

UNION TOOL

Tungsten Carbide End Mills UNIMAX Series

Published July 2025

NEW

2 Flute Ball End Mills

HWB



For hard materials
from 40HRC to over 60HRC

HWB-S

Short shank series of HWB

CWB



Best for soft materials up to 40 HRC

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



UNION TOOL CO.

New Coating Series

New coating that exceeds the conventional tools

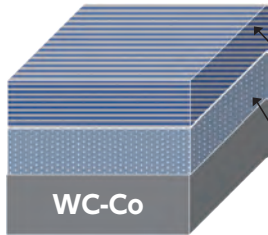
HMG COAT

Suitable for hard materials especially over 65HRC

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

HMW COAT

Upgraded version of HARDMAX coating with improved wear resistance



Ultra-high hardness layer

Increased numbers of layers by nano-laminated structure.

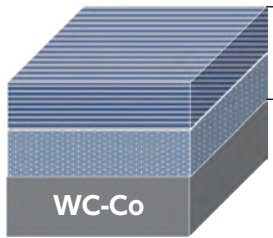
Longer tool life due to wear resistance and the suppression of crack propagation.

Shock absorption layer

New nanocomposite structure improves hardness and toughness.

UTW COAT

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



High hardness and high toughness

New nanocomposite structure offers ultra multilayer structure

High toughness and wear resistance provide excellent performance in work materials up to 40HRC

How to find the best series for your material applications

(★ Highly Recommended ● Recommended ○ Suggested)

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

HWB/HWB-S



HMWCOAT 2 Flute Ball End Mills / Short Shank Ball End Mills

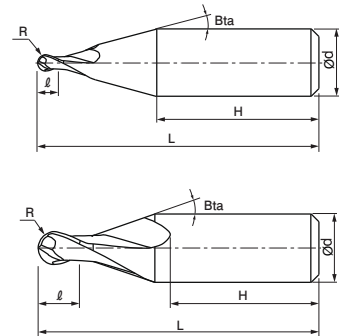
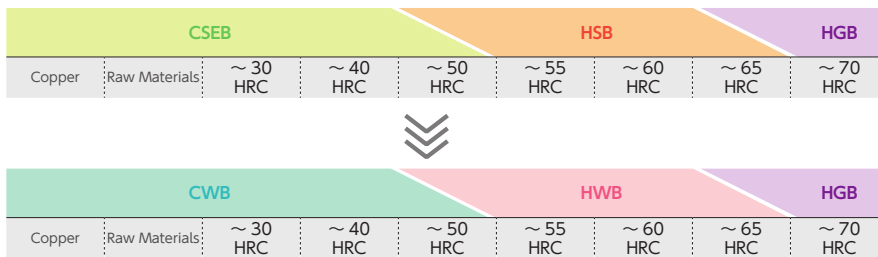
R0.03~R6 **Super MG** **HMW COAT**

Material Applications (★ Highly Recommended ● Recommended ○ Suggested)

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

Upgrade

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



The shank taper angle and shank length shown are not exact values.

Tool Design

With the same tool shape as our long-selling HSB/HSB-S, the transition from HSB/HSB-S is made easy.

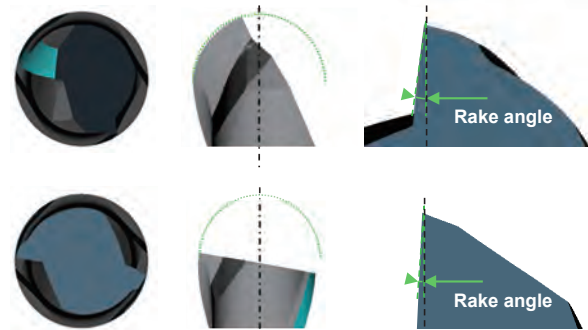
Variable rake angle design

Tip point

Negative rake angle design prevents fracture and chipping.

Peripheral cutting edge

Slightly negative rake angle design reduces cutting resistance and prevents chattering.



High Precision

Even higher accuracy than before!

Conventional HSB

| Radius of Ball Nose | Ball Radius Accuracy | Diameter Tolerance | Shank Diameter Tolerance |
|---------------------|----------------------|--------------------|--------------------------|
| R0.03 ~ R0.05 | ± 0.002 | 0/-0.01 | 0/-0.005 |
| R0.1 ~ R3 | ± 0.005 | 0/-0.015 | |
| R4 ~ R6 | ± 0.007 | 0/-0.02 | |



HWB

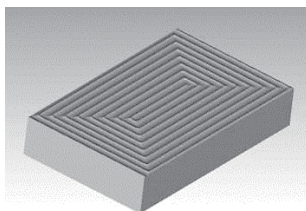
Unit (mm)

| Radius of Ball Nose | Ball Radius Accuracy | Diameter Tolerance | Shank Diameter Tolerance | Helix Angle |
|---------------------|----------------------|--------------------|--------------------------|-------------|
| R0.03 ~ R0.05 | ± 0.002 | 0/-0.006 | 0/-0.004 (h4) | 0° |
| R0.1 ~ R1 | ± 0.003 | | | 0/-0.009 |
| R1.5 ~ R3 | | ± 0.007 | 0/-0.01 | |
| R4 ~ R6 | | | | |

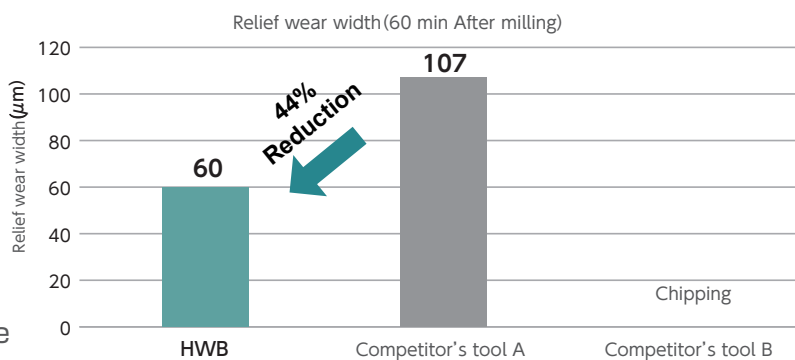
Roughing – Tool wear comparison

SKD11 (60HRC)

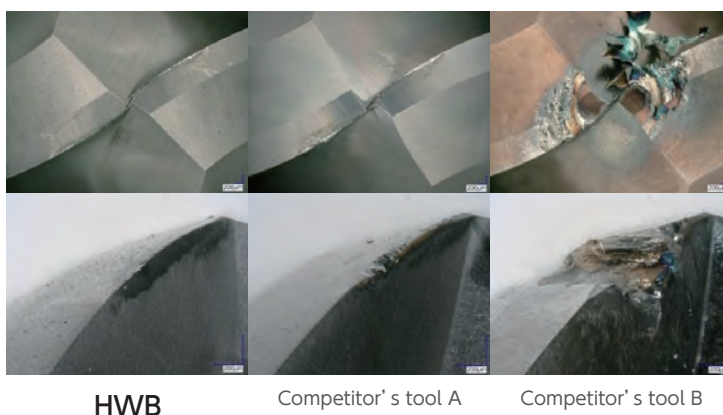
HWB R6 × L22



Work Size
200 × 100 × 3.4 mm
Coolant : Air Blow Through Spindle
Overhang Length : 40 mm



| | |
|--------------------------------|----------------------------|
| Spindle Speed | 3,600 (min ⁻¹) |
| Feed Rate | 1,400 (mm/min) |
| a _p Axial Depth | 0.42 (mm) |
| a _e Radial Depth | 2.1 (mm) |
| Cycle Time | 60 min |

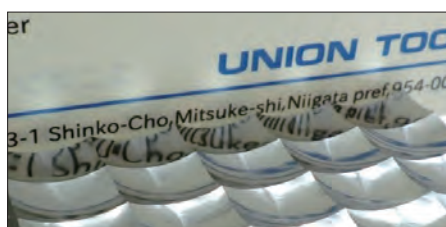
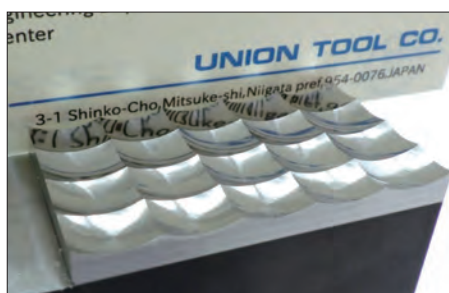


Less tool wear compared with competitor's tool for hard materials

Curved surface milling

HWB R1.5 X L4.5

STAVAX (52HRC)



Smooth surface

Work Size
46 × 26 mm

Coolant : Oil Mist

| Process | Tool | Spindle Speed (min ⁻¹) | Feed Rate (mm/min) | a _p Axial Depth (mm) | a _e Radial Depth (mm) | Cycle Time |
|-------------|-----------------|------------------------------------|--------------------|------------------------------------|-------------------------------------|-------------------|
| Roughing | HWB R3 X L6 | 13,000 | 2,500 | 0.15 | 0.8 | 8 min 25 sec |
| Semi-Finish | | 13,000 | 2,000 | 0.11 | 0.25 | 2 min 44 sec |
| Semi-Finish | HWB R1.5 X L4.5 | 30,000 | 1,500 | 0.055 | 0.025 | 55 min 56 sec |
| Finishing | | 30,000 | 800 | 0.02 | 0.01 | 3 h 35 min 56 sec |

Total 56 models

Unit (mm)

| Model Number | Short Shank | Radius of Ball Nose R | Length of Cut ℓ | Shank Taper Angle Bta | Overall Length L | Shank Diameter ϕd | Shank Length H | Series |
|----------------|-------------|-----------------------|----------------------|-----------------------|------------------|-------------------------|----------------|--------|
| HWB 20006-0006 | | R0.03 | 0.06 | 11° | 50 | 4 | 35.7 | HWB |
| HWB 20008-0008 | | R0.04 | 0.08 | 11° | 50 | 4 | 35.7 | HWB |
| HWB 2001-0010 | | R0.05 | 0.1 | 11° | 50 | 4 | 35.7 | HWB |
| HWB 2002-0020S | ○ | R0.1 | 0.2 | 16° | 35 | 4 | 27.3 | HWB |
| HWB 2002-0020 | | | 0.2 | | 50 | 4 | 42.3 | HWB |
| HWB 2002-0030 | | | 0.3 | | 50 | 4 | 42.2 | HWB |
| HWB 2003-0030S | ○ | R0.15 | 0.3 | 16° | 35 | 4 | 27.5 | HWB |
| HWB 2003-0030 | | | 0.3 | | 50 | 4 | 42.5 | HWB |
| HWB 2003-0045 | | | 0.45 | | 50 | 4 | 42.3 | HWB |
| HWB 2004-0040S | ○ | R0.2 | 0.4 | 16° | 35 | 4 | 27.6 | HWB |
| HWB 2004-0040 | | | 0.4 | | 50 | 4 | 42.6 | HWB |
| HWB 2004-0060 | | | 0.6 | | 50 | 4 | 42.4 | HWB |
| HWB 2005-0050 | | R0.25 | 0.5 | 16° | 50 | 4 | 42.7 | HWB |
| HWB 2005-0075 | | | 0.75 | | 50 | 4 | 42.4 | HWB |
| HWB 2006-0060S | ○ | R0.3 | 0.6 | 16° | 35 | 4 | 27.5 | HWB |
| HWB 2006-0060 | | | 0.6 | | 50 | 4 | 42.5 | HWB |
| HWB 2006-0090 | | | 0.9 | | 50 | 4 | 42.2 | HWB |
| HWB 2008-0080 | | R0.4 | 0.8 | 16° | 50 | 4 | 42.7 | HWB |
| HWB 2008-0120 | | | 1.2 | | 50 | 4 | 42.3 | HWB |
| HWB 2010-0100S | ○ | R0.5 | 1 | 16° | 35 | 4 | 27.8 | HWB |
| HWB 2010-0100 | | | 1 | | 50 | 4 | 42.8 | HWB |
| HWB 2010-0150 | | | 1.5 | | 50 | 4 | 42.3 | HWB |
| HWB 2010-0250 | | | 2.5 | | 50 | 4 | 41.3 | HWB |
| HWB 2012-0180 | | R0.6 | 1.8 | 16° | 50 | 4 | 42.0 | HWB |
| HWB 2015-0150S | ○ | R0.75 | 1.5 | 16° | 35 | 4 | 27.7 | HWB |
| HWB 2015-0150 | | | 1.5 | | 50 | 4 | 42.7 | HWB |
| HWB 2015-0200 | | | 2 | | 50 | 4 | 42.2 | HWB |
| HWB 2015-0225 | | | 2.25 | | 50 | 4 | 42.0 | HWB |
| HWB 2015-0400 | | | 4 | | 50 | 4 | 40.2 | HWB |
| HWB 2020-0200S | ○ | R1 | 2 | 16° | 35 | 4 | 27.2 | HWB |
| HWB 2020-0200 | | | 2 | | 50 | 4 | 42.2 | HWB |
| HWB 2020-0300 | | | 3 | | 50 | 4 | 41.2 | HWB |
| HWB 2020-0600 | | | 6 | | 60 | 4 | 48.2 | HWB |
| HWB 2030-0300 | | R1.5 | 3 | 16° | 50 | 6 | 39.0 | HWB |
| HWB 2030-0450 | | | 4.5 | | 70 | 6 | 57.5 | HWB |
| HWB 2030-0800 | | | 8 | | 70 | 6 | 54.0 | HWB |

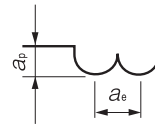
| Model Number | Short Shank | Radius of Ball Nose R | Length of Cut ℓ | Shank Taper Angle Bta | Overall Length L | Shank Diameter $\varnothing d$ | Shank Length H | Series |
|-----------------|-------------|-----------------------|----------------------|-----------------------|------------------|--------------------------------|----------------|--------|
| HWB 2040-0400 | | R2 | 4 | 16° | 50 | 6 | 37.2 | HWB |
| HWB 2040-0600-4 | | | 6 | — | 70 | 4 | 58.3 | HWB |
| HWB 2040-0600 | | | 6 | 16° | 70 | 6 | 55.2 | HWB |
| HWB 2040-0800 | | | 8 | | 70 | 6 | 53.2 | HWB |
| HWB 2050-0500 | | R2.5 | 5 | 16° | 50 | 6 | 36.7 | HWB |
| HWB 2050-0750 | | | 7.5 | | 80 | 6 | 64.2 | HWB |
| HWB 2050-0800 | | | 8 | | 80 | 6 | 63.7 | HWB |
| HWB 2050-1200 | | | 12 | | 80 | 6 | 59.7 | HWB |
| HWB 2060-0600 | | R3 | 6 | — | 50 | 6 | 35.6 | HWB |
| HWB 2060-0900 | | | 9 | | 80 | 6 | 62.6 | HWB |
| HWB 2060-1200 | | | 12 | | 80 | 6 | 59.6 | HWB |
| HWB 2080-0800 | | R4 | 8 | — | 60 | 8 | 40.6 | HWB |
| HWB 2080-1200 | | | 12 | | 90 | 8 | 66.6 | HWB |
| HWB 2080-1400 | | | 14 | | 90 | 8 | 64.6 | HWB |
| HWB 2100-1000 | | R5 | 10 | — | 70 | 10 | 46.6 | HWB |
| HWB 2100-1500 | | | 15 | | 100 | 10 | 71.6 | HWB |
| HWB 2100-1800 | | | 18 | | 100 | 10 | 68.6 | HWB |
| HWB 2120-1200 | | R6 | 12 | — | 75 | 12 | 48.2 | HWB |
| HWB 2120-1800 | | | 18 | | 110 | 12 | 77.2 | HWB |
| HWB 2120-2200 | | | 22 | | 110 | 12 | 73.2 | HWB |

HWB/HWB-S Milling Conditions

| WORK MATERIAL | | | PREHARDENED STEELS/ HARDENED STEELS NAK / STAVAX (~55HRC) | | | | HARDENED STEELS SKD11 (55~62HRC) | | | | HARDENED STEELS HAP10 (62~66HRC) | | | | HARDENED STEELS HAP72 (66~70HRC) | | | |
|---------------|--------------------------|--------------------|--|--------------------|---------------------------------|----------------------------------|--|--------------------|---------------------------------|----------------------------------|--|--------------------|---------------------------------|----------------------------------|--|--------------------|---------------------------------|----------------------------------|
| Model Number | Radius of Ball Nose (mm) | Length of Cut (mm) | Spindle Speed (min ⁻¹) | Feed Rate (mm/min) | a _p Axial Depth (mm) | a _e Radial Depth (mm) | Spindle Speed (min ⁻¹) | Feed Rate (mm/min) | a _p Axial Depth (mm) | a _e Radial Depth (mm) | Spindle Speed (min ⁻¹) | Feed Rate (mm/min) | a _p Axial Depth (mm) | a _e Radial Depth (mm) | Spindle Speed (min ⁻¹) | Feed Rate (mm/min) | a _p Axial Depth (mm) | a _e Radial Depth (mm) |
| 2006 | R0.03 | 0.06 | 30,000 | 100 | 0.002 or below | 0.02 | — | — | — | — | — | — | — | — | — | — | — | — |
| 2008 | R0.04 | 0.08 | 30,000 | 130 | 0.003 or below | 0.03 | — | — | — | — | — | — | — | — | — | — | — | — |
| 2001 | R0.05 | 0.1 | 30,000 | 200 | 0.004 or below | 0.04 | — | — | — | — | — | — | — | — | — | — | — | — |
| 2002 | R0.1 | 0.2 | 60,000 | 200 | 0.003 | 0.005 | 60,000 | 200 | 0.002 | 0.003 | 60,000 | 130 | 0.002 | 0.003 | 45,000 | 65 | 0.002 | 0.003 |
| | | 0.3 | 60,000 | 200 | 0.003 | 0.005 | 60,000 | 200 | 0.002 | 0.003 | 60,000 | 130 | 0.002 | 0.003 | 45,000 | 65 | 0.002 | 0.003 |
| 2003 | R0.15 | 0.3 | 60,000 | 350 | 0.006 | 0.008 | 45,000 | 310 | 0.004 | 0.007 | 43,500 | 180 | 0.003 | 0.005 | 32,500 | 90 | 0.003 | 0.005 |
| | | 0.45 | 60,000 | 350 | 0.006 | 0.008 | 45,000 | 310 | 0.004 | 0.007 | 43,500 | 180 | 0.003 | 0.005 | 32,500 | 90 | 0.003 | 0.005 |
| 2004 | R0.2 | 0.4 | 50,000 | 500 | 0.01 | 0.02 | 37,500 | 420 | 0.007 | 0.012 | 35,000 | 240 | 0.005 | 0.008 | 26,250 | 120 | 0.005 | 0.008 |
| | | 0.6 | 50,000 | 500 | 0.01 | 0.02 | 37,500 | 420 | 0.007 | 0.012 | 35,000 | 240 | 0.005 | 0.008 | 26,250 | 120 | 0.005 | 0.008 |
| 2005 | R0.25 | 0.5 | 44,000 | 650 | 0.015 | 0.04 | 33,000 | 530 | 0.01 | 0.02 | 30,000 | 300 | 0.007 | 0.01 | 22,500 | 150 | 0.007 | 0.01 |
| | | 0.75 | 44,000 | 650 | 0.015 | 0.04 | 33,000 | 530 | 0.01 | 0.02 | 30,000 | 300 | 0.007 | 0.01 | 22,500 | 150 | 0.007 | 0.01 |
| 2006 | R0.3 | 0.6 | 40,000 | 1,100 | 0.03 | 0.13 | 30,000 | 1,200 | 0.02 | 0.1 | 26,500 | 800 | 0.01 | 0.075 | 20,000 | 400 | 0.01 | 0.075 |
| | | 0.9 | 40,000 | 1,100 | 0.03 | 0.13 | 30,000 | 1,200 | 0.02 | 0.1 | 26,500 | 800 | 0.01 | 0.075 | 20,000 | 400 | 0.01 | 0.075 |
| 2008 | R0.4 | 0.8 | 35,000 | 1,600 | 0.06 | 0.21 | 27,000 | 1,600 | 0.04 | 0.17 | 23,500 | 1,000 | 0.02 | 0.12 | 17,500 | 500 | 0.02 | 0.12 |
| | | 1.2 | 35,000 | 1,600 | 0.06 | 0.21 | 27,000 | 1,600 | 0.04 | 0.17 | 23,500 | 1,000 | 0.02 | 0.12 | 17,500 | 500 | 0.02 | 0.12 |
| 2010 | R0.5 | 1 | 30,000 | 1,750 | 0.2 | 0.4 | 24,000 | 2,000 | 0.1 | 0.3 | 21,000 | 1,750 | 0.05 | 0.2 | 16,000 | 875 | 0.05 | 0.2 |
| | | 1.5 | 30,000 | 1,750 | 0.2 | 0.4 | 24,000 | 2,000 | 0.1 | 0.3 | 21,000 | 1,750 | 0.05 | 0.2 | 16,000 | 875 | 0.05 | 0.2 |
| | | 2.5 | 30,000 | 1,750 | 0.1 | 0.3 | 24,000 | 2,000 | 0.05 | 0.2 | 21,000 | 1,750 | 0.03 | 0.17 | 16,000 | 875 | 0.03 | 0.17 |
| 2012 | R0.6 | 1.8 | 30,000 | 2,000 | 0.22 | 0.46 | 20,500 | 2,000 | 0.11 | 0.34 | 17,800 | 1,750 | 0.05 | 0.23 | 13,350 | 875 | 0.05 | 0.23 |
| 2015 | R0.75 | 1.5 | 30,000 | 2,450 | 0.25 | 0.55 | 17,000 | 2,000 | 0.12 | 0.4 | 15,000 | 1,750 | 0.06 | 0.29 | 11,250 | 875 | 0.06 | 0.29 |
| | | 2 | 30,000 | 2,450 | 0.25 | 0.55 | 17,000 | 2,000 | 0.12 | 0.4 | 15,000 | 1,750 | 0.06 | 0.29 | 11,250 | 875 | 0.06 | 0.29 |
| | | 2.25 | 30,000 | 2,450 | 0.25 | 0.55 | 17,000 | 2,000 | 0.12 | 0.4 | 15,000 | 1,750 | 0.06 | 0.29 | 11,250 | 875 | 0.06 | 0.29 |
| | | 4 | 30,000 | 2,450 | 0.15 | 0.45 | 17,000 | 2,000 | 0.07 | 0.31 | 15,000 | 1,750 | 0.04 | 0.24 | 11,250 | 875 | 0.04 | 0.24 |
| 2020 | R1 | 2 | 28,000 | 2,900 | 0.3 | 0.7 | 14,000 | 2,100 | 0.15 | 0.5 | 12,250 | 1,800 | 0.08 | 0.35 | 9,200 | 900 | 0.08 | 0.35 |
| | | 3 | 28,000 | 2,900 | 0.3 | 0.7 | 14,000 | 2,100 | 0.15 | 0.5 | 12,250 | 1,800 | 0.08 | 0.35 | 9,200 | 900 | 0.08 | 0.35 |
| | | 6 | 28,000 | 2,900 | 0.2 | 0.6 | 14,000 | 2,100 | 0.1 | 0.4 | 12,250 | 1,800 | 0.06 | 0.3 | 9,200 | 900 | 0.06 | 0.3 |
| 2030 | R1.5 | 3 | 21,000 | 3,000 | 0.4 | 1 | 10,500 | 2,200 | 0.2 | 0.7 | 9,200 | 1,900 | 0.12 | 0.55 | 6,900 | 950 | 0.12 | 0.55 |
| | | 4.5 | 21,000 | 3,000 | 0.4 | 1 | 10,500 | 2,200 | 0.2 | 0.7 | 9,200 | 1,900 | 0.12 | 0.55 | 6,900 | 950 | 0.12 | 0.55 |
| | | 8 | 21,000 | 3,000 | 0.3 | 0.9 | 10,500 | 2,200 | 0.15 | 0.65 | 9,200 | 1,900 | 0.1 | 0.5 | 6,900 | 950 | 0.1 | 0.5 |
| 2040 | R2 | 4 | 18,000 | 3,200 | 0.5 | 1.3 | 9,000 | 2,300 | 0.25 | 0.95 | 7,900 | 2,000 | 0.15 | 0.75 | 5,900 | 1,000 | 0.15 | 0.75 |
| | | 6 | 18,000 | 3,200 | 0.5 | 1.3 | 9,000 | 2,300 | 0.25 | 0.95 | 7,900 | 2,000 | 0.15 | 0.75 | 5,900 | 1,000 | 0.15 | 0.75 |
| | | 8 | 18,000 | 3,200 | 0.5 | 1.3 | 9,000 | 2,300 | 0.25 | 0.95 | 7,900 | 2,000 | 0.15 | 0.75 | 5,900 | 1,000 | 0.15 | 0.75 |
| 2050 | R2.5 | 5 | 15,600 | 3,500 | 0.5 | 1.5 | 7,800 | 2,500 | 0.25 | 1.05 | 6,800 | 2,100 | 0.15 | 0.85 | 5,100 | 1,050 | 0.15 | 0.85 |
| | | 7.5 | 15,600 | 3,500 | 0.5 | 1.5 | 7,800 | 2,500 | 0.25 | 1.05 | 6,800 | 2,100 | 0.15 | 0.85 | 5,100 | 1,050 | 0.15 | 0.85 |
| | | 8 | 15,600 | 3,500 | 0.5 | 1.5 | 7,800 | 2,500 | 0.25 | 1.05 | 6,800 | 2,100 | 0.15 | 0.85 | 5,100 | 1,050 | 0.15 | 0.85 |
| | | 12 | 15,600 | 3,500 | 0.5 | 1.5 | 7,800 | 2,500 | 0.25 | 1.05 | 6,800 | 2,100 | 0.15 | 0.85 | 5,100 | 1,050 | 0.15 | 0.85 |

HWB/HWB-S Milling Conditions

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



Note:

- Decrease the feed rate more than 50% from the milling parameters when slot milling.
- Decrease both spindle speed and feed rate proportionally when the milling parameters exceed the machine's maximum spindle speed, or when chattering and red-hot occur.
- Every coolant offers stable milling.



Advisory for Safe Use of End Mills

Correct application and operation is strongly advised to avoid clogging, abrasion, etc, that could cause serious accidents or injuries. Ignition or sparks generated during milling could lead to fire or extreme damage to the work piece. End Mills are made with very sharp cutting edges and must be handled with extra care.

- Never touch the cutting edge with your bare hands, as this could cause serious injury. Special caution is required when opening the package.
- Dropping the tool could cause breakage or flying debris, leading to serious injury.
- During milling, unexpected impact or shock on the tool could cause breakage or flying debris. Ensure to use protective items such as safety glasses and a face guard.
- For best results, fine parameter adjustment may be required, depending on the materials; milling shape and strategy; machine rigidity and spindle capability.
- Use a machine that has high rigidity and generates a low level of vibration. Recommend setting the runout control value at $5\mu\text{m}$ or below for the small diameter tools $\phi 1$ or below.
- Do not use flammable cutting oils.

Advisory for Regrinding End Mills

- Never regrind the tool without wearing safety glasses and a face guard.

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Price & Specifications are subject to change without notice.