000	100	0.001	0.002
	1.25	45,900	270	0.005	0.008	40,000	200	0.003	0.006	40,000	150	0.002	0.003	40,000	110	0.001	0.002	40,000	80	0.001	0.002
	1.5	45,900	270	0.005	0.008	40,000	170	0.003	0.006	40,000	130	0.002	0.003	40,000	90	0.001	0.002	40,000	60	0.001	0.002
R0.15	0.5	50,000	450	0.015	0.023	40,000	390	0.011	0.017	40,000	330	0.008	0.011	40,000	310	0.003	0.006	40,000	220	0.003	0.006
	0.6	50,000	450	0.011	0.015	40,000	390	0.008	0.011	40,000	330	0.006	0.008	40,000	280	0.003	0.006	40,000	200	0.003	0.006
	0.75	50,000	450	0.011	0.015	40,000	360	0.008	0.011	40,000	310	0.006	0.008	40,000	250	0.003	0.006	40,000	190	0.003	0.006
	1	50,000	450	0.011	0.015	40,000	350	0.008	0.011	40,000	280	0.006	0.008	40,000	220	0.003	0.006	40,000	170	0.003	0.006
	1.25	50,000	450	0.008	0.011	40,000	310	0.006	0.008	40,000	220	0.003	0.006	40,000	180	0.002	0.003	40,000	110	0.003	0.006
	1.5	50,000	450	0.008	0.011	40,000	250	0.006	0.008	40,000	200	0.003	0.006	40,000	130	0.002	0.003	40,000	100	0.002	0.003
	1.75	45,900	400	0.005	0.008	40,000	200	0.003	0.006	40,000	170	0.002	0.003	40,000	110	0.002	0.002	40,000	80	0.002	0.002
	2	45,900	370	0.005	0.008	40,000	170	0.003	0.006	40,000	130	0.002	0.003	40,000	100	0.002	0.002	40,000	60	0.002	0.002
R0.2	0.5	50,000	770	0.045	0.113	40,000	880	0.033	0.055	40,000	790	0.033	0.033	40,000	640	0.01	0.022	35,000	460	0.01	0.022
	0.8	50,000	770	0.045	0.113	40,000	880	0.022	0.055	40,000	790	0.022	0.033	40,000	640	0.009	0.022	35,000	460	0.009	0.022
	1	50,000	770	0.042	0.107	40,000	880	0.022	0.055	40,000	790	0.022	0.033	40,000	640	0.009	0.022	35,000	440	0.009	0.022
	1.5	50,000	660	0.035	0.09	40,000	680	0.011	0.033	40,000	550	0.011	0.022	40,000	440	0.006	0.011	35,000	310	0.006	0.011
	2	50,000	550	0.029	0.073	40,000	550	0.011	0.022	40,000	420	0.011	0.011	40,000	330	0.006	0.008	35,000	240	0.006	0.008
	2.5	36,720	360	0.024	0.06	40,000	460	0.008	0.011	40,000	330	0.006	0.008	40,000	290	0.003	0.006	35,000	210	0.003	0.006
	3	36,720	360	0.017	0.043	40,000	330	0.008	0.011	40,000	260	0.006	0.008	40,000	220	0.003	0.006	35,000	190	0.002	0.003
R0.25	1	50,000	1,190	0.046	0.077	40,000	1,100	0.033	0.055	40,000	950	0.022	0.033	40,000	720	0.011	0.022	30,000	500	0.011	0.022
	1.5	50,000	1,190	0.031	0.077	40,000	940	0.022	0.055	40,000	790	0.011	0.033	40,000	570	0.008	0.022	30,000	390	0.008	0.022
	2	50,000	960	0.031	0.046	40,000	790	0.022	0.033	40,000	720	0.011	0.022	40,000	440	0.008	0.011	30,000	300	0.008	0.011
	2.5	45,450	650	0.015	0.031	40,000	660	0.011	0.022	40,000	580	0.008	0.011	40,000	400	0.006	0.008	30,000	260	0.006	0.008
	3	45,450	650	0.015	0.031	40,000	550	0.011	0.022	40,000	460	0.008	0.011	40,000	350	0.006	0.008	30,000	240	0.006	0.008
	3.5	45,000	600	0.011	0.015	40,000	460	0.008	0.011	40,000	400	0.006	0.008	40,000	310	0.003	0.006	30,000	220	0.003	0.006
	4	34,970	500	0.011	0.015	40,000	390	0.008	0.011	40,000	330	0.006	0.008	40,000	290	0.003	0.006	30,000	200	0.003	0.006
R0.3	1	50,000	1,950	0.077	0.154	40,000	1,540	0.055	0.11	40,000	1,100	0.033	0.066	30,000	790	0.022	0.055	25,000	590	0.022	0.055
	1.5	50,000	1,950	0.077	0.154	40,000	1,540	0.055	0.11	40,000	1,100	0.033	0.066	30,000	790	0.022	0.055	25,000	590	0.022	0.055
	2	50,000	1,950	0.077	0.154	40,000	1,540	0.055	0.11	40,000	1,100	0.033	0.066	30,000	790	0.022	0.055	25,000	590	0.022	0.055
	2.5	50,000	1,560	0.046	0.077	40,000	1,320	0.033	0.055	40,000	920	0.022	0.044	30,000	700	0.022	0.033	25,000	530	0.022	0.033

**2KMB Reference cutting conditions table** Long neck type

Ball radius RE (mm)	Effective length LU (mm)	Prehardened steel NAK(35-45HRC)				Prehardened steel / Hardened steel STAVAX · SKD61(45-55HRC)				Hardened steel SKD11(55-62HRC)				Hardened steel Powder high-speed steel · SKH (62-66HRC)				Hardened steel Powder high-speed steel (66-70HRC)			
		No. of revolutions n (min-1)	Feed Vf (mm/min)	Depth of cut ap (mm)	Cutting width ae (mm)	No. of revolutions n (min-1)	Feed Vf (mm/min)	Depth of cut ap (mm)	Cutting width ae (mm)	No. of revolutions n (min-1)	Feed Vf (mm/min)	Depth of cut ap (mm)	Cutting width ae (mm)	No. of revolutions n (min-1)	Feed Vf (mm/min)	Depth of cut ap (mm)	Cutting width ae (mm)	No. of revolutions n (min-1)	Feed Vf (mm/min)	Depth of cut ap (mm)	Cutting width ae (mm)
R0.3	3	50,000	1,560	0.046	0.077	40,000	1,320	0.033	0.055	40,000	920	0.022	0.044	30,000	700	0.022	0.033	25,000	500	0.022	0.033
	3.5	48,960	1,450	0.031	0.046	40,000	1,100	0.022	0.033	40,000	680	0.011	0.033	30,000	530	0.011	0.022	25,000	340	0.011	0.022
	4	48,960	1,450	0.031	0.046	40,000	1,100	0.022	0.033	40,000	680	0.011	0.033	30,000	530	0.011	0.022	25,000	340	0.011	0.022
	4.5	45,900	1,070	0.031	0.046	35,000	990	0.022	0.033	35,000	640	0.011	0.022	30,000	470	0.009	0.017	25,000	250	0.011	0.022
	5	39,780	930	0.015	0.031	30,000	790	0.011	0.022	30,000	550	0.008	0.017	30,000	440	0.008	0.011	25,000	220	0.011	0.022
R0.35	2	50,000	2,160	0.108	0.154	40,000	1,760	0.077	0.11	40,000	1,430	0.055	0.088	30,000	1,100	0.033	0.077	25,000	770	0.022	0.055
	4	48,960	1,600	0.062	0.092	40,000	1,430	0.044	0.066	40,000	900	0.033	0.044	30,000	660	0.017	0.022	25,000	330	0.011	0.022
R0.4	2	50,000	2,400	0.154	0.231	40,000	2,200	0.11	0.165	40,000	1,760	0.077	0.11	30,000	1,320	0.055	0.11	25,000	990	0.033	0.11
	3	50,000	2,400	0.154	0.231	40,000	2,200	0.11	0.165	40,000	1,760	0.077	0.11	30,000	1,320	0.055	0.055	25,000	990	0.033	0.055
	4	50,000	2,400	0.077	0.154	40,000	1,760	0.055	0.11	40,000	1,320	0.055	0.055	30,000	950	0.033	0.055	20,000	700	0.022	0.055
	5	48,960	2,110	0.077	0.077	40,000	1,760	0.055	0.055	40,000	1,100	0.033	0.055	30,000	680	0.022	0.033	20,000	510	0.017	0.033
	6	42,840	1,730	0.046	0.077	30,000	1,320	0.033	0.055	30,000	840	0.022	0.033	25,000	620	0.011	0.022	20,000	330	0.017	0.033
R0.45	2	50,000	2,820	0.154	0.308	40,000	2,420	0.11	0.22	30,000	1,980	0.088	0.165	30,000	1,430	0.066	0.11	25,000	990	0.033	0.055
	4	48,450	2,370	0.077	0.185	40,000	1,980	0.055	0.132	30,000	1,540	0.044	0.088	25,000	990	0.033	0.055	20,000	660	0.017	0.028
	6	40,700	1,520	0.054	0.077	30,000	1,320	0.039	0.055	25,000	880	0.028	0.039	20,000	660	0.017	0.028	20,000	330	0.011	0.022
R0.5	2	45,900	3,100	0.154	0.462	40,000	2,750	0.11	0.33	30,000	2,200	0.11	0.22	25,000	1,540	0.088	0.11	20,000	1,100	0.055	0.11
	2.5	45,900	3,100	0.154	0.462	40,000	2,750	0.11	0.33	30,000	2,200	0.11	0.22	25,000	1,540	0.088	0.11	20,000	1,100	0.055	0.11
	3	45,900	3,100	0.154	0.462	40,000	2,750	0.11	0.33	30,000	2,200	0.11	0.22	25,000	1,540	0.088	0.11	20,000	1,100	0.055	0.11
	4	45,900	3,100	0.154	0.308	40,000	2,750	0.11	0.22	30,000	1,980	0.055	0.165	25,000	1,320	0.055	0.11	20,000	990	0.033	0.11
	5	39,780	2,600	0.077	0.231	30,000	2,200	0.055	0.165	25,000	1,760	0.044	0.11	20,000	1,010	0.033	0.055	16,000	770	0.022	0.055
	6	38,560	2,320	0.077	0.154	30,000	1,980	0.055	0.11	25,000	1,320	0.044	0.055	20,000	810	0.022	0.055	16,000	610	0.017	0.055
	7	33,050	1,340	0.062	0.092	30,000	1,320	0.044	0.066	25,000	1,050	0.033	0.044	20,000	750	0.022	0.033	16,000	540	0.011	0.033
R0.6	2.4	39,230	2,720	0.154	0.462	30,000	2,750	0.11	0.33	30,000	2,200	0.11	0.22	25,000	1,760	0.055	0.11	20,000	1,320	0.055	0.11
	4	39,230	2,720	0.154	0.308	30,000	2,750	0.11	0.22	30,000	2,200	0.077	0.22	25,000	1,760	0.055	0.11	20,000	1,320	0.055	0.11
	6	39,230	2,720	0.108	0.154	30,000	2,200	0.077	0.11	25,000	1,760	0.055	0.11	20,000	1,320	0.033	0.077	16,000	830	0.022	0.077
	8	31,820	2,070	0.077	0.154	30,000	1,760	0.055	0.11	25,000	1,320	0.033	0.077	20,000	1,010	0.022	0.055	16,000	720	0.017	0.055
R0.7	8	27,850	1,810	0.185	0.308	30,000	2,750	0.132	0.22	20,000	1,980	0.088	0.165	20,000	1,100	0.033	0.088	15,000	680	0.022	0.055
	12	25,700	1,250	0.108	0.185	20,000	1,540	0.077	0.132	18,000	1,210	0.044	0.088	18,000	770	0.017	0.055	15,000	620	0.017	0.05
R0.75	3	35,700	3,210	0.231	0.462	30,000	3,300	0.165	0.33	30,000	2,750	0.11	0.33	25,000	2,200	0.11	0.22	20,000	1,650	0.066	0.22
	4	35,700	3,210	0.231	0.462	30,000	3,300	0.165	0.33	30,000	2,750	0.11	0.33	25,000	2,200	0.11	0.22	18,000	1,320	0.066	0.22
	6	35,700	3,210	0.231	0.308	30,000	3,300	0.165	0.22	30,000	2,200	0.11	0.22	25,000	1,760	0.11	0.11	16,000	1,050	0.066	0.11
	8	27,850	1,810	0.154	0.308	25,000	2,750	0.11	0.22	25,000	1,760	0.055	0.22	20,000	1,320	0.055	0.11	13,000	770	0.033	0.11
	10	25,700	1,670	0.154	0.154	25,000	2,750	0.11	0.11	25,000	1,320	0.055	0.11	20,000	950	0.055	0.055	13,000	720	0.033	0.055
	12	25,700	1,390	0.077	0.154	20,000	1,980	0.055	0.11	20,000	1,010	0.033	0.11	18,000	860	0.022	0.055	10,000	500	0.017	0.033
R0.8	8	30,940	2,490	0.154	0.308	25,000	2,750	0.11	0.22	20,000	2,200	0.077	0.165	18,000	1,760	0.055	0.11	13,000	830	0.033	0.11
	12	27,850	2,180	0.108	0.154	20,000	1,980	0.077	0.11	16,000	1,650	0.055	0.077	14,000	1,320	0.033	0.055	10,000	500	0.022	0.055

## 2KMB Reference cutting conditions table Long neck type

Ball radius RE (mm)	Effective length LU (mm)	Prehardened steel NAK(35-45HRC)				Prehardened steel / Hardened steel STAVAX · SKD61(45-55HRC)				Hardened steel SKD11(55-62HRC)				Hardened steel Powder high-speed steel · SKH (62-66HRC)				Hardened steel Powder high-speed steel (66-70HRC)			
		No. of revolutions n (min-1)	Feed Vf (mm/min)	Depth of cut ap (mm)	Cutting width ae (mm)	No. of revolutions n (min-1)	Feed Vf (mm/min)	Depth of cut ap (mm)	Cutting width ae (mm)	No. of revolutions n (min-1)	Feed Vf (mm/min)	Depth of cut ap (mm)	Cutting width ae (mm)	No. of revolutions n (min-1)	Feed Vf (mm/min)	Depth of cut ap (mm)	Cutting width ae (mm)	No. of revolutions n (min-1)	Feed Vf (mm/min)	Depth of cut ap (mm)	Cutting width ae (mm)
R1	3	26,780	3,620	0.308	0.77	25,000	3,300	0.22	0.55	25,000	2,750	0.22	0.55	20,000	2,200	0.165	0.33	16,000	1,650	0.11	0.33
	4	26,780	3,620	0.308	0.77	25,000	3,300	0.22	0.55	25,000	2,750	0.22	0.55	20,000	2,200	0.165	0.33	16,000	1,650	0.11	0.33
	6	26,780	3,210	0.308	0.77	25,000	2,750	0.22	0.55	25,000	2,200	0.22	0.33	20,000	1,760	0.165	0.33	16,000	1,320	0.11	0.33
	8	26,780	3,210	0.308	0.462	20,000	2,200	0.22	0.33	18,000	1,760	0.11	0.22	16,000	1,320	0.11	0.22	13,000	1,050	0.066	0.165
	10	24,990	2,700	0.154	0.462	18,000	2,200	0.11	0.33	16,000	1,760	0.11	0.22	14,000	1,320	0.11	0.11	11,000	830	0.066	0.11
	12	22,490	2,430	0.154	0.308	16,000	1,760	0.11	0.22	14,000	1,320	0.11	0.11	12,000	1,030	0.055	0.11	9,500	720	0.033	0.11
	13	22,490	2,430	0.123	0.308	16,000	1,760	0.088	0.22	14,000	1,320	0.066	0.11	12,000	1,030	0.044	0.088	9,500	610	0.033	0.055
	14	22,490	2,110	0.108	0.231	16,000	1,760	0.077	0.165	14,000	1,320	0.055	0.088	12,000	1,030	0.033	0.077	8,500	500	0.033	0.055
	16	20,890	1,350	0.108	0.231	16,000	1,760	0.077	0.165	14,000	1,320	0.055	0.088	12,000	1,030	0.033	0.077	8,000	390	0.033	0.055
R1.25	6	23,590	3,800	0.462	0.616	20,000	3,080	0.33	0.44	20,000	2,530	0.22	0.55	18,000	2,200	0.165	0.44	14,000	1,650	0.11	0.44
	8	23,590	3,800	0.385	0.462	20,000	2,860	0.275	0.33	20,000	2,310	0.165	0.33	18,000	1,980	0.132	0.275	14,000	1,430	0.11	0.33
	10	23,590	3,800	0.308	0.462	20,000	2,750	0.22	0.33	20,000	2,200	0.165	0.22	18,000	1,760	0.11	0.165	13,000	1,210	0.066	0.165
	15	18,400	2,130	0.154	0.308	18,000	2,200	0.11	0.22	16,000	1,760	0.077	0.165	14,000	1,320	0.055	0.11	9,500	770	0.033	0.11
	20	16,980	1,640	0.108	0.231	16,000	1,650	0.077	0.165	14,000	1,320	0.055	0.11	10,000	1,100	0.033	0.055	8,500	500	0.033	0.055
R1.5	6	23,590	4,100	0.308	1.232	20,000	3,300	0.22	0.88	18,000	2,750	0.22	0.66	14,000	2,200	0.22	0.55	12,000	1,650	0.132	0.55
	8	23,590	4,100	0.308	1.232	20,000	3,300	0.22	0.88	18,000	2,750	0.22	0.66	14,000	2,200	0.22	0.55	12,000	1,650	0.132	0.55
	10	23,590	4,100	0.308	0.924	20,000	2,750	0.22	0.66	18,000	2,200	0.22	0.44	14,000	1,650	0.11	0.33	12,000	1,430	0.11	0.33
	12	23,590	3,400	0.308	0.924	20,000	2,750	0.22	0.66	18,000	2,200	0.22	0.44	14,000	1,650	0.11	0.33	12,000	1,210	0.066	0.33
	14	19,040	2,700	0.154	0.616	18,000	2,200	0.11	0.44	16,000	1,760	0.11	0.33	12,000	1,320	0.11	0.22	10,000	990	0.066	0.22
	16	19,040	2,300	0.154	0.616	18,000	2,200	0.11	0.44	16,000	1,760	0.11	0.33	12,000	1,320	0.11	0.22	10,000	720	0.066	0.22
	20	15,910	1,920	0.154	0.462	18,000	1,760	0.11	0.33	16,000	1,320	0.11	0.22	12,000	1,050	0.11	0.11	9,500	500	0.066	0.11
	25	15,910	1,390	0.154	0.308	16,000	1,320	0.11	0.22	14,000	1,200	0.077	0.165	10,000	880	0.055	0.077	8,500	300	0.053	0.088
R1.75	15	23,590	2,750	0.385	1.54	20,000	3,300	0.275	1.1	16,000	2,530	0.165	0.55	14,000	1,650	0.143	0.44	12,000	990	0.143	0.422
	20	19,040	2,100	0.278	0.924	18,000	2,750	0.198	0.66	15,000	1,980	0.11	0.33	12,000	1,320	0.11	0.22	9,500	720	0.11	0.22
	25	15,910	1,710	0.186	0.539	16,000	1,980	0.132	0.385	14,000	1,760	0.11	0.22	10,000	1,100	0.066	0.132	8,500	500	0.066	0.132
	30	15,190	1,710	0.154	0.385	14,000	1,650	0.11	0.275	11,000	1,050	0.077	0.165	9,000	880	0.055	0.088	7,500	300	0.055	0.088
R2	8	20,400	4,100	0.462	2.31	20,000	3,300	0.33	1.65	16,000	2,750	0.22	0.88	12,000	2,200	0.22	0.66	9,500	1,650	0.165	0.66
	10	20,400	4,100	0.462	2.31	20,000	3,300	0.33	1.65	16,000	2,750	0.22	0.88	12,000	2,200	0.22	0.66	9,500	1,650	0.165	0.66
	12	20,400	4,100	0.462	2.31	20,000	3,300	0.33	1.65	16,000	2,750	0.22	0.88	12,000	2,200	0.22	0.66	9,500	1,650	0.165	0.66
	14	20,400	3,900	0.462	2.31	20,000	3,300	0.33	1.65	16,000	2,200	0.22	0.88	12,000	1,760	0.22	0.66	9,500	1,320	0.132	0.66
	15	20,400	3,900	0.462	2.31	20,000	3,300	0.33	1.65	16,000	2,200	0.22	0.88	12,000	1,760	0.22	0.66	9,500	1,320	0.132	0.66
	20	15,910	2,800	0.308	1.54	16,000	2,640	0.22	1.1	14,000	1,980	0.11	0.66	10,000	1,540	0.11	0.44	8,000	990	0.088	0.44
	25	15,910	1,900	0.308	1.232	16,000	1,760	0.22	0.88	14,000	1,320	0.11	0.44	10,000	1,100	0.11	0.22	8,000	720	0.088	0.22
	30	15,190	1,800	0.154	0.462	14,000	1,760	0.11	0.33	10,000	1,310	0.077	0.22	8,200	1,100	0.055	0.165	6,500	500	0.07	0.176
35	14,000	1,370	0.154	0.308	14,000	1,320	0.11	0.22	10,000	1,100	0.077	0.165	8,200	900	0.055	0.11	6,500	300	0.07	0.176	

If chatter occurs, adjust cutting conditions as necessary.

Pay particular attention to cutting condition settings and tool passes in areas where cutting load is high, such as corners.

Adjust the number of revolutions and feed rate at the same rate.

Oil mist coolant is recommended.

If  $\phi 1$  mm or L/D (aspect ratio) exceeds 8, adjust cutting conditions as needed.