

# 2KMB K-Series



Kyocera's original coating technology MEGACOAT HARD EX provides long tool life, high quality and stable machining

New K-Series solid tool for hardened material supporting up to 70 HRC is now available!  
Higher precision, larger variety.



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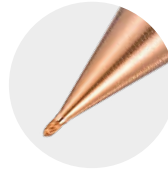
**LinkedIn**



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

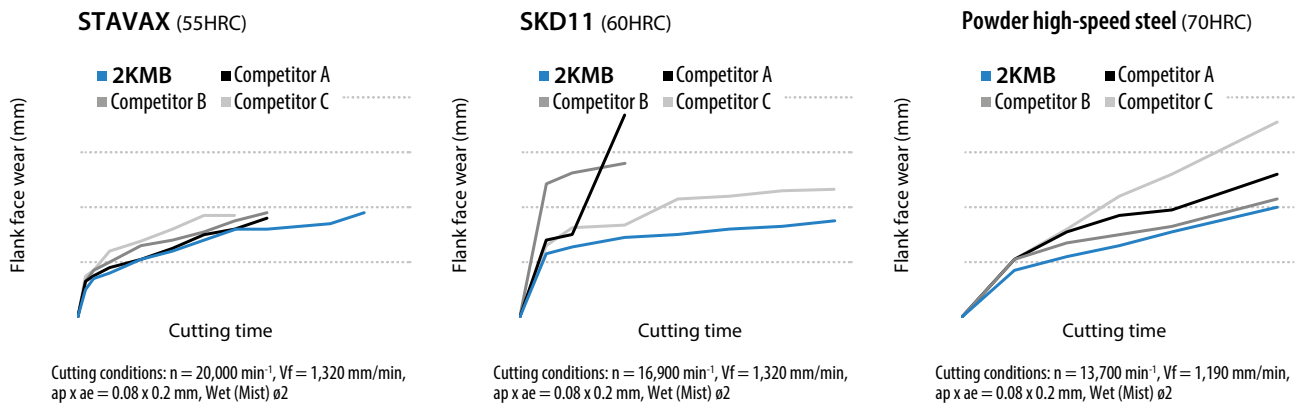
The new solid tool lineup is an optimized tool for precision parts and mold machining.

### Long tool life in various hardened materials

|                                  |                                                    |                               |                               |                               |
|----------------------------------|----------------------------------------------------|-------------------------------|-------------------------------|-------------------------------|
| Prehardened steel<br>35 - 45 HRC | Prehardened steel<br>Hardened steel<br>45 - 55 HRC | Hardened steel<br>55 - 62 HRC | Hardened steel<br>62 - 66 HRC | Hardened steel<br>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

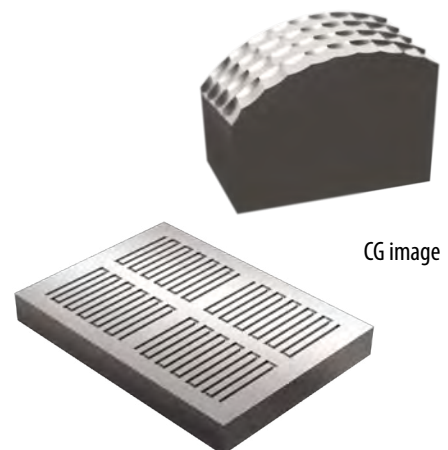
The new MEGACOAT HARD EX coating technology and a unique shape creates a glossy and beautiful finished surface

Reduced process cycle times

### Surface finish condition

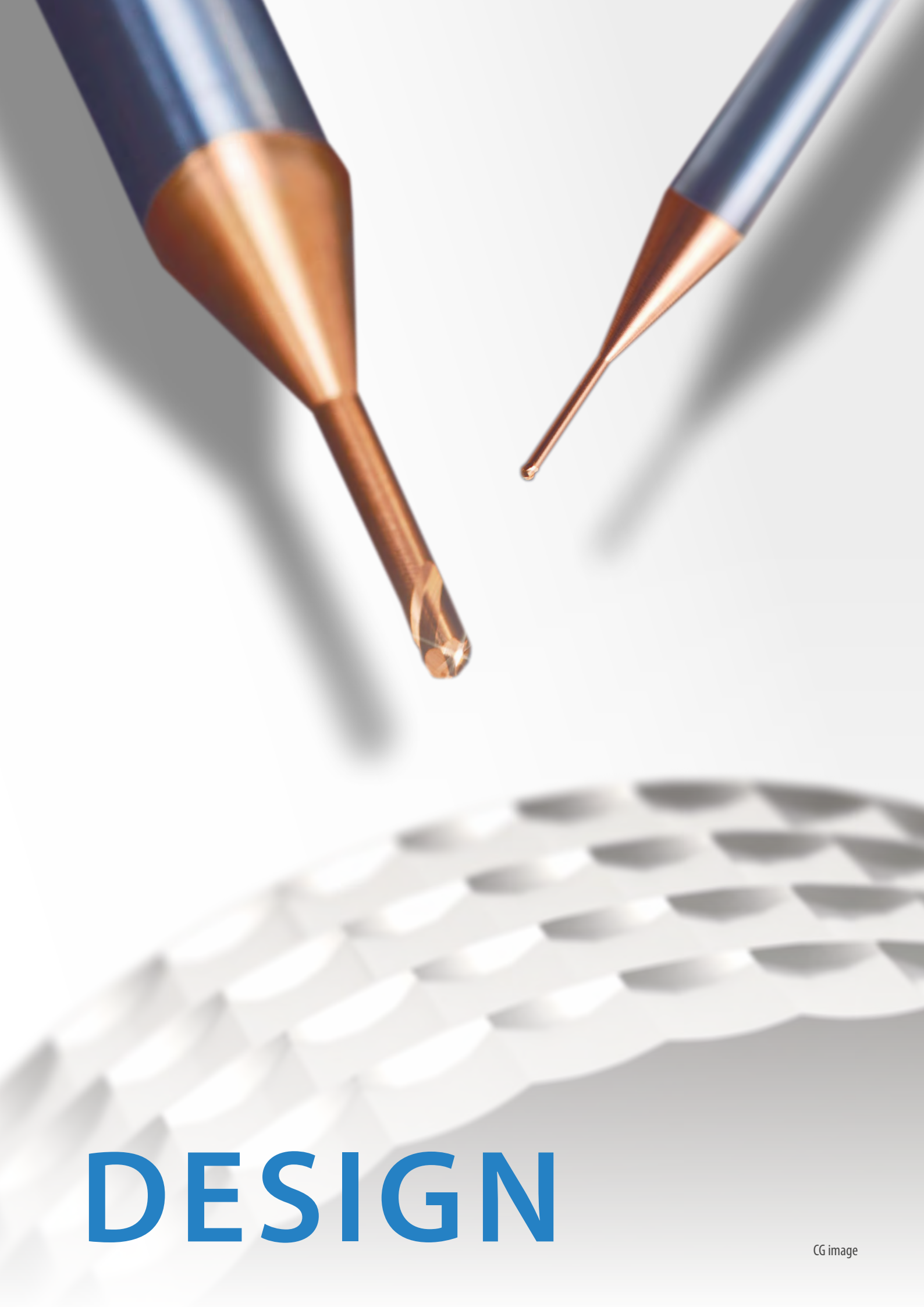
(Internal evaluation)

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)



CG image

# INNOVATIVE



# DESIGN

# Long tool life with unique coating



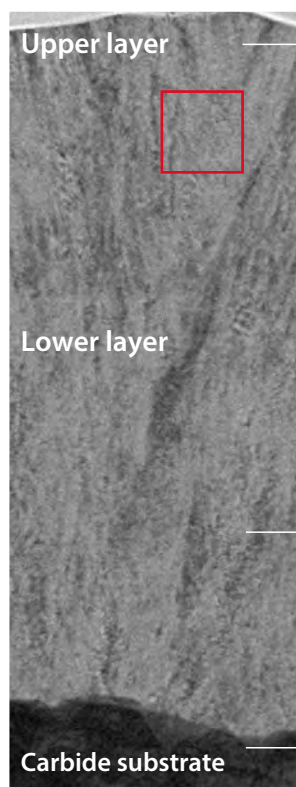
New PVD coating **NEW**

## 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



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

### Suppresses the progression of high-temperature wear

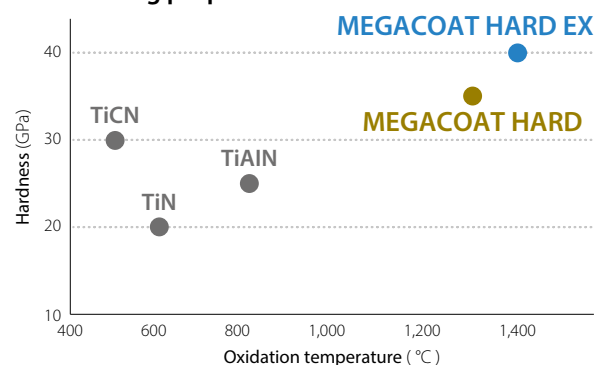
Special laminated structural layer

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

### Suppresses hard film peeling

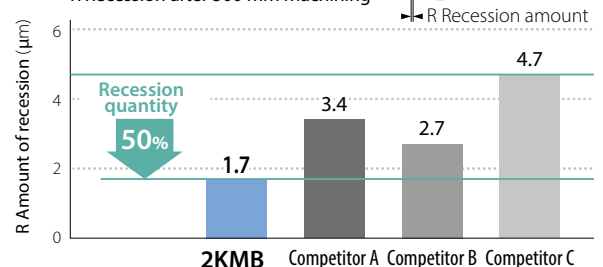
Special interface treatment

### 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

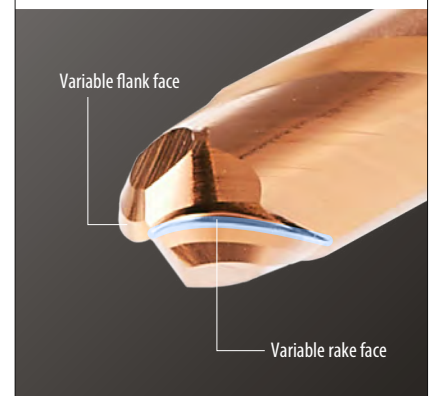


Point

04

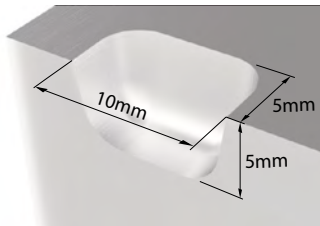
## Stable machining with a unique cutting edge shape

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





## 80° Slope half pocketing

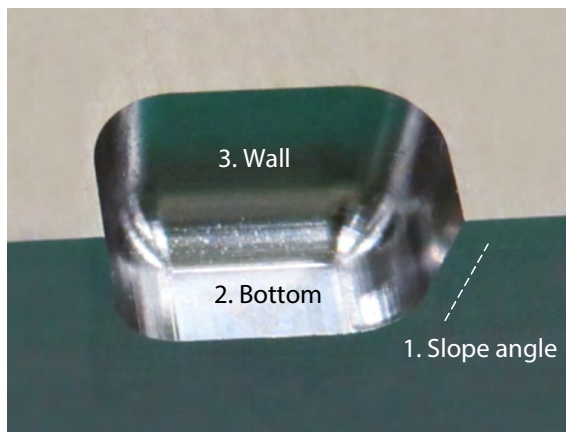


**2KMBL0200-0800-S4** Tool diameter DC  $\phi 2$  Long neck type  
**SKD11 (60HRC)**

|                  | n (min <sup>-1</sup> ) | Vf (mm/min) | ap×ae (mm) | Coolant    |
|------------------|------------------------|-------------|------------|------------|
| Wall finishing   | 10,000                 | 400         | 0.02×0.02  | Wet (Mist) |
| Bottom finishing | 10,000                 | 400         | 0.02×0.02  | Wet (Mist) |

**Provides an excellent surface finish that is resistant to deflection even when machining at large depths**

**Long tool life with stable cuts and uniform finish is possible**

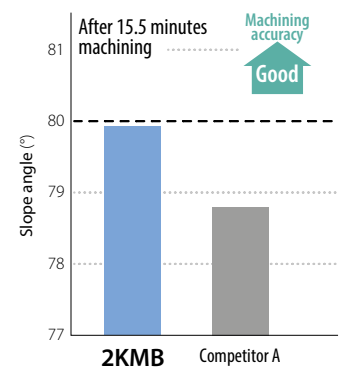


01

### Machining accuracy

2KMB shows smaller deflection and higher precision machining than competitors.

### Machining accuracy comparison (Internal evaluation)

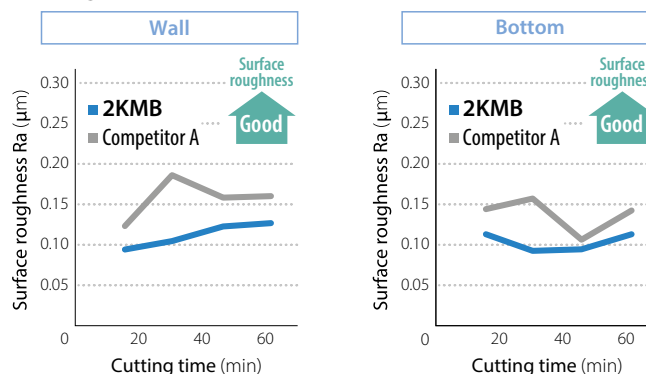


02

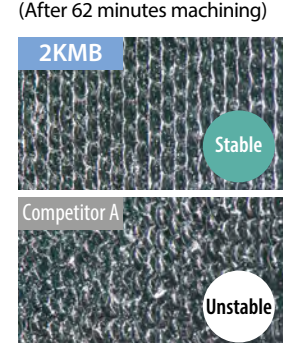
### Machining quality

2KMB shows a better surface and superior surface finish than competitors.

### Roughness comparison (Internal evaluation)



### Bottom condition (After 62 minutes machining)

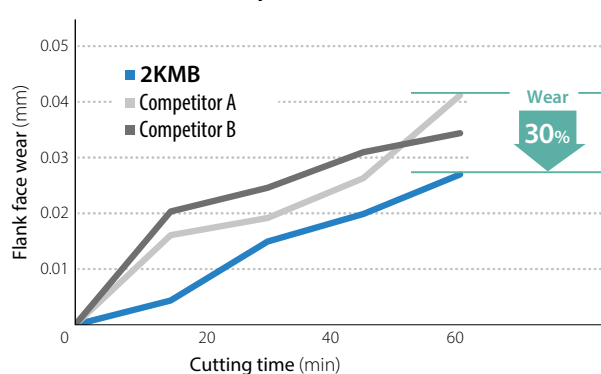


03

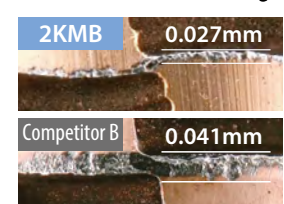
### Tool life

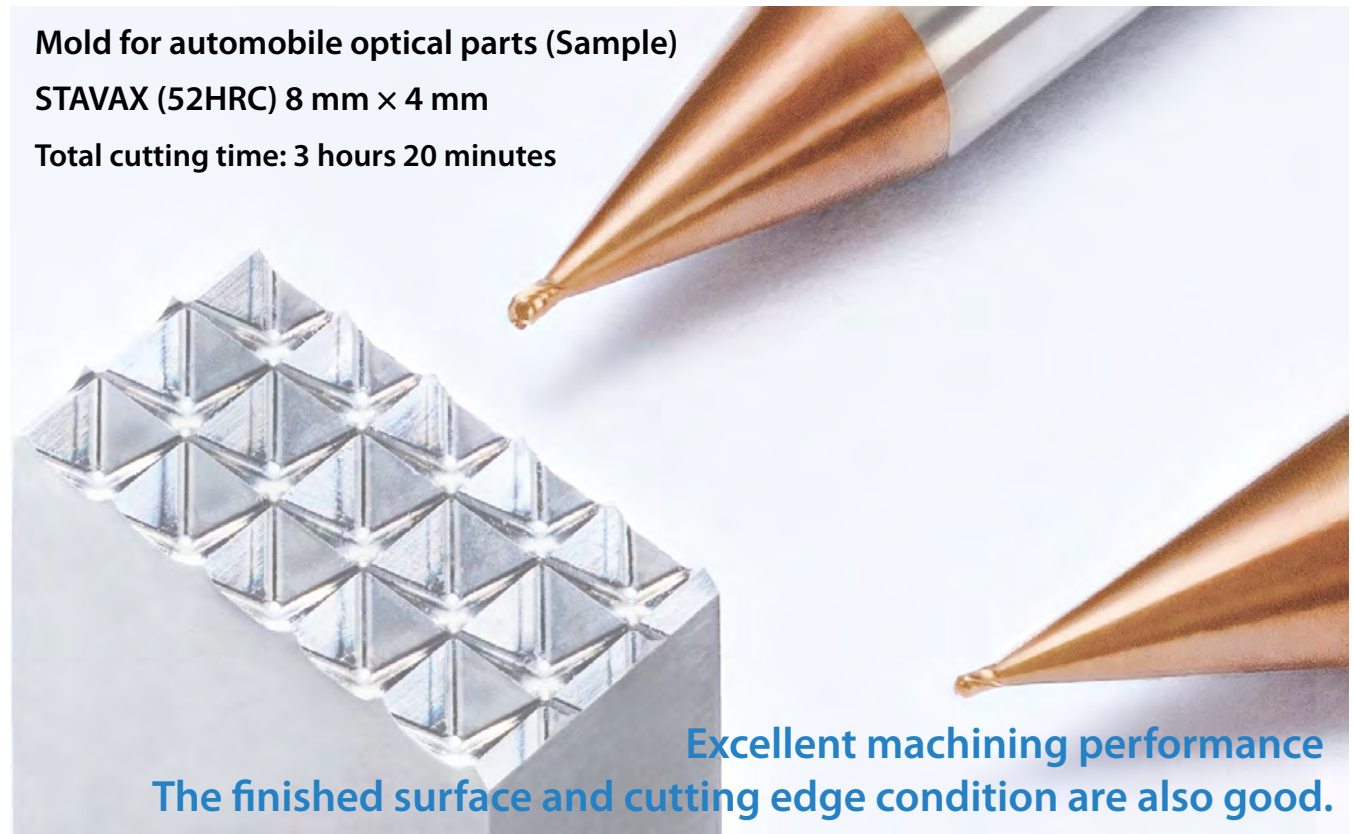
2KMB shows smaller wear with higher wear resistance than competitors.

### Wear resistance comparison (Internal evaluation)



### Cutting edge condition (After 62 minutes machining)

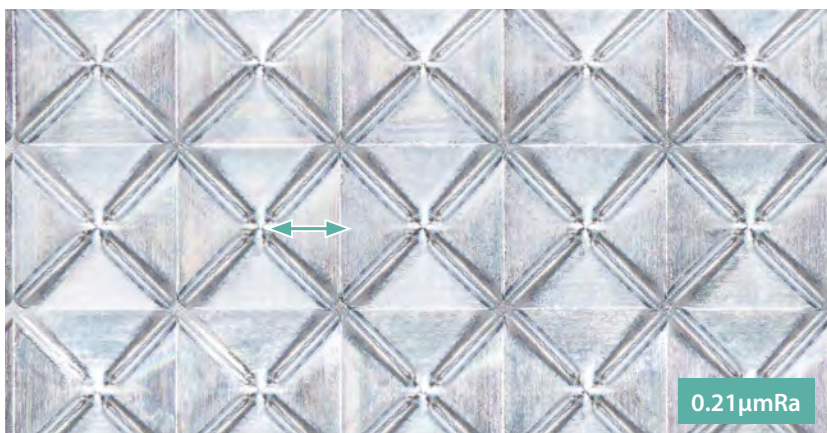




### Cutting conditions

|                                           | Roughing       | Roughing                 | Medium roughing | Medium roughing          | Medium finishing         | Finishing                |
|-------------------------------------------|----------------|--------------------------|-----------------|--------------------------|--------------------------|--------------------------|
| Tool                                      | R0.5<br>Radius | R0.3<br>2KMB0060-0090-S4 |                 | R0.2<br>2KMB0040-0060-S4 | R0.2<br>2KMB0040-0060-S4 | R0.2<br>2KMB0040-0060-S4 |
| No. of revolutions n (min <sup>-1</sup> ) | 15,000         | 15,000                   | 18,000          | 18,000                   | 18,000                   | 18,000                   |
| Vf (mm/min)                               | 600            | 300                      | 300             | 150                      | 150                      | 150                      |
| ap (mm)                                   | 0.035          | 0.025                    | 0.03            | 0.02                     | 0.01                     | 0.005                    |
| Thickness (mm)                            | 0.2            | 0.2                      | 0.1             | 0.1                      | 0.05                     | 0                        |
| Cutting time (min)                        | 8              | 18                       | 9               | 21                       | 46                       | 49 x 2 pcs               |

### Finished surface

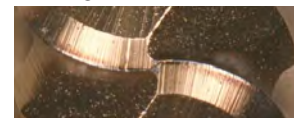


### Edge condition

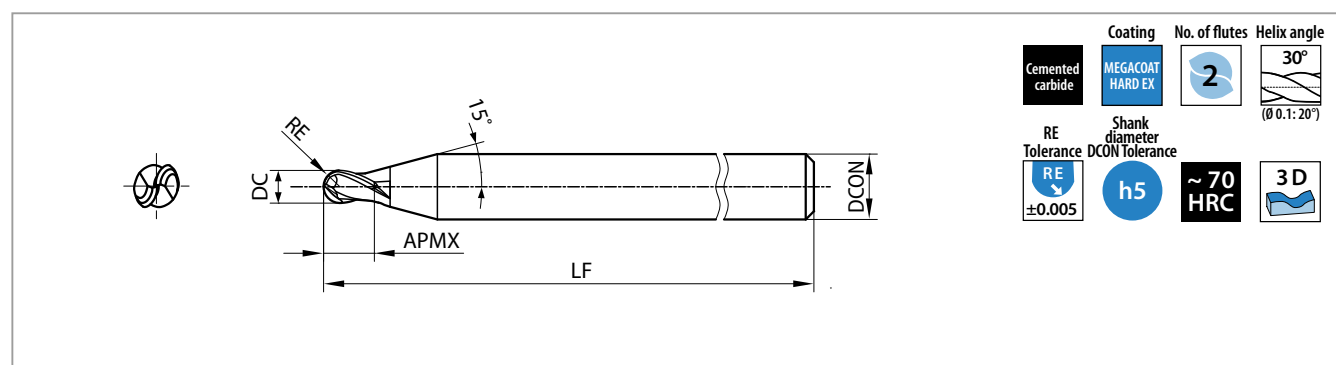
Roughing and medium roughing R0.3



Finishing R0.2



## 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

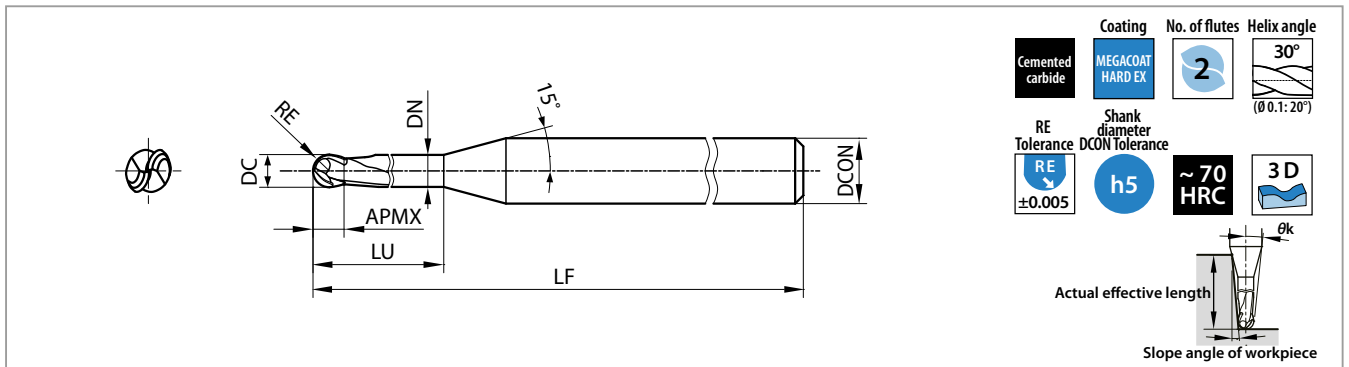
## Description's view

Example: 2KMBL0100-0500-S4

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



## Long neck type

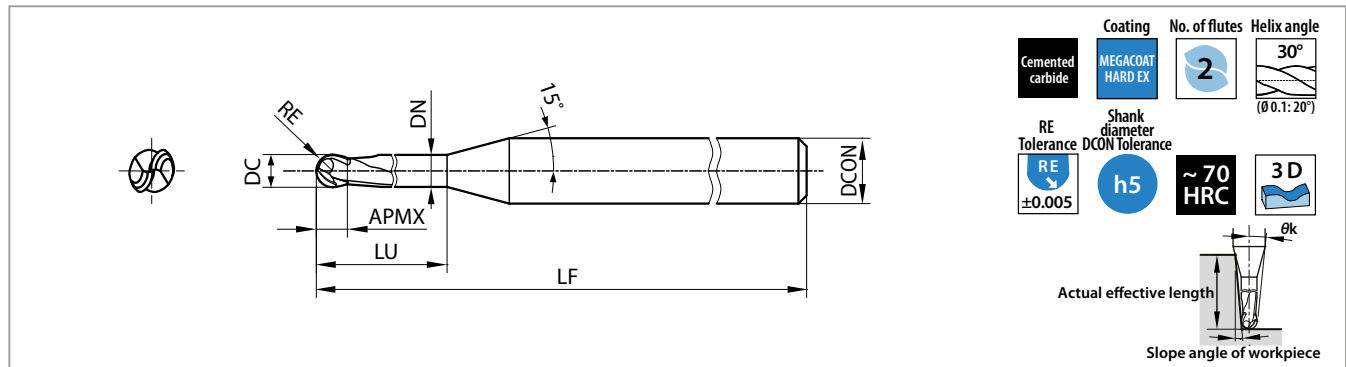


| Description       | Availability | Dimensions (mm) |      |      |      |      |      |    | Interference angle | Actual effective length for slope angle of workpiece |      |      |      |      |
|-------------------|--------------|-----------------|------|------|------|------|------|----|--------------------|------------------------------------------------------|------|------|------|------|
|                   |              | RE              | DC   | APMX | LU   | DN   | DCON | LF |                    | 0.5°                                                 | 1°   | 1.5° | 2°   | 3°   |
| 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

## Long neck type



| Description       | Availability | Dimensions (mm) |     |      |     |      |      |       | Interference angle | Actual effective length for slope angle of workpiece |       |       |       |      |
|-------------------|--------------|-----------------|-----|------|-----|------|------|-------|--------------------|------------------------------------------------------|-------|-------|-------|------|
|                   |              | RE              | DC  | APMX | LU  | DN   | DCON | LF    |                    | θk                                                   | 0.5°  | 1°    | 1.5°  | 2°   |
| 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

## 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 |      |      | 50    | 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°              | 6.25                                                 | 6.43  | 6.61  | 6.81  | 7.27  |
| 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 |      |      | 50    | 2.59°              | 15.55                                                | 16.05 | 16.59 | 17.16 | -     |
| 2KMBL0250-2000-S4 | ●            |                 |     |      | 20 |      |      | 55    | 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 |      |      | 65    | 3.54°              | 20.81                                                | 21.48 | 22.21 | 22.98 | 24.73 |
| 2KMBL0300-2500-S6 | ●            |                 |     |      | 25 |      |      | 70    | 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°              | 15.63                                                | 16.12 | 16.64 | 17.2  | 18.45 |
| 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 |      |      | 70    | 2.13°              | 25.96                                                | 26.8  | 27.69 | 28.66 | -     |
| 2KMBL0400-3000-S6 | ●            |                 |     |      | 30 |      |      | 75    | 1.8°               | 31.13                                                | 32.15 | 33.23 | -     | -     |
| 2KMBL0400-3500-S6 | ●            |                 |     |      | 35 |      |      | 80    | 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

## Reference cutting conditions table

### Standard type

|                           |                              | Prehardened steel<br>NAK(35-45HRC)                 |                        |                               |                                | Prehardened steel / Hardened steel<br>STAVAX · SKD61(45-55HRC) |                        |                               |                                | Hardened steel<br>SKD11(55-62HRC)                  |                        |                               |                                | Hardened steel<br>Powder high-speed steel · SKH<br>(62-66HRC) |                        |                               |                                | Hardened steel<br>Powder high-speed steel<br>(66-70HRC) |                        |                               |                                |
|---------------------------|------------------------------|----------------------------------------------------|------------------------|-------------------------------|--------------------------------|----------------------------------------------------------------|------------------------|-------------------------------|--------------------------------|----------------------------------------------------|------------------------|-------------------------------|--------------------------------|---------------------------------------------------------------|------------------------|-------------------------------|--------------------------------|---------------------------------------------------------|------------------------|-------------------------------|--------------------------------|
| Ball radius<br>RE<br>(mm) | Flute length<br>APMX<br>(mm) | No. of<br>revolutions<br>n<br>(min <sup>-1</sup> ) | Feed<br>Vf<br>(mm/min) | Depth<br>of cut<br>ap<br>(mm) | Cutting<br>width<br>ae<br>(mm) | No. of<br>revolutions<br>n<br>(min <sup>-1</sup> )             | Feed<br>Vf<br>(mm/min) | Depth<br>of cut<br>ap<br>(mm) | Cutting<br>width<br>ae<br>(mm) | No. of<br>revolutions<br>n<br>(min <sup>-1</sup> ) | Feed<br>Vf<br>(mm/min) | Depth<br>of cut<br>ap<br>(mm) | Cutting<br>width<br>ae<br>(mm) | No. of<br>revolutions<br>n<br>(min <sup>-1</sup> )            | Feed<br>Vf<br>(mm/min) | Depth<br>of cut<br>ap<br>(mm) | Cutting<br>width<br>ae<br>(mm) | No. of<br>revolutions<br>n<br>(min <sup>-1</sup> )      | Feed<br>Vf<br>(mm/min) | Depth<br>of cut<br>ap<br>(mm) | Cutting<br>width<br>ae<br>(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 ø1mm or L/D (aspect ratio) exceeds 8, adjust cutting conditions as needed.



## Reference cutting conditions table

### Long neck type

|                           |                                   | Prehardened steel<br>NAK(35-45HRC)                 |                        |                               |                                | Prehardened steel / Hardened steel<br>STAVAX·SKD61(45-55HRC) |                        |                               |                                | Hardened steel<br>SKD11(55-62HRC)                  |                        |                               |                                | Hardened steel<br>Powder high-speed steel·SKH<br>(62-66HRC) |                        |                               |                                | Hardened steel<br>Powder high-speed steel<br>(66-70HRC) |                        |                               |                                |
|---------------------------|-----------------------------------|----------------------------------------------------|------------------------|-------------------------------|--------------------------------|--------------------------------------------------------------|------------------------|-------------------------------|--------------------------------|----------------------------------------------------|------------------------|-------------------------------|--------------------------------|-------------------------------------------------------------|------------------------|-------------------------------|--------------------------------|---------------------------------------------------------|------------------------|-------------------------------|--------------------------------|
| Ball radius<br>RE<br>(mm) | Effective<br>length<br>LU<br>(mm) | No. of<br>revolutions<br>n<br>(min <sup>-1</sup> ) | Feed<br>Vf<br>(mm/min) | Depth<br>of cut<br>ap<br>(mm) | Cutting<br>width<br>ae<br>(mm) | No. of<br>revolutions<br>n<br>(min <sup>-1</sup> )           | Feed<br>Vf<br>(mm/min) | Depth<br>of cut<br>ap<br>(mm) | Cutting<br>width<br>ae<br>(mm) | No. of<br>revolutions<br>n<br>(min <sup>-1</sup> ) | Feed<br>Vf<br>(mm/min) | Depth<br>of cut<br>ap<br>(mm) | Cutting<br>width<br>ae<br>(mm) | No. of<br>revolutions<br>n<br>(min <sup>-1</sup> )          | Feed<br>Vf<br>(mm/min) | Depth<br>of cut<br>ap<br>(mm) | Cutting<br>width<br>ae<br>(mm) | No. of<br>revolutions<br>n<br>(min <sup>-1</sup> )      | Feed<br>Vf<br>(mm/min) | Depth<br>of cut<br>ap<br>(mm) | Cutting<br>width<br>ae<br>(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                          |

## Reference cutting conditions table

### Long neck type

|                           |                                   | Prehardened steel<br>NAK(35-45HRC)                 |                        |                               |                                | Prehardened steel / Hardened steel<br>STAVAX-SKD61(45-55HRC) |                        |                               |                                | Hardened steel<br>SKD11(55-62HRC)                  |                        |                               |                                | Hardened steel<br>Powder high-speed steel · SKH<br>(62-66HRC) |                        |                               |                                | Hardened steel<br>Powder high-speed steel<br>(66-70HRC) |                        |                               |                                |
|---------------------------|-----------------------------------|----------------------------------------------------|------------------------|-------------------------------|--------------------------------|--------------------------------------------------------------|------------------------|-------------------------------|--------------------------------|----------------------------------------------------|------------------------|-------------------------------|--------------------------------|---------------------------------------------------------------|------------------------|-------------------------------|--------------------------------|---------------------------------------------------------|------------------------|-------------------------------|--------------------------------|
| Ball radius<br>RE<br>(mm) | Effective<br>length<br>LU<br>(mm) | No. of<br>revolutions<br>n<br>(min <sup>-1</sup> ) | Feed<br>Vf<br>(mm/min) | Depth<br>of cut<br>ap<br>(mm) | Cutting<br>width<br>ae<br>(mm) | No. of<br>revolutions<br>n<br>(min <sup>-1</sup> )           | Feed<br>Vf<br>(mm/min) | Depth<br>of cut<br>ap<br>(mm) | Cutting<br>width<br>ae<br>(mm) | No. of<br>revolutions<br>n<br>(min <sup>-1</sup> ) | Feed<br>Vf<br>(mm/min) | Depth<br>of cut<br>ap<br>(mm) | Cutting<br>width<br>ae<br>(mm) | No. of<br>revolutions<br>n<br>(min <sup>-1</sup> )            | Feed<br>Vf<br>(mm/min) | Depth<br>of cut<br>ap<br>(mm) | Cutting<br>width<br>ae<br>(mm) | No. of<br>revolutions<br>n<br>(min <sup>-1</sup> )      | Feed<br>Vf<br>(mm/min) | Depth<br>of cut<br>ap<br>(mm) | Cutting<br>width<br>ae<br>(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                          |

## Reference cutting conditions table

### Long neck type

|                           |                                   | Prehardened steel<br>NAK(35-45HRC)                 |                        |                            |                                |                                                    | Prehardened steel / Hardened steel<br>STAVAX·SKD61(45-55HRC) |                            |                                |                                                    | Hardened steel<br>SKD11(55-62HRC) |                            |                                |                                                    | Hardened steel<br>Powder high-speed steel ·SKH<br>(62-66HRC) |                            |                                |                                                    | Hardened steel<br>Powder high-speed steel<br>(66-70HRC) |                            |                                |  |
|---------------------------|-----------------------------------|----------------------------------------------------|------------------------|----------------------------|--------------------------------|----------------------------------------------------|--------------------------------------------------------------|----------------------------|--------------------------------|----------------------------------------------------|-----------------------------------|----------------------------|--------------------------------|----------------------------------------------------|--------------------------------------------------------------|----------------------------|--------------------------------|----------------------------------------------------|---------------------------------------------------------|----------------------------|--------------------------------|--|
| Ball radius<br>RE<br>(mm) | Effective<br>length<br>LU<br>(mm) | No. of<br>revolutions<br>n<br>(min <sup>-1</sup> ) | Feed<br>Vf<br>(mm/min) | Depth of cut<br>ap<br>(mm) | Cutting<br>width<br>ae<br>(mm) | No. of<br>revolutions<br>n<br>(min <sup>-1</sup> ) | Feed<br>Vf<br>(mm/min)                                       | Depth of cut<br>ap<br>(mm) | Cutting<br>width<br>ae<br>(mm) | No. of<br>revolutions<br>n<br>(min <sup>-1</sup> ) | Feed<br>Vf<br>(mm/min)            | Depth of cut<br>ap<br>(mm) | Cutting<br>width<br>ae<br>(mm) | No. of<br>revolutions<br>n<br>(min <sup>-1</sup> ) | Feed<br>Vf<br>(mm/min)                                       | Depth of cut<br>ap<br>(mm) | Cutting<br>width<br>ae<br>(mm) | No. of<br>revolutions<br>n<br>(min <sup>-1</sup> ) | Feed<br>Vf<br>(mm/min)                                  | Depth of cut<br>ap<br>(mm) | Cutting<br>width<br>ae<br>(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.

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# KDA

Applicable to a wide range of machining applications

## Type N

General purpose design without coolant holes.  
Economical style for machining with external coolant.

## Type C

Coolant-through design  
Provides higher efficiency and stable machining with stainless steel etc.



Learn more about Kyocera's end mills

# Q Series

Solid end mills for general machining

## Varied interval flute design

Superior anti vibration performance due to variable pitch flute design.

## Variety of processes

High efficiency machining for steel, stainless steel and hardened material <68 HRC.



Extended lineup

